COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 15.05.1998

COM(1998) 257 final

98/0162 (ACC)

Proposal for a
COUNCIL REGULATION (EC)
setting up a Community regime for the control of exports of dual-use goods and technology

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. Introduction

Export controls are a trade aspect of international security. Until fairly recently, in the European Union, such controls were enforced by national legislation only. The completion of the Internal Market however required a minimum of harmonization of export controls in order to allow for the free movement of dual-use goods inside the Community. It is in this context that the Council of the European Union adopted, on 19 December 1994, the current Community export control regime for dual-use goods: a two-pillar system consisting of Council Regulation (EC) No 3381/94[1] and Council Decision 94/942/CFSP[2]. The former deals chiefly with licensing aspects and administrative cooperation; the latter contains the lists of controlled products and an indicative list of countries for which simplified licensing procedures may be applied by Member States. In summary, the two major elements of the present regime are, on the one hand, a common product list and, on the other, the principle of mutual recognition of export licences.

At the time of the adoption of this legislation, which became applicable on 1 July 1995, the Council and Commission agreed, in a declaration to the Council minutes, that the regime should be reviewed after two years of application. It was clear to Member States and the Commission alike that the regime was but a first step, confined to the very minimal harmonization which was indispensable to ensure the free movement of goods inside the Community, and that further harmonization was indeed desirable. As is stated in the Regulation itself, the current regime was considered to be transitory in nature.

2. The reasons for the present proposal

After two years of application, it has become clear that the present common export control mechanism is not functioning satisfactorily.

The report to Parliament and Council on the practical application of the Regulation which the Commission is submitting simultaneously with this proposal concludes that whilst the regime has been, on the whole, successful in terms of Internal Market objectives, it has failed at the same time, due to an insufficient convergence of national policies and practices, to establish a credible common system of export controls accepted by exporters and routinely enforced by customs.

It appears that the present regime, where numerous types of national global and general licences, often for the same destinations but with slightly different product scope, coexist, is too complex to be routinely managed by custom officials at the border, and is judged by industry to be too cumbersome to be useful in practice. In other words, the legitimate activities of exporters are hampered by delays at borders without any commensurate benefits in terms of combating proliferation.

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[1] OJ L 367, 31.12.1994, as amended by Regulation (EC) No 837/95 of 10 April 1995 (OJ L 90, 21.4.1995).

[2] OJ L 367, 31.12.1994, as last amended by Council Decision 98/232/CFSP (OJ L 92, 25.3.1998).

The Commission therefore considers it necessary to simplify and strengthen the present regime with a view to facilitate legitimate trade and to allow resources to be concentrated on the control of sensitive exports and the combat of fraud.

The present proposal is in important legislative instrument to attain these goals. It should however not be seen as an isolated iniative, on the contrary.

On the one hand, the proposal is one of the measures envisaged in the Commission's recent Communication on "Implementing European Union strategy on defence-related industries"[3].

On the other hand, export control legislation is linked to non-proliferation objectives, and it is clear that, at Union level, non-proliferation issues are and will continue to be dealt with in the CFSP context. The Commission, in pursuing the objective of an overall coherence of the Unions' external action, therefore intends to present in the near futur appropriate measures to accompany or to complement the present proposal.

3. Key elements of the present proposal

Compared with the present regime the major elements of change are as follows:

(a) Creation of a general Community Licence for certain exports: Article 6(1) and Annex II)

This proposal aims to consolidate the substantial amount of *de facto* convergence of Member States licensing policies vis-à-vis the countries mentioned in Annex II of the present CFSP decision: Australia, Canada, Japan, New Zealand, Norway, Switzerland and the United States.

Presently, 12 Member States out of 15 have granted a general export authorization for the vast majority of dual-use items when shipped to these countries. The three Member States not presently applying any general licences have indicated that they could envisage to do so.

The proposal of the Commission is to translate this *de facto* convergence into a harmonized Community licence. On the one hand, such a licence would greatly contribute to reducing the complexity of the present regime to manageable levels, and would cover a considerable volume of trade, estimated to account for more than 70% of exports of these goods from the Community. One the other hand, the most sensitive dual-use items would be excluded from the benefit of this General Licence.

Finally, it is proposed to extend the application of this General Licence to those Central and Eastern European countries applying for membership of the European Union with whom accession negiotiations are to begin on 31 of March 1998 and which are also very advanced in terms of effective export control legislation and membership in the relevant international non-proliferation regimes: Czech Republic, Hungary and Poland.

The list of countries covered by the Community General Licence will be kept under constant review.

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[3] COM(97) 583 final, in Annex II (Action Plan, page 6, point V 9).

For items not covered by the Community General Licence and for all exports to other destinations the current situation will continue to apply: national licence authorities will be competent for determining if an export is authorized or not. Mechanisms aimed at increasing transparency, exchange of information and consultation between Member States with regard to exports not covered by the Community licence should however be enhanced.

(b) The legal basis

The European Court of Justice, in two rulings of 17 October 1995 (C-70/94 and C-83/94) has clearly established exclusive Community competence for export controls concerning dual-use goods. The Court has explicitly stated that neither the particular nature of the goods nor the fact that the control measures are taken in light of foreign policy or security consideration has any bearing on Article 113 being applicable. However, the Court has also ruled that Article 113 does not preclude national measures regarding export controls, provided this is done on the basis of a delegation of powers by the EC and within the limitations posed by Regulation (EEC) No 2603/69.

On this basis, therefore, the Commission must strike a balance between the principle of Community competence that the Court has so clearly affirmed, and the legitimate concerns of Member States to remain in control of matters relating to their national security.

On the one hand, in conformity with the Court Rulings, the Commission considers Article 113 to be the appropriate legal basis for a Community export-control regime concerning dual-use goods.

On the other hand, the present proposal recognizes that all security relevant issues, and in particular the issuing of export licences to sensitive destinations, remain in the hands of the competent national authorities.

Furthermore, recognizing that the technical expertise of Member States is indispensable to assess which goods are to be controlled, the responsibility of adapting the list of controlled goods is delegated to them. A List Group, chaired by the Member State exercising the Presidency, will therefore be in charge of updating the product list. Any modification of the list of controlled items by means of a Commission Regulation shall be based on the deliberations of this List Group.

(c) Extension of the catch-all to all military end-use for shipments to countries subject to an UN embargo: Article 4(2)

A "catch-all" clause means that any unlisted good may also be made subject to an authorization requirement if there are concerns about its end-use. The solution adopted by the Council in 1994 limits the scope of Article 4(2) of the present Regulation to concerns in relation with programmes of "weapons of mass destruction."

This proposal foresees an extension of the catch-all to all military end-use, when the goods in question are destined for a country which is subject to an UN embargo.

It should be noted that this clause does not in any way interfere with the right of Member States to grant permission to export dual-use items which will have a military end-use. The objective of this proposal is solely to allow the competent authorities in Member States to exercise judgment on a case-by-case basis on the desirability of such exports to certain destinations.

(d) Coverage of technology transfer by PC, fax and telephone: Article 3(5)

The present regime (see Decision 94/942/CFSP, Annex 1, General notes, note No 3) specifies that the control of technology transfer is limited to "tangible forms". Transmission of data by other means is therefore not covered. This means that if a blueprint concerning controlled technology is send by mail (in a "tangible" form), the Regulation and the authorization requirement applies - if the same blueprint is however sent by fax or E-mail, there is no licensing obligation. Given the degree to which modern means of communication are now routinely used, this situation is simply anachronistic, as has been recognized by Member States which have repeatedly discussed the issue. It is therefore proposed to close the loophole in legislation at Community level.

(e) Abolition of licensing procedures for intra-Community trade: Article 22(3)

Article 19(5) of this Regulation foresees that, after a transitory phase, certain restrictions concerning intra-Community trade are to be reviewed.

It is proposed that nearly all still existing licensing requirements for intra-Community transfers of dual-use items contained in Annexes IV and V of the present CFSP Decision should be abolished.

However, recognizing the particular sensitivity of certain items listed in the present Annex IV, the Commission is proposing a notification procedure for their transfers allowing the competent authorities to be aware of all intra-Community trade with them. Furthermore, if these items are to be subsequently exported to third countries, the Member State where they were originally located must be consulted and may oppose the granting of an export authorization, in which case the export will not be allowed.

The objective of the proposal is to eliminate any restrictions on the right to transfer such items within the Community whilst ensuring that trade with them can be monitored and that exports are tightly controlled and subject to consultation procedures if necessary.

(f) Reinforced administrative cooperation: Article 9(3); Articles 4(4), 5, 6 and 7: Article 16(2)

The key proposal is to reinforce the exchange of information and consultations between Member States regarding sensitive exports, be it for listed items or for transactions covered by the catch-all clause. Whilst Member States maintain the right to decide to grant an export permission which another Member State has refused, the proposal stipulates that in such cases prior consultations are obligatory, and that a Member State must state the reason for authorizing an export which another Member State has previously denied. The objective is to

create an on-going exchange of views between the competent authorities on export control policy, in order to reduce differences in perception and knowledge of security concerns among Member States, and allow for a more consistent, and therefore more effective, application of export controls throughout the Community.

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THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 113 thereof,

Having regard to the proposal from the Commission[4],

(1) Whereas dual-use goods and technology (dual-use items) should be subject to effective control when they are exported from the Community;

(2) Whereas an effective common system of export controls on dual-use items is necessary to ensure that the international commitments of the Member States and the European Union, especially regarding non-proliferation, are complied with;

(3) Whereas the existence of a common control system is a prerequisite for establishing the free movement of dual-use items inside the Community;

(4) Whereas the current regime of export controls on dual-use items established by Council Regulation (EC) No 3381/94[5], as amended by Regulation (EC) No 837/95[6], and Council Decision 94/942/CFSP[7], as last amended by Decision 98/232/CFSP[8], needs to be further harmonized in order to guarantee the effective application of controls;

(5) Whereas common lists of dual-use items, destinations and guidelines are essential elements for an effective export control system; whereas such lists have been established by Decision 94/942/CFSP and should be incorporated into the present Regulation;

(6) Whereas the responsibility for issuing export licences lies essentially with national authorities; whereas national provisions and decisions affecting exports of dual-use items must be taken in the framework of the Common Commercial Policy;

(7) Whereas the expertise of Member States' authorities is indispensable to ensure the regular updating of the list of controlled items; whereas the task of updating that list should be delegated to a List Group composed of Member States' experts and a representative of the Commission;

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4 OJ
5 OJ L 367, 31.12.1994, p. 1.
6 OJ L 90, 21.4.1995, p. 1.
7 OJ L 367, 31.12.1994, p. 8.
8 OJ L 92, 25.3.1998, p. 1.

(8) Whereas the updated lists should be immediately integrated into this Regulation by way of a Commission Regulation;

(9) Whereas export of technology by means of electronic media, fax and telephone should also be controlled;

(10) Whereas the Ministers for Foreign Affairs of the Member States adopted, on 20 November 1984, the Declaration of Common Policy, which was subsequently also adopted by Spain, Portugal, Austria, Finland and Sweden, which covers in particular the arrangements concerning intra-Community transfers of separated plutonium and of uranium enriched to more than 20%, as well as of installations, the main components of crucial importance and technology related to reprocessing, to enrichment and to the production of heavy water;

(11) Whereas the Community has adopted a body of customs rules, contained in Council Regulation (EEC) No 2913/92[9], as last amended by Regulation (EC) No 82/97 of the European Parliament and of the Council[10] (the Community Customs Code) and Commission Regulation (EEC) No 2454/93[11], as last amended by Regulation (EC) No 75/98[12], which lay down, among other things, provisions relating to the export and re-export of goods; whereas nothing in this Regulation constrains any powers under and pursuant to the Community Customs Code and its implementing provisions;

(12) Whereas Member States should, when considering conditions concerning re-export or end-use of dual-use items, take into account relevant principles of international law;

(13) Whereas, in order to ensure that this Regulation is properly applied, each Member State should take measures giving the competent authorities appropriate powers;

(14) Whereas each Member State should determine the penalties to be imposed in the event of breach of the provisions of this Regulation;

(15) Whereas in view of the foregoing, Regulation (EC) No 3381/94 should be repealed,

HAS ADOPTED THIS REGULATION:

CHAPTER I

Subject and definitions

Article 1

This Regulation sets up a Community system of export controls for dual-use goods and technology.

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9 OJ L 302, 19.10.1992, p. 1.
10 OJ L 17, 21.1.1997, p. 1.
11 OJ L 253, 11.10.1993, p. 1.
12 OJ L 7, 13.1.1998, p. 3.

Article 2

For the purpose of this Regulation:

(a) "dual-use items" shall mean goods or technology which can be used for both civil and military purposes;

(b) "export" shall mean a procedure referred to in Article 161 of the Community Customs Code under which Community goods temporarily or definitively leave the customs territory of the Community. It includes re-export, that is to say a transaction of the kind referred to in Article 182 of the Community Customs Code by which non-Community goods leave the customs territory of the Community. It also includes transmission of technology by electronic media, fax and telephone;

(c) "exporter" shall mean any natural or legal person on whose behalf the export declaration is made and who, at the time when the declaration is accepted, has the right of disposal over the dual-use item. Where the benefit of a right to dispose of the dual-use item belongs to a person established outside the Community pursuant to the contract on which the export is based, the exporter shall be considered to be the contracting party established in the Community. "Exporter" shall also mean any natural or legal person transmitting technology by electronic media, fax and telephone;

(d) "export declaration" shall mean the act whereby a person indicates in the prescribed form and manner the wish to place dual-use items under an export or re-export procedure.

CHAPTER II

Scope

Article 3

1. An authorization shall be required for the export of the dual-use items listed in Annex I.

2. The authorization requirement applies not only to the physical export of goods or technologies, but also to transmission of technologies via electronic media, telephone and fax. However, this Regulation does not apply to the supply of services or the transmission of technology requiring cross-border movement of natural persons.

3. In pursuance of Article 4 or Article 5, an authorization may be required for the export to all or certain destinations of certain dual-use items not listed in Annex I.

4. This Regulation does not apply to dual-use items which only pass through the territory of the Community, that is those which are not assigned a customs-approved treatment or use other than the external transit procedure or which are merely placed in a free zone or free warehouse and where no record of them has to be kept in an approved stock record.

5. Dual-use items which are exported by governments of Member States or legal or natural persons acting on behalf of governments of Member States are not subject to the authorization requirement laid down in paragraph 1.

Article 4

1. An authorization shall be required for the export of dual-use items not listed in Annex I if the exporter has been informed by the competent authorities of the Member State in which he is established that the items in question are or may be intended, in their entirety or in part, for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or the development, production, maintenance or storage of missiles capable of delivering such weapons.

2. An authorization shall also be required for the export of dual-use items not listed in Annex I if the exporter has been informed by the authorities referred to in paragraph 1 that the items in question are or may be intended, in their entirety or in part, for a military end-use in a country subject to a UN embargo.

3. If the exporter is aware that the dual-use items are intended, in their entirety or in part, for one of the purposes referred to in paragraphs 1 and 2, he must notify the authorities referred to in paragraph 1, which will decide whether or not it is expedient to make the export concerned subject to authorization.

4. Member States may adopt or maintain national legislation providing that the exporter must notify the authorities referred to in paragraph 1 where he has grounds for suspecting that the dual-use items are intended wholly or in part, for one of the purposes referred to in paragraphs 1 and 2, and that in such a case the export operation may be made subject to authorization.

5. A Member State which imposes an authorization requirement, in application of paragraphs 1 to 4 on an unlisted dual-use item, shall inform the other Member States and the Commission. The other Member States shall give all due consideration to this information and shall inform, to the extent possible, their customs offices and other relevant national authorities.

6. If a Member State denies authorization for an export of an unlisted dual-use item, it shall immediately inform the other Member States and the Commission.

7. If a Member States authorizes an export of an unlisted dual-use item that is essentially identical to an export which has been denied authorization by another Member State, it shall inform the other Member States and the Commission of its decision and provide all relevant information on the reasons for the decision.

Article 5

1. A Member State may exceptionally prohibit or make subject to authorization the export of dual-use items not listed in Annex I for reasons of national security.

2. Member States shall notify any measures adopted pursuant to paragraph 1 to the other Member States and the Commission immediately after their adoption and indicate the precise reasons for the measures and their envisaged duration.

Member States shall also immediately notify the other Member States and the Commission of any modifications to measures adopted pursuant to paragraph 1.

3. The Commission shall publish the measures notified to it pursuant to paragraph 2 in the "C" series of the *Official Journal of the European Communities*.

CHAPTER III

Export authorization

Article 6

1. An authorization shall be required for each export subject to this Regulation. The authorization shall be granted by the competent authorities of the Member State where the exporter is established, except for those exports covered by the Community General Export Authorization as set out in Annex II.

2. The authorization may be an individual, global or general authorization.

However, national general authorizations may be granted only in respect of a type or category of dual-use items for export to destinations other than those listed in Schedule B of Annex II.

3. Member States shall maintain or introduce in their respective national legislation the possibility of granting a global authorization to a specific exporter in respect of a type or category of dual-use items which may be valid for exports to one or more specified countries.

4. The authorization may be subject, if appropriate, to certain requirements and conditions. In particular, the competent authorities of a Member State shall require a statement of end-use for exports of goods and technology which are both:

(a) subject to an individual authorization; and

(b) exported to a destination not listed in Schedule B of Annex II.

5. The authorization shall be valid throughout the Community.

Article 7

1. If the dual-use items in respect of which an application has been made for an individual export authorization to a destination not specifically mentioned in Annex II or to all destinations in the case of very sensitive dual-use items which are referred to in Annex IV are or will be located in a different Member State, or have been located in a different Member State in the last nine months, that fact shall be indicated in the

application. The licensing authorities of the Member State to which the application for authorization has been made shall immediately consult the licensing authorities of the Member State or States in question and provide the relevant information. The Member State or States consulted shall make known within ten working days, any objections it or they may have to the granting of such an authorization, which shall bind the Member State in which the application has been made.

If no objections are received within ten working days, the opinion of the Member State consulted shall be regarded as positive.

In exceptional cases, the Member State consulted may request the extension of the ten-day period. However, the extension may not exceed 30 working days.

2. If an export might prejudice its essential security interests, a Member State may request another Member State not to grant an export authorization or, if such authorization has been granted, request its annulment, suspension, modification or revocation. The Member State receiving such a request shall immediately engage in consultations of a non-binding nature with the requesting Member State, to be terminated within ten working days.

3. Member States shall furnish the Commission with a list of the competent authorities empowered to grant export authorizations for dual-use items.

4. The Commission shall publish the list of the authorities referred to in paragraph 3 in the "C" series of the *Official Journal of the European Communities*.

Article 8

In deciding whether or not to grant an export authorization, the Member States shall take into account:

(a) their commitments under international agreements on non-proliferation and the control of sensitive goods;

(b) their obligations under sanctions imposed by the UN Security Council or agreed in other international fora;

(c) considerations of national foreign and security policy, including, where relevant, those covered by the criteria agreed by the European Council in Luxembourg in June 1991 and in Lisbon in June 1992 with regard to the export of conventional arms;

(d) considerations about intended end-use and the risk of diversion.

Article 9

1. Exporters shall supply the competent authorities with all relevant information required for their applications for authorization.

2. The competent authorities, acting in accordance with this Regulation, may refuse to grant an export authorization and may annul, suspend, modify or revoke an export authorization which they have already granted. Where they refuse, annull, suspend, substantially limit or revoke an authorization, they shall inform the competent authorities of the other Member States and the Commission thereof and exchange the relevant information with the other Member States and the Commission, while complying with the provisions of Article 16(3) concerning the confidentiality of such information.

3. A Member State, before authorizing an essentially identical export that has been denied authorization by another Member State, shall consult that Member State. If the first-mentioned Member State decides, after those consultations, to grant an export authorization, it shall immediately inform the other Member States and the Commission of its decision, and provide all relevant information on the reasons for the decision.

Article 10

1. All individual national export authorizations shall be issued on forms in accordance with the model set out in Annex III.

2. At the request of exporters, national general and global authorizations shall be issued on the forms referred to in paragraph 1.

3. At the request of exporters, global authorizations that contain quantitative limitations may be split.

4. Legally valid copies of authorizations shall be made available to exporters in accordance with national regulations concerning certification of copies.

CHAPTER IV

Imports and reexports

Article 11

International Import Certificates or an equivalent end-use certificate shall be used only to certify that an authorization for reexport from the Community exists.

Member States shall only give the commitment that the relevant items will not be reexported without the authorization of the authorities of the Member State in which the exporter is established.

CHAPTER V

Updating of list of dual-use items

Article 12

1. The list set out in Annex I shall be updated by a List Group composed of a representative of each Member State and of the Commission.

2. The List Group shall be chaired by the Member State holding the Presidency of the Council and shall be assisted by a technical secretariat from one of the Member States.

3. The Member State holding the Presidency shall call for meetings and present appropriate proposals for the updating of Annex I, in particular after the meetings of the international non-proliferation regimes. Meetings may also be held at the request of any other Member State or the Commission. Member States and the Commission may submit proposals regarding the establishment and updating of Annex I.

4. Decisions on updating of Annex I shall be taken by the Member States' representatives by consensus and shall be implemented as amendments to Annex I by a Commission Regulation.

CHAPTER VI

Customs procedures

Article 13

1. When completing the export formalities at the customs office responsible for handling the export declaration, the exporter shall furnish proof that the export has been duly authorized.

2. A translation of any documents furnished as proof into the official language or one of the official languages of the Member State where the declaration is presented may be required of the exporter.

3. Without prejudice to any powers conferred on it under, and pursuant to, the Community Customs Code, a Member State may also, for a period not exceeding ten working days, suspend the process of release for export from its territory, or, if necessary, otherwise prevent the dual-use items listed in Annex I which are covered by a valid authorization from leaving the Community via its territory, where it has grounds for suspicion that:

   (a) relevant information was not taken into account when the authorization was granted, or

   (b) circumstances have materially changed since the grant of the authorization.

In such cases, the competent authorities of the Member State which granted the export authorization shall be consulted forthwith in order that they may take action pursuant to Article 9(2).

If those authorities decide to maintain the authorization or if no reply is received within ten working days, the dual-use items shall be released immediately.

Article 14

1. Member States may provide that customs formalities for the export of dual-use items may be completed only at customs offices empowered to that end.

2. Member States availing themselves of the option set out in paragraph 1 shall inform the Commission of the duly empowered customs offices. The Commission shall publish the information in the "C" series of the *Official Journal of the European Communities*.

Article 15

The provisions of Part II, Title II, Chapter 11 of Regulation (EEC) No 2454/93 also apply to the restrictions relating to the reexportation of dual-use items covered by this Regulation.

CHAPTER VII

Administrative cooperation

Article 16

1. Acting in liaison with the Commission, Member States shall take all appropriate measures to establish direct cooperation and exchange of information between competent authorities, in particular to eliminate the risk that possible disparities in the application of export controls may lead to a deflection of trade, which could create difficulties for one or more Member States.

2. Member States shall take all appropriate measures to establish direct cooperation and exchange of information between competent authorities on sensitive end-users with a view to providing a similar level of guidance to exporters concerned by this Regulation.

3. Council Regulation (EC) No 515/97 of 13 March 1997[13], and in particular the provisions on the confidentiality of information, shall apply *mutatis mutandis*, without prejudice to Article 19 of this Regulation.

[13] OJ L 82, 22.3.1997, p. 1.

CHAPTER VIII

Control measures

Article 17

1. The exporters shall keep detailed registers or records of their transactions, in accordance with the practice in force in the respective Member States. Such registers or records shall include in particular commercial documents such as invoices, manifests and transport and other dispatch documents containing sufficient information to allow the following to be identified:

   (a) the description of the dual-use items;

   (b) the quantity of the dual-use items;

   (c) the name and address of the exporter and of the consignee;

   (d) where known, the end-use and end-user of the dual-use items.

2. The registers and records and the documents referred to in paragraph 1 shall be kept for at least three years from the end of the calendar year in which the export took place. They shall be produced to the competent authorities on request.

Article 18

In order to ensure that this Regulation is properly applied, each Member State shall take whatever measures are needed to permit the competent authorities:

(a) to gather information on any order or transaction involving dual-use items;

(b) to establish that the control measures are being properly applied, which may include in particular the power to enter the premises of persons with an interest in an export transaction.

CHAPTER IX

General and final provisions

Article 19

1. A Coordinating Group chaired by a representative of the Commission shall be set up. Each Member State shall appoint a representative to the Coordinating Group.

   The Coordinating Group shall examine any question concerning the application of this Regulation which may be raised either by the chairman or by a representative of a Member State and, in particular, the measures which should be taken by Member States to inform exporters of their obligations under this Regulation.

2. The Coordinating Group may, whenever it considers it to be necessary, consult organizations representative of exporters concerned by this Regulation.

Article 20

Each Member State shall take appropriate measures to ensure proper enforcement of all the provisions of this Regulation. In particular, it shall lay down the penalties applicable to infringements of the provisions of this Regulation or of those adopted for its implementation. Those penalties must be effective, proportionate and dissuasive.

In particular, for the implementation of Article 4(3), each Member State shall lay down and specify the nature of the breach of national law and shall determine the nature of the penalty to be imposed.

Article 21

Each Member State shall inform the Commission of the laws, regulations and administrative provisions adopted in implementation of this Regulation, including the measures referred to in Article 20. The Commission shall forward the information to the other Member States. Every three years the Commission shall present a report to the European Parliament and the Council on the application of this Regulation. Member States shall provide to the Commission all appropriate information for the preparation of the report.

Article 22

1. Paragraphs 2 to 5 shall apply in respect of consignments dispatched from one Member State to another.

2. For transfers of dual-use items listed in Annex IV, Part B, notification by the natural or legal person transferring the items to the competent authorities of the Member State where the items are located shall be required by all Member States. The information contained in such a notification must be identical to the information supplied to national authorities by a natural or legal person which applies for an individual export authorization for those dual-use items.

   The procedure for notification and provision of information shall not introduce or maintain unjustified and disproportionate restrictions on the free movement of goods within the Community.

3. In the case where a dual-use item listed in Annex IV has previously been transferred from one Member State to another and is subsequently to be exported, that fact shall be indicated in the application for an export authorization. The Member State or States in which the item was originally located must be consulted by the Member State in which the potential exporter is established. The licensing authorities of the Member State or States consulted shall make known within ten working days, any objections they may have to the grant of an export authorization. The opinion of the consulted Member State shall be binding.

If no objections are received within ten working days, the opinion of the Member State consulted shall be regarded as positive.

The Member State consulted may request the extension of the ten-day period.

4. Documents and records of intra-Community consignments of dual-use items listed in Annex I shall be kept for at least three years from the end of the year in which a transaction took place and shall be produced to the competent authorities on request.

5. The relevant commercial documents relating to intra-Community transfers of dual-use items listed in Annex I shall indicate clearly that those items are subject to controls if exported from the Community. Relevant commercial documents are, in particular, the sales contract, the order confirmation, the invoice or the dispatch note.

Article 23

1. An authorization shall be required for intra-Community transfers of separated plutonium and uranium enriched to more than 20%, as well as installations, main components of crucial importance and technology related to reprocessing, to enrichment and to the production of heavy water, under the terms of the Declaration of Common Policy of 20 November 1984. The relevant items are listed in Annex IV, Part A.

2. The authorization procedure pursuant to paragraph 1 shall not involve the application of internal frontier controls within the Community, but solely controls which are performed as part of the normal control procedures applied in a non-discriminatory fashion throughout the territory of the Community.

Article 24

This Regulation does not affect the application of the Treaty establishing the European Atomic Energy Community.

Article 25

Regulation (EC) No 3381/94 is repealed.

However, for export authorization applications made before the date of entry into force of this Regulation, the relevant provisions of Regulation (EC) No 3381/94 shall continue to apply.

Article 26

This Regulation shall enter into force on 1 January 1999.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Council
The President

ANNEX I - LIST OF PRODUCTS SUBJECT TO AN EXPORT AUTHORIZATION

GENERAL NOTES TO ANNEX I

1. For control of goods which are designed or modified for military use, see the relevant list(s) of controls on military goods maintained by individual Member States. References in this Annex that state "SEE ALSO MILITARY GOODS CONTROLS" refer to the same lists.

2. The object of the controls contained in this Annex should not be defeated by the export of any non-controlled goods (including plant) containing one or more controlled components when the controlled component or components are the principal element of the goods and can feasibly be removed or used for other purposes.

N.B. In judging whether the controlled component or components are to be considered the principal element, it is necessary to weigh the factors of quantity, value and technological know-how involved and other special circumstances which might establish the controlled component or components as the principal element of the goods being procured.

3. Goods specified in this Annex include both new and used goods.

"NUCLEAR TECHNOLOGY NOTE (NTN)

(To be read in conjunction with section E of Category 0).

The "technology" directly associated with any goods controlled in Category 0 is controlled according to the provisions of Category 0.

"Technology" for the "development", "production" or "use" of goods under control remains under control even when applicable to non-controlled goods.

The approval of goods for export also authorizes the export to the same end-user of the minimum "technology" required for the installation, operation, maintenance and repair of the goods.

Controls on "technology" transfer do not apply to information "in the public domain" or to "basic scientific research".

GENERAL TECHNOLOGY NOTE (GTN)

(To be read in conjunction with section E of Categories 1 to 9.)

The export of "technology" which is "required" for the "development", "production" or "use" of goods controlled in Categories 1 to 9, is controlled according to the provisions of Categories 1 to 9.

"Technology" "required" for the "development", "production" or "use" of goods under control remains under control even when applicable to non-controlled goods.

Controls do not apply to that "technology" which is the minimum necessary for the installation , operation, maintenance (checking) and repair of those goods which are not controlled or whose export has been authorised.
N.B.: This does not release such "technology" specified in 1E002.e. and 1E002.f. and 8E002.a. and 8E002.b.

Controls on "technology" transfer do not apply to information "in the public domain", to "basic scientific research" or to the minimum necessary information for patent applications.

GENERAL SOFTWARE NOTE (GSN)

(This note overrides any control within section D of Categories 0 to 9)

Categories 0 to 9 of this list do not control "software" which is either:

a. Generally available to the public by being:
   1. Sold from stock at retail selling points, without restriction, by means of:

a. Over-the-counter transactions;
b. Mail order transactions; or
c. Telephone order transactions; and

2. Designed for installation by the user without further substantial support by the supplier; or

b. "In the public domain".

DEFINITIONS OF TERMS IN THIS ANNEX

Category references are given in brackets after the defined term.

"Accuracy" (2 6), usually measured in terms of inaccuracy, means the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value (usually measured in terms of inaccuracy).

"Active flight control systems" (7) are systems that function to prevent undesirable "aircraft" and missile motions or structural loads by autonomously processing outputs from multiple sensors and then providing necessary preventive commands to effect automatic control.

"Active pixel" (6 8) is a minimum (single) element of the solid state array which has a photoelectric transfer function when exposed to light (electromagnetic) radiation.

"Adapted for use in war" (1) means any modification or selection (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) designed to increase the effectiveness in producing casualties in humans or animals, degrading equipment or damaging crops or the environment.

"Adaptive control" (2) means a control system that adjusts the response from conditions detected during the operation (ref. ISO 2806-1980).

"Aircraft" (1 7 9) means a fixed wing, swivel wing, rotary wing (helicopter), tilt rotor or tilt-wing airborne vehicle.
N.B.: See also "civil aircraft".

"Angular position deviation" (2) means the maximum difference between angular position and the actual, very accurately measured angular position after the workpiece mount of the table has been turned out of its initial position (ref. VDI/VDE 2617, Draft: 'Rotary tables on coordinate measuring machines').

"Asynchronous transfer mode" ("ATM") (5) means a transfer mode in which the information is organised into cells; it is asynchronous in the sense that the recurrence of cells depends on the required or instantaneous bit rate (CCITT recommendation L.113).

"ATM" is equivalent to "Asynchronous transfer mode".

"Automatic target tracking" (6) means a processing technique that automatically determines and provides as output an extrapolated value of the most probable position of the target in real time.

"Basic gate propagation delay time" (3) means the propagation delay time value corresponding to the basic gate used within a "family" of "monolithic integrated circuits". This may be specified, for a given "family", either as the propagation delay time per typical gate or as the typical propagation delay time per gate.
N.B.: *"Basic gate propagation delay time" is not to be confused with the input/output delay time of a complex "monolithic integrated circuit".*

"Basic scientific research" (GTN NTN) means experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena or observable facts, not primarily directed towards a specific practical aim or objective.

"Bias" (accelerometer) (7) means an accelerometer output when no acceleration is applied.

"Camming" (axial displacement) (2) means axial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle faceplate, at a point next to the circumference of the spindle faceplate (ref. ISO 230/1 1986, paragraph 5.63).

"Carbon fibre preforms" (1) means an ordered arrangement of uncoated or coated fibres intended to constitute a framework of a part before the "matrix" is introduced to form a "composite".

"CE" is equivalent to "computing element".

"CEP" (circle of equal probability) (7) is a measure of accuracy; the radius of the circle centred at the target, at a specific range, in which 50% of the payloads impact.

"Chemical Laser" (6) means a "laser" in which the excited species is produced by the output energy from a chemical reaction.

"Circulation-controlled anti-torque or circulation controlled direction control systems" (7) are systems that use air blown over aerodynamic surfaces to increase or control the forces generated by the surfaces.

"Civil aircraft" (1 7 9) means those "aircraft" listed by designation in published airworthiness certification lists by the civil aviation authorities to fly commercial civil internal and external routes or for legitimate civil, private or business use.
N.B.: See also "aircraft".

"Commingled" (1) means filament to filament blending of thermoplastic fibres and reinforcement fibres in order to produce a fibre reinforcement/ "matrix" mix in total fibre form.

"Comminution" (1) means a process to reduce a material to particles by crushing or grinding.

"Common channel signalling" (5) is a signalling method in which a single channel between exchanges conveys, by means of labelled messages, signalling information relating to a multiplicity of circuits or calls and other information such as that used for network management.

"Communications channel controller" (5) means the physical interface which controls the flow of synchronous or asynchronous digital information. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

"Composite" (1 2 6 8 9) means a "matrix" and an additional phase or additional phases consisting of particles, whiskers, fibres or any combination thereof, present for a specific purpose or purposes.

"Composite theoretical performance" ("CTP") (3 4) is a measure of computational performance given in millions of theoretical operations per second (Mtops), calculated using the aggregation of "computing elements" ("CE").
N.B.: See Category 4, Technical Note.

"Compound rotary table" (2) means a table allowing the workpiece to rotate and tilt about two non-parallel axes, which can be coordinated simultaneously for "contouring control".

"Computing element" ("CE") (4) means the smallest computational unit that produces an arithmetic or logic result.

"Contouring control" (2) means two or more "numerically controlled" motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated (ref. ISO/DIS 2806 - 1980).

"Critical temperature" (1 3 6) (sometimes referred to as the transition temperature) of a specific "superconductive" material means the temperature at which the material loses all resistance to the flow of direct electrical current.

"Cryptography" (5) means the discipline which embodies principles, means and methods for the transformation of data in order to hide its information content, prevent its undetected modification or prevent its unauthorized use. "Cryptography" is limited to the transformation of information using one or more "secret parameters" (e.g., crypto variables) or associated key management.
N.B.: "Secret parameter": a constant or key kept from the knowledge of others or shared only within a group.

"CTP" is equivalent to "composite theoretical performance".

"Data signalling rate" (5) means the rate, as defined in ITU Recommendation 53-36, taking into account that, for non-binary modulation, baud and bit per second are not equal. Bits for coding, checking and synchronisation functions are to be included.

N.B.: 1. *When determining the "data signalling rate", servicing and administrative channels shall be excluded.*

2. *It is the maximum one-way rate, i.e., the maximum rate in either transmission or reception.*

"Deformable mirrors" (6) (also known as adaptive optic mirrors) means mirrors having:

a. a single continuous optical reflecting surface which is dynamically deformed by the application of individual torques or forces to compensate for distortions in the optical waveform incident upon the mirror; or
b. multiple optical reflecting elements that can be individually and dynamically repositioned by the application of torques or forces to compensate for distortions in the optical waveform incident upon the mirror.

"Depleted uranium" (0) means uranium depleted in the isotope 235 below that occurring in nature.

"Development" (GTN NTN All) is related to all phases prior to serial production, such as: design, design research, design analyses, design concepts, assembly and testing of prototypes, pilot production schemes, design data, process of transforming design data into a product, configuration design, integration design, layouts.

"Diffusion bonding" (1 2 9) means a solid state molecular joining of at least two separate metals into a single piece with a joint strength equivalent to that of the weakest material.

"Digital computer" (4 5) means equipment which can, in the form of one or more discrete variables, perform all of the following:

a. Accept data;
b. Store data or instructions in fixed or alterable (writable) storage devices;
c. Process data by means of a stored sequence of instructions which is modifiable; and
d. Provide output of data.

N.B.: *Modifications of a stored sequence of instructions include replacement of fixed storage devices, but not a physical change in wiring or interconnections.*

"Digital transfer rate" (5) means the total bit rate of the information that is directly transferred on any type of medium.

N.B.: *See also "total digital transfer rate".*

"Direct-acting hydraulic pressing" (2) means a deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece.

"Drift rate" (gyro) (7) means the time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent input angular displacement per unit time with respect to inertial space.

"Dynamic adaptive routing" (5) means automatic rerouting of traffic based on sensing and analysis of current actual network conditions.

N.B.: *This does not include cases of routing decisions taken on predefined information.*

"Dynamic signal analysers" (3) means "signal analysers" which use digital sampling and transformation techniques to form a Fourier spectrum display of the given waveform including amplitude and phase information.

N.B.: *See also "signal analysers".*

"Effective gramme" (0 1) of "special fissile material" means:

a. For plutonium isotopes and uranium-233, the isotope weight in grammes;

b. For uranium enriched 1 per cent or greater in the isotope uranium-235, the element weight in grammes multiplied by the square of its enrichment expressed as a decimal weight fraction;

c. For uranium enriched below 1 per cent in the isotope uranium-235, the element weight in grammes multiplied by 0.0001.

"Electronic assembly" (3 4 5) means a number of electronic components (i.e., "circuit elements", 'discrete components', integrated circuits, etc.) connected together to perform (a) specific function(s), replaceable as an entity and normally capable of being disassembled.

N.B.: 1. "Circuit element" a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

2. "Discrete component": a separately packaged "circuit element" with its own external connections.

"Electronically steerable phased array antenna" (5 6) means an antenna which forms a beam by means of phase coupling, i.e., the beam direction is controlled by the complex excitation coefficients of the radiating elements and the direction of that beam can be varied in azimuth or in elevation, or both, by application, both in transmission and reception, of an electrical signal.

"End-effectors" (2) include grippers, "active tooling units" and any other tooling that is attached to the baseplate on the end of a "robot" manipulator arm.

N.B.: "Active tooling unit": a device for applying motive power, process energy or sensing to the workpiece.

"Equivalent Density" (6) means the mass of an optic per unit optical area projected onto the optical surface.

"Expert systems" (4 7) mean systems providing results by application of rules to data which are stored independently of the "programme" and capable of any of the following:

a. Modifying automatically the "source code" introduced by the user;
b. Providing knowledge linked to a class of problems in quasi-natural language; or
c. Acquiring the knowledge required for their development (symbolic training).

"FADEC" is equivalent to "full authority digital engine control".

"Family" (3) means a group of microprocessor or microcomputer microcircuits with:

a. The same architecture;
b. The same basic instruction set; and
c. The same basic technology (e.g., only NMOS or only CMOS).

"Fault tolerance" (4) is the capability of a computer system, after any malfunction of any of its hardware or "software" components, to continue to operate without human intervention, at a given level of service that provides: continuity of operation, data integrity and recovery of service within a given time.

"Fibrous or filamentary materials" (0 1 8) include:

a. Continuous "monofilaments";
b. Continuous "yarns" and "rovings";
c. "Tapes", fabrics, random mats and braids;
d. Chopped fibres, staple fibres and coherent fibre blankets;
e. Whiskers, either monocrystalline or polycrystalline, of any length;
f. Aromatic polyamide pulp.

"Film type integrated circuit" (3) means an array of 'circuit elements' and metallic interconnections formed by deposition of a thick or thin film on an insulating "substrate".

N.B.: "Circuit element" is a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

"Fixed" (5) means that the coding or compression algorithm cannot accept externally supplied parameters (e.g., cryptographic or key variables) and cannot be modified by the user.

"Flight control optical sensor array" (7) is a network of distributed optical sensors, using "laser" beams, to provide real-time flight control data for on-board processing.

"Flight path optimization" (7) is a procedure that minimizes deviations from a four-dimensional (space and time) desired trajectory based on maximizing performance or effectiveness for mission tasks.

"Focal plane array" (6) means a linear or two-dimensional planar layer, or combination of planar layers, of individual detector elements, with or without readout electronics, which work in the focal plane.

N.B.: This is not intended to include a stack of single detector elements or any two, three or four element detectors provided time delay and integration is not performed within the element.

"Frequency agility" (frequency hopping) (5) means a form of "spread spectrum" in which the transmission frequency of a single communication channel is made to change by discrete steps.

"Frequency switching time" (3 5) means the maximum time (i.e., delay), taken by a signal, when switched from one selected output frequency to another selected output frequency, to reach:

a. A frequency within 100 Hz of the final frequency; or
b. An output level within 1 dB of the final output level.

"Frequency synthesise" (3) means any kind of frequency source or signal generator, regardless of the actual technique used, providing a multiplicity of simultaneous or alternative output frequencies, from one or more outputs, controlled by, derived from or disciplined by a lesser number of standard (or master) frequencies.

"Full Authority Digital Engine Control" ("FADEC") (7 9) means an electronic control system for gas turbine or combined cycle engines utilising a digital computer to control the variables required to regulate engine thrust or shaft power output throughout the engine operating range from the beginning of fuel metering to fuel shutoff.

"Gas Atomisation" (1) means a process to reduce a molten stream of metal alloy to droplets of 500 micrometre diameter or less by a high pressure gas stream.

"Gateway" (5) means the function, realised by any combination of equipment and "software", to carry out the conversion of conventions for representing, processing or communicating information used in one system into the corresponding but different conventions used in another system.

"Geographically dispersed" (6) is where each location is distant from any other more than 1,500 m in any direction. Mobile sensors are always considered "geographically dispersed".

"Global interrupt latency time" (4) means the time taken by the computer system to recognize an interrupt due to the event, service the interrupt and perform a context switch to an alternate memory-resident task waiting on the interrupt.

"Guidance set" (7) means systems that integrate the process of measuring and computing a vehicles position and velocity (ie. navigation) with that of computing and sending commands to the vehicles flight control systems to correct the trajectory.

"Hot isostatic densification" (2) means the process of pressurising a casting at temperatures exceeding 375 K (102°C) in a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal force in all directions to reduce or eliminate internal voids in the casting.

"Hybrid computer" (4) means equipment which can perform all of the following:

a. Accept data;
b. Process data, in both analogue and digital representations; and
c. Provide output of data.

"Hybrid integrated circuit" (3) means any combination of integrated circuit(s), or integrated circuit with "circuit elements" or "discrete components" connected together to perform (a) specific function(s), and having all of the following characteristics:

a. Containing at least one unencapsulated device;
b. Connected together using typical IC production methods;
c. Replaceable as an entity; and
d. Not normally capable of being disassembled.

N.B.: 1. "Circuit element": a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

2. "Discrete component": a separately packaged "circuit element" with its own external connections.

"Image enhancement" (4) means the processing of externally derived information-bearing images by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform). This does not include algorithms using only linear or rotational transformation of a single image, such as translation, feature extraction, registration or false coloration.

"Immunotoxin" (1) is a conjugate of one cell specific monoclonal antibody and a "toxin" or "sub-unit of toxin", that selectively affects diseased cells.

"In the public domain" (GTN NTN GSN), as it applies herein, means "technology" or "software" which has been made available without restrictions upon its further dissemination (copyright restrictions do not remove "technology" or "software" from being "in the public domain").

"Information security" (4 5) is all the means and functions ensuring the accessibility, confidentiality or integrity of information or communications, excluding the means and functions intended to safeguard against malfunctions. This includes "cryptography", 'cryptanalysis', protection against compromising emanations and computer security.

N.B.: "Cryptanalysis": analysis of a cryptographic system or its inputs and outputs to derive confidential variables or sensitive data, including clear text.

"Instantaneous bandwidth" (3 5 7) means the bandwidth over which output power remains constant within 3 dB without adjustment of other operating parameters.

"Instrumented range" (6) means the specified unambiguous display range of a radar.

"Insulation" (9) is applied to the components of a rocket motor, ie. the case, nozzle, inlets, case closures, and includes cured or semi-cured compounded rubber sheet stock containing an insulating or refractory material. It may also be incorporated as stress relief boots or flaps.

"Integrated Services Digital Network" (ISDN) (5) means a unified end-to-end digital network, in which data originating from all types of communication (e.g., voice, text, data, still and moving pictures) are transmitted from one port (terminal) in the exchange (switch) over one access line to and from the subscriber.

"Interconnected radar sensors" (6) means two or more radar sensors are interconnected when they mutually exchange data in real time.

"Interior lining" (9) is suited for the bond interface between the solid propellant and the case or insulating liner. Usually a liquid polymer based dispersion of refractory or insulating materials, eg carbon filled HTPB or other polymer with added curing agents sprayed or screeded over a case interior.

"Intrinsic Magnetic Gradiometer" (6) is a single magnetic field gradient sensing element and associated electronics the output of which is a measure of magnetic field gradient.

N.B.: See also "magnetic gradiometer".

"ISDN" is equivalent to "Integrated Services Digital Network".

"Isolated live cultures" (1) includes live cultures in dormant form and in dried preparations.

"Isostatic presses" (2) mean equipment capable of pressurising a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal pressure in all directions within the cavity upon a workpiece or material.

"Laser" (0 2 3 5 6 7 8 9) is an assembly of components which produce both spatially and temporally coherent light that is amplified by stimulated emission of radiation.

N.B.: See also: *"Chemical laser";*
"Q-switched laser";
"Super High Power Laser";
"Transfer laser".

"Linearity" (2) (usually measured in terms of non-linearity) means the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalise and minimise the maximum deviations.

"Local area network" (4) is a data communication system having all of the following characteristics:
a. Allows an arbitrary number of independent 'data devices' to communicate directly with each other; and
b. Is confined to a geographical area of moderate size (e.g., office building, plant, campus, warehouse).
N.B.: "Data device" means equipment capable of transmitting or receiving sequences of digital information.

"Magnetic Gradiometers" (6) are instruments designed to detect the spatial variation of magnetic fields from sources external to the instrument. They consist of multiple "magnetometers" and associated electronics the output of which is a measure of magnetic field gradient.
N.B.: See also "intrinsic magnetic gradiometer".

"Magnetometers" (6) are instruments designed to detect magnetic fields from sources external to the instrument. They consist of a single magnetic field sensing element and associated electronics the output of which is a measure of the magnetic field.

"Main storage" (4) means the primary storage for data or instructions for rapid access by a central processing unit. It consists of the internal storage of a "digital computer" and any hierarchical extension thereto, such as cache storage or non-sequentially accessed extended storage.

"Materials resistant to corrosion by UF_6" (0) may be copper, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or alloy containing 60 weight percent or more nickel and UF_6- resistant fully fluorinated hydrocarbon polymers, as appropriate for the type of separation process."

"Matrix" (1 2 8 9) means a substantially continuous phase that fills the space between particles, whiskers or fibres.

"Measurement uncertainty" (2) is the characteristic parameter which specifies in what range around the output value the correct value of the measurable variable lies with a confidence level of 95 %. It includes the uncorrected systematic deviations, the uncorrected backlash and the random deviations (ref. ISO 10360-2, or VDI/VDE 2617).

"Mechanical Alloying" (1) means an alloying process resulting from the bonding, fracturing and rebonding of elemental and master alloy powders by mechanical impact. Non-metallic particles may be incorporated in the alloy by addition of the appropriate powders.

"Media access unit" (5) means equipment which contains one or more communication interfaces ("network access controller", "communications channel controller", modem or computer bus) to connect terminal equipment to a network.

"Melt Extraction" (1) means a process to 'solidify rapidly' and extract a ribbon-like alloy product by the insertion of a short segment of a rotating chilled block into a bath of a molten metal alloy.
N.B.: "Solidify rapidly": solidification of molten material at cooling rates exceeding 1,000 K/sec.

"Melt Spinning" (1) means a process to "solidify rapidly" a molten metal stream impinging upon a rotating chilled block, forming a flake, ribbon or rod-like product.
N.B.: "Solidify rapidly": solidification of molten material at cooling rates exceeding 1,000 K/sec.

"Microcomputer microcircuit" (3) means a "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing general purpose instructions from an internal storage, on data contained in the internal storage.
N.B.: The internal storage may be augmented by an external storage.

"Microprocessor microcircuit" (3) means a "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing a series of general purpose instructions from an external storage.

N.B.: 1. The "microprocessor microcircuit" normally does not contain integral user-accessible storage, although storage present on-the-chip may be used in performing its logic function.
2. This includes chip sets which are designed to operate together to provide the function of a "microprocessor microcircuit".

"Microorganisms" (1 2) means bacteria, viruses, mycoplasms, rickettsiae, chlamydiae or fungi, whether natural, enhanced or modified, either in the form of isolated live cultures or as material including living material which has been deliberately inoculated or contaminated with such cultures.

"Missiles" (1 3 5 6 7 9) means complete rocket systems and unmanned air vehicle systems, capable of delivering at least 500 kg payload to a range of at least 300 km.

"Monofilament" (1) or filament is the smallest increment of fibre, usually several micrometres in diameter.

"Monolithic integrated circuit" (3) means a combination of passive or active "circuit elements" or both which:
a. Are formed by means of diffusion processes, implantation processes or deposition processes in or on a single semiconducting piece of material, a so-called "chip";
b. Can be considered as indivisibly associated; and
c. Perform the function(s) of a circuit.
N.B.: "Circuit element" is a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

"Monospectral imaging sensors" (6) are capable of acquisition of imaging data from one discrete spectral band.

"Multichip integrated circuit" (3) means two or more "monolithic integrated circuits" bonded to a common "substrate".

"Multi-data-stream processing" (4) means the "microprogramme" or equipment architecture technique which permits simultaneous processing of two or more data sequences under the control of one or more instruction sequences by means such as:
a. Single Instruction Multiple Data (SIMD) architectures such as vector or array processors;
b. Multiple Single Instruction Multiple Data (MSIMD) architectures;
c. Multiple Instruction Multiple Data (MIMD) architectures, including those which are tightly coupled, closely coupled or loosely coupled; or
d. Structured arrays of processing elements, including systolic arrays.
N.B.: "Microprogramme" means a sequence of elementary instructions, maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction into an instruction register.

"Multilevel security" (5) means a class of system containing information with different sensitivities that simultaneously permits access by users with different security clearances and needs-to-know, but prevents users from obtaining access to information for which they lack authorization.
N.B.: "Multilevel security" is computer security and not computer reliability which deals with equipment fault prevention or human error prevention in general.

"Multispectral imaging sensors" (6) are capable of simultaneous or serial acquisition of imaging data from two or more discrete spectral bands. Sensors having more than twenty discrete spectral bands are sometimes referred to as hyperspectral imaging sensors.

"Natural uranium" (0) means uranium containing the mixtures of isotopes occurring in nature.

"Network access controller" (4 5) means a physical interface to a distributed switching network. It uses a common medium which operates throughout at the same "digital transfer rate" using arbitration (e.g., token or carrier sense) for transmission. Independently from any other, it selects data packets or data groups (e.g., IEEE 802) addressed to it. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

"Neural computer" (4) means a computational device designed or modified to mimic the behaviour of a neuron or a collection of neurons, i.e., a computational device which is distinguished by its hardware capability to modulate the weights and numbers of the interconnections of a multiplicity of computational components based on previous data.

"Noise level" (6) means an electrical signal given in terms of power spectral density. The relation between "noise level" expressed in peak-to-peak is given by $S^2_{pp} = 8N_o(f_2-f_1)$, where S_{pp} is the peak-to-peak value of the signal (e.g., nanoteslas), N_o is the power spectral density (e.g., (nanotesla)^2/Hz) and (f_2-f_1) defines the bandwidth of interest.

"Nuclear reactor" (0) means the items within or attached directly to the reactor vessel, the equipment which controls the level of power in the core, and the components which normally contain, come into direct contact with or control the primary coolant of the reactor core.

"Numerical control" (2) means the automatic control of a process performed by a device that makes use of numeric data usually introduced as the operation is in progress (ref. ISO 2382).

"Object code" (9) means an equipment executable form of a convenient expression of one or more processes ("source code" (source language)) which has been converted by programming system.

"Optical amplification" (5), in optical communications, means an amplification technique that introduces a gain of optical signals that have been generated by a separate optical source, without conversion to electrical signals, i.e., using semiconductor optical amplifiers, optical fibre luminescent amplifiers.

"Optical computer" (4) means a computer designed or modified to use light to represent data and whose computational logic elements are based on directly coupled optical devices.

"Optical fibre preforms" (5 6) means bars, ingots, or rods of glass, plastic or other materials which have been specially processed for use in fabricating optical fibres. The characteristics of the preform determine the basic parameters of the resultant drawn optical fibres.

"Optical integrated circuit" (3) means a "monolithic integrated circuit" or a "hybrid integrated circuit", containing one or more parts designed to function as a photosensor or photoemitter or to perform (an) optical or (an) electro-optical function(s).

"Optical switching" (5) means the routing of or switching of signals in optical form without conversion to electrical signals.

"Overall current density" (3) means the total number of ampere-turns in the coil (i.e., the sum of the number of turns multiplied by the maximum current carried by each turn) divided by the total cross-section of the coil (comprising the superconducting filaments, the metallic matrix in which the superconducting filaments are embedded, the encapsulating material, any cooling channels, etc.).

"Participating state" (7 9) means a participating state in the Wassenaar Arrangement.

"Peak power" (6), means energy per pulse in joules divided by the pulse duration in seconds.

"Personalized smart card" (5) means a smart card containing a microcircuit which has been programmed for a specific application and cannot be reprogrammed for any other application by the user.

"Power management" (7) means changing the transmitted power of the altimeter signal so that received power at the "aircraft" altitude is always at the minimum necessary to determine the altitude.

"Pressure transducers" (2) are devices that convert pressure measurements into an electrical signal.

"Previously separated" (0 1) means the application of any process intended to increase the concentration of the controlled isotope.

"Primary flight control" (7) means an "aircraft" stability or manoeuvering control using force/moment generators, i.e., aerodynamic control surfaces or propulsive thrust vectoring.

"Principal element" (4), as it applies in Category 4, is a "principal element" when its replacement value is more than 35% of the total value of the system of which it is an element. Element value is the price paid for the element by the manufacturer of the system, or by the system integrator. Total value is the normal international selling price to unrelated parties at the point of manufacture or consolidation of shipment.

"Production" (GTN NTN All) means all production phases, such as: construction, production engineering, manufacture, integration, assembly (mounting), inspection, testing, quality assurance.

"Production equipment" (9) means tooling, templates, jigs, mandrels, moulds, dies, fixtures, alignment mechanisms, test equipment, other machinery and components therefor, limited to those specially designed or modified for "development" or for one or more phases of "production".

"Production facilities" (9) means equipment and specially designed software therefor integrated into installations for "development" or for one or more phases of "production".

"Programme" (2 6) means a sequence of instructions to carry out a process in, or convertible into, a form executable by an electronic computer.

"Pulse compression" (6) means the coding and processing of a radar signal pulse of long time duration to one of short time duration, while maintaining the benefits of high pulse energy.

"Pulse duration" (6) is the duration of a "laser" pulse measured at Full Width Half Intensity (FWHI) levels.

"Q-switched laser" (6) means a "laser" in which the energy is stored in the population inversion or in the optical resonator and subsequently emitted in a pulse.

"Radar frequency agility" (6) means any technique which changes, in a pseudo-random sequence, the carrier frequency of a pulsed radar transmitter between pulses or between groups of pulses by an amount equal to or larger than the pulse bandwidth.

"Radar spread spectrum" (6) means any modulation technique for spreading energy originating from a signal with a relatively narrow frequency band, over a much wider band of frequencies, by using random or pseudo-random coding.

"Real time bandwidth" (3) for "dynamic signal analysers" is the widest frequency range which the analyser can output to display or mass storage without causing any discontinuity in the analysis of the input data. For analysers with more than one channel, the channel configuration yielding the widest "real-time bandwidth" shall be used to make the calculation.

"Real time processing" (2 4 6 7) means the processing of data by a computer system providing a required level of service, as a function of available resources, within a guaranteed response time, regardless of the load of the system, when stimulated by an external event.

"Required" (GTN 1-9), as applied to "technology" or "software", refers to only that portion of "technology" or "software" which is peculiarly responsible for achieving or extending the controlled performance levels, characteristics or functions. Such "required" "technology" or "software" may be shared by different goods.

"Resolution" (2) means the least increment of a measuring device; on digital instruments, the least significant bit (ref. ANSI B-89.1.12).

"Robot" (2 8) means a manipulation mechanism, which may be of the continuous path or of the point-to-point variety, may use sensors, and has all the following characteristics:

a. Is multifunctional;
b. Is capable of positioning or orienting material, parts, tools or special devices through variable movements in three dimensional space;
c. Incorporates three or more closed or open loop servo-devices which may include stepping motors; and
d. Has "user-accessible programmability" by means of teach/playback method or by means of an electronic computer which may be a programmable logic controller, i.e., without mechanical intervention.

N.B.: The above definition does not include the following devices:

1. *Manipulation mechanisms which are only manually/ teleoperator controllable;*

2. *Fixed sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is mechanically limited by fixed stops, such as pins or cams. The sequence of motions and the selection of paths or angles are not variable or changeable by mechanical, electronic or electrical means;*

3. *Mechanically controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is mechanically limited by fixed, but adjustable stops, such as pins or cams. The sequence of motions and the selection of paths or angles are variable within the fixed programme pattern. Variations or modifications of the programme pattern (e.g., changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations;*

4. *Non-servo-controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is variable but the sequence proceeds only by the binary signal from mechanically fixed electrical binary devices or adjustable stops;*

5. *Stacker cranes defined as Cartesian coordinate manipulator systems manufactured as an integral part of a vertical array of storage bins and designed to access the contents of those bins for storage or retrieval.*

"Rotary atomisation" (1) means a process to reduce a stream or pool of molten metal to droplets to a diameter of 500 micrometre or less by centrifugal force.

"Roving" (1) is a bundle (typically 12-120) of approximately parallel "strands".

N.B.: "Strand' is a bundle of "monofilaments" (typically over 200) arranged approximately parallel.

"Run out" (out-of-true running) (2) means radial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle axis at a point on the external or internal revolving surface to be tested (ref. ISO 230/1-1986, paragraph 5.61).

"Scale factor" (gyro or accelerometer) (7) means the ratio of change in output to a change in the input intended to be measured. Scale factor is generally evaluated as the slope of the straight line that can be fitted by the method of least squares to input-output data obtained by varying the input cyclically over the input range.

"SDH" is equivalent to "synchronous digital hierarchy".

"Settling time" (3) means the time required for the output to come within one-half bit of the final value when switching between any two levels of the converter.

"SHPL" is equivalent to "super high power laser".

"Signal analysers" (3) means apparatus capable of measuring and displaying basic properties of the single-frequency components of multi-frequency signals.

"Signal processing" (3 4 5 6) means the processing of externally derived information-bearing signals by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform).

"Software" (GSN All) means a collection of one or more "programmes" or "microprogrammes" fixed in any tangible medium of expression.

N.B.: "Microprogramme" means a sequence of elementary instructions, maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction into an instruction register.

"SONET" is equivalent to "synchronous optical network".

"Source code" (or source language) (4 5 6 7 9) is a convenient expression of one or more processes which may be turned by a programming system into equipment executable form ("object code" (or object language)).

"Spacecraft" (7 9) means active and passive satellites and space probes.

"Space qualified" (3 6) refers to products designed, manufactured and tested to meet the special electrical, mechanical or environmental requirements for use in the launch and deployment of satellites or high altitude flight systems operating at altitudes of 100 km or higher.

"Special fissile material" (0) means plutonium-239, uranium-233, "uranium enriched in the isotopes 235 or 233", and
any material containing the foregoing."

"Specific modulus" (0 1) is Young's modulus in pascals, equivalent to N/m^2 divided by specific weight in N/m^3, measured at a temperature of (296 ± 2) K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.

"Specific tensile strength" (0 1) is ultimate tensile strength in pascals, equivalent to N/m^2 divided by specific weight in N/m^3, measured at a temperature of (296 ± 2) K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.

"Spectral efficiency" (5) is a figure of merit parametrized to characterize the efficiency of transmission system which uses complex modulation schemes such as QAM (quadrature amplitude modulation), Trellis coding, QPSK (Q-phased shift key), etc. It is defined as follows:

$$\text{"Spectral efficiency"} = \frac{\text{"Digital transfer rate"(bits/second)}}{\text{6 dB spectrum bandwidth (Hz)}}$$

"Splat Quenching" (1) means a process to "solidify rapidly" a molten metal stream impinging upon a chilled block, forming a flake-like product.

N.B.: "Solidify rapidly": solidification of molten material at cooling rates exceeding 1,000 K/sec.

"Spread spectrum" (5) means the technique whereby energy in a relatively narrow-band communication channel is spread over a much wider energy spectrum.

"Spread spectrum" radar (6) - see "Radar spread spectrum"

"Stability" (7) means the standard deviation (1 sigma) of the variation of a particular parameter from its calibrated value measured under stable temperature conditions. This can be expressed as a function of time.

"Stored programme controlled" (2 3 5) means controlled by using instructions stored in an electronic storage which a processor can execute in order to direct the performance of predetermined functions.

N.B.: Equipment may be "stored programme controlled" whether the electronic storage is internal or external to the equipment.

"Substrate" (3) means a sheet of base material with or without an interconnection pattern and on which or within which "discrete components" or integrated circuits or both can be located.

N.B.: 1. "Discrete component": a separately packaged "circuit element" with its own external connections.

2. "Circuit element": a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

"Substrate blanks" (6) means monolithic compounds with dimensions suitable for the production of optical elements such as mirrors or optical windows.

"Sub-unit of toxin" (1) is a structurally and functionally discrete component of a whole "toxin".

"Superalloys" (2 9) means nickel-, cobalt- or iron-base alloys having strengths superior to any alloys in the AISI 300 series at temperatures over 922 K (649°C) under severe environmental and operating conditions.

"Superconductive" (1 3 6 8) means materials, i.e., metals, alloys or compounds, which can lose all electrical resistance, i.e., which can attain infinite electrical conductivity and carry very large electrical currents without Joule heating.

N.B.: The "superconductive" state of a material is individually characterised by a "critical temperature", a critical magnetic field, which is a function of temperature, and a critical current density which is, however, a function of both magnetic field and temperature.

"Super High Power Laser" ("SHPL") (6) means a "laser" capable of delivering (the total or any portion of) the output energy exceeding 1 kJ within 50 ms or having an average or CW power exceeding 20 kW.

"Superplastic forming" (1 2) means a deformation process using heat for metals that are normally characterised by low values of elongation (less than 20%) at the breaking point as determined at room temperature by conventional tensile strength testing, in order to achieve elongations during processing which are at least 2 times those values.

"Switch fabric" (5) is that hardware and associated "software" which provides the physical or virtual connection path for in-transit message traffic being switched.

"Synchronous digital hierarchy" ("SDH") (5) means a digital hierarchy providing a means to manage, multiplex and access various forms of digital traffic using a synchronous transmission format on different types of media. The format is based on the Synchronous Transport Module (STM) which is defined by CCITT Recommendation G.703, G.707, G.708, G.709 and others yet to be published, The first level rate of "SDH" is 155.52 Mbit/s.

"Synchronous optical network" ("SONET") (5) means a network providing a means to manage, multiplex and access various forms of digital traffic using a synchronous transmission format on fibre optics. The format is the North America version of "SDH" and also uses the Synchronous Transport Module (STM). However, it uses the Synchronous Transport Signal (STS) as the basic transport module with a first level rate of 51.81 Mbit/s. The "SONET" standards are being integrated into those of "SDH".

"System tracks" (6) means processed, correlated (fusion of radar target data to flight plan position) and updated aircraft flight position report available to the Air Traffic Control centre controllers.

"Systolic array computer" (4) means a computer where the flow and modification of the data is dynamically controllable at the logic gate level by the user.

"Tape" (1) is a material constructed of interlaced or unidirectional "monofilaments", "strands", "rovings", "tows", or "yarns", etc., usually preimpregnated with resin.

N.B.: "Strand' is a bundle of "monofilaments" (typically over 200) arranged approximately parallel.

"Technology" (GTN NTN All) means specific information necessary for the "development", "production" or "use" of goods. This information takes the form of 'technical data" or 'technical assistance".

N.B.: 1. "Technical assistance" may take forms such as instructions, skills, training, working knowledge and consulting services and may involve the transfer of "technical data".

2. "Technical data" may take forms such as blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories.

"Terminal interface equipment" (4) means equipment at which information enters or leaves the telecommunication system, e.g., telephone, data device, computer, facsimile device.

"Three dimensional Vector Rate" (4) means the number of vectors generated per second which have 10 pixel poly line vectors, clip tested, randomly oriented, with either integer or floating point X-Y-Z coordinate values (whichever produces the maximum rate).

"Tilting spindle" (2) means a tool-holding spindle which alters, during the machining process, the angular position of its centre line with respect to any other axis.

"Time constant" (6) is the time taken from the application of a light stimulus for the current increment to reach a value of 1-1/e times the final value (i.e., 63% of the final value).

"Total control of flight" (7) means an automated control of "aircraft" state variables and flight path to meet mission objectives responding to real time changes in data regarding objectives, hazards or other "aircraft".

"Total digital transfer rate" (5) means the number of bits, including line coding, overhead and so forth per unit time passing between corresponding equipment in a digital transmission system.
N.B.: See also "digital transfer rate".

"Tow" (1) is a bundle of "monofilaments", usually approximately parallel.

"Toxins" (1 2) means toxins in the form of deliberately isolated preparations or mixtures, no matter how produced, other than toxins present as contaminants of other materials such as pathological specimens, crops, foodstuffs or seed stocks of "microorganisms".

"Transfer laser" (6) means a "laser" in which the lasing species is excited through the transfer of energy by collision of a non-lasing atom or molecule with a lasing atom or molecule species.

"Tunable" (6) means the ability of a "laser" to produce a continuous output at all wavelengths over a range of several "laser" transitions. A line selectable "laser" produces discrete wavelengths within one "laser" transition and is not considered "tunable".

"Uranium enriched in the isotopes 235 or 233" (0) means uranium containing the isotopes 235 or 233, or both, in an amount such that the abundance ratio of the sum of these isotopes to the isotope 238 is more than the ratio of the isotope 235 to the isotope 238 occurring in nature (isotopic ratio 0.72 per cent).

"Use" (GTN NTN All) means operation, installation (including on-site installation), maintenance (checking), repair, overhaul and refurbishing.

"User-accessible programmability" (4 5 6) means the facility allowing a user to insert, modify or replace "programmes" by means other than:
a. A physical change in wiring or interconnections; or
b. The setting of function controls including entry of parameters.

"Vaccine" (1) is a medicinal product which is intended to stimulate a protective immunological response in humans or animals in order to prevent disease.

"Vacuum atomisation" (1) means a process to reduce a molten stream of metal to droplets of a diameter of 500 micrometre or less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

"Variable geometry airfoils" (7) means the use of trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

"Yarn" (1) is a bundle of twisted "strands".
N.B.: "Strand' is a bundle of "monofilaments" (typically over 200) arranged approximately parallel.

ACRONYMS AND ABBREVIATIONS USED IN THIS ANNEX

An acronym or abbreviation, when used as a defined term, will be found in "Definitions of Terms used in this Annex".

ACRONYM OR ABBREVIATION	MEANING
ABEC	Annular Bearing Engineers Committee
AGMA	American Gear Manufacturers' Association
AHRS	attitude and heading reference systems
AISI	American Iron and Steel Institute
ALU	arithmetic logic unit
ANSI	American National Standards Institute
ASTM	the American Society for Testing and Materials
ATC	air traffic control
AVLIS	atomic vapour "laser" isotope separation
CAD	computer-aided-design
CCITT	International Telegraph and Telephone Consultative Committee
CDU	control and display unit
CEP	circular error probable
CNTD	controlled nucleation thermal deposition
CRISLA	chemical reaction by isotope selective "laser" activation
CVD	chemical vapour deposition
CW	chemical warfare
CW (for lasers)	continuous wave
DME	distance measuring equipment
DS	directionally solidified
EB-PVD	electron beam physical vapour deposition
ECM	electro-chemical machining
ECR	electron cyclotron resonance
EDM	electrical discharge machines
EEPROMS	electrically erasable programmable read only memory
EIA	Electronic Industries Association
EMC	electromagnetic compatibility
FFT	Fast Fourier Transform
GLONASS	global navigation satellite system
GPS	global positioning system
HBT	hetero-bipolar transistors
HDDR	high density digital recording
HEMT	high electron mobility transistors

ACRONYM OR ABBREVIATION	MEANING
ICAO	International Civil Aviation Organisation
IEEE	Institute of Electrical and Electronic Engineers
IFOV	instantaneous-field-of-view
ILS	instrument landing system
IRIG	inter-range instrumentation group
ISAR	inverse synthetic aperture radar
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JIS	Japanese Industrial Standard
JT	Joule-Thomson
LIDAR	light detection and ranging
LRU	line replaceable unit
MAC	message authentication code
Mach	ratio of speed of an object to speed of sound (after Ernst Mach)
MLS	microwave landing systems
MLIS	molecular "laser" isotope separation.
MOCVD	metal organic chemical vapour deposition
MRI	magnetic resonance imaging
MTBF	mean-time-between-failures
Mtops	million theoretical operations per second
MTTF	mean-time-to-failure
NBC	Nuclear, Biological and Chemical
NDT	non-destructive test
PAR	precision approach radar
PIN	personal identification number
ppm	parts per million
PSD	power spectral density
QAM	quadrature-amplitude-modulation
RF	radio frequency
SACMA	Suppliers of Advanced Composite Materials Association
SAR	synthetic aperture radar
SC	single crystal
SLAR	sidelooking airborne radar
SRA	shop replaceable assembly
SRAM	static random access memory
SRM	SACMA Recommended Methods
SSB	single sideband
SSR	secondary surveillance radar
TCSEC	trusted computer system evaluation criteria
TIR	total indicated reading
UV	ultraviolet
UTS	ultimate tensile strength
VOR	very high frequency omni-directional range
YAG	yttrium/aluminum garnet

CATEGORY 0 - NUCLEAR MATERIALS, FACILITIES, AND EQUIPMENT

"0A Systems, Equipment and Components

"0A001 "Nuclear reactors" and specially designed or prepared equipment and components therefor, as follows:

a. "Nuclear reactors" capable of operation so as to maintain a controlled self-sustaining fission chain reaction;

b. Metal vessels, or major shop-fabricated parts therefor, specially designed or prepared to contain the core of a "nuclear reactor", including the reactor vessel head for a reactor pressure vessel;

c. Manipulative equipment specially designed or prepared for inserting or removing fuel in a "nuclear reactor";

d. Control rods specially designed or prepared for the control of the fission process in a "nuclear reactor", support or suspension structures therefor, rod drive mechanisms and rod guide tubes;

e. Pressure tubes specially designed or prepared to contain fuel elements and the primary coolant in a "nuclear reactor" at an operating pressure in excess of 5.1 MPa;

f. Zirconium metal and alloys in the form of tubes or assemblies of tubes in which the ratio of hafnium to zirconium is less than 1:500 parts by weight, specially designed or prepared for use in a "nuclear reactor";

g. Coolant pumps specially designed or prepared for circulating the primary coolant of "nuclear reactors";

h. 'Nuclear reactor internals' specially designed or prepared for use in a "nuclear reactor", including support columns for the core, fuel channels, thermal shields, baffles, core grid plates, and diffuser plates;

Note: In entry 0A001.h., 'nuclear reactor internals' means any major structure within a reactor vessel which has one or more functions such as supporting the core, maintaining fuel alignment, directing primary coolant flow, providing radiation shields for the reactor vessel, and guiding in-core instrumentations.

i. Heat exchangers (steam generators) specially designed or prepared for use in the primary coolant circuit of a "nuclear reactor";

j. Neutron detection and measuring instruments specially designed or prepared for determining neutron flux levels within the core of a "nuclear reactor".

0A002 Power generating or propulsion equipment specially designed for use with space, marine or mobile "nuclear reactors".

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

Note: 0A002 does not apply to conventional power generating equipment which, although designed for use in a particular nuclear station, could in principle be used in conjunction with conventional systems.

0B Test, Inspection and Production Equipment

0B001 Plant for the separation of isotopes of "natural uranium", "depleted uranium" and "special fissile materials", and specially designed or prepared equipment and components therefor, as follows:

a. Plant specially designed for separating isotopes of "natural uranium", "depleted uranium", and "special fissile materials", as follows:

1. Gas centrifuge separation plant;
2. Gaseous diffusion separation plant;
3. Aerodynamic separation plant;
4. Chemical exchange separation plant;
5. Ion-exchange separation plant;
6. Atomic vapour "laser" isotope separation (AVLIS) plant;
7. Molecular "laser" isotope separation (MLIS) plant;
8. Plasma separation plant;
9. Electro magnetic separation plant;

b. Gas centrifuges and assemblies and components, specially designed or prepared for gas centrifuge separation process, as follows:

Note: *In 0B001.b., 'high strength-to-density ratio material' means any of the following:*

a. Maraging steel capable of an ultimate tensile strength of 2,050 MPa or more;

b. Aluminium alloys capable of an ultimate tensile strength of 460 MPa or more; or

c. "Fibrous or filamentary materials" with a "specific modulus" of more than 3.18×10^6 m and a "specific tensile strength" greater than 76.2×10^3 m;

1. Gas centrifuges;

2. Complete rotor assemblies;

3. Rotor tube cylinders with a wall thickness of 12 mm or less, a diameter of between 75 mm and 400 mm, made from 'high strength-to-density ratio materials';

4. Rings or bellows with a wall thickness of 3 mm or less and a diameter of between 75 mm and 400 mm and designed to give local support to a rotor tube or to join a number together, made from 'high strength-to-density ratio materials';

5. Baffles of between 75 mm and 400 mm diameter for mounting inside a rotor tube, made from 'high strength-to-density ratio materials';

6. Top or bottom caps of between 75 mm and 400 mm diameter to fit the ends of a rotor tube, made from 'high strength-to-density ratio materials';

7. Magnetic suspension bearings consisting of an annular magnet suspended within a housing made of or protected by "materials resistant to corrosion by UF_6" containing a damping medium and having the magnet coupling with a pole piece or second magnet fitted to the top cap of the rotor;

8. Specially prepared bearings comprising a pivot-cup assembly mounted on a damper;

9. Molecular pumps comprised of cylinders having internally machined or extruded helical grooves and internally machined bores;

10. Ring-shaped motor stators for multiphase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in the frequency range of 600 to 2,000 Hz and a power range of 50 to 1,000 Volt-Amps;

11. Centrifuge housing/recipients to contain the rotor tube assembly of a gas centrifuge, consisting of a rigid cylinder of wall thickness up to 30 mm with precision machined ends and made of or protected by "materials resistant to corrosion by UF_6";

12. Scoops consisting of tubes of up to 12 mm internal diameter for the extraction of UF_6 gas from within a centrifuge rotor tube by a Pitot tube action, made of or protected by "materials resistant to corrosion by UF_6";

13. Frequency changers (converters or inverters) specially designed or prepared to supply motor stators for gas centrifuge enrichment, having all of the following characteristics, and specially designed components therefor:

    a. Multiphase output of 600 to 2,000 Hz;
    b. Frequency control better than 0.1%;
    c. Harmonic distortion of less than 2%; and
    d. An efficiency greater than 80%;

c. Equipment and components, specially designed or prepared for gaseous diffusion separation process, as follows:

1. Gaseous diffusion barriers made of porous metallic, polymer or ceramic "materials resistant to corrosion by UF_6" with a pore size of 10 to 100 nm, a thickness of 5 mm or less, and, for tubular forms, a diameter of 25 mm or less;

2. Gaseous diffuser housings made of or protected by "materials resistant to corrosion by UF_6";

3. Compressors (positive displacement, centrifugal and axial flow types) or gas blowers with a suction volume capacity of 1 m^3/min or more of UF_6, and discharge pressure up to 666.7 kPa, made of or protected by "materials resistant to corrosion by UF_6";

4. Rotary shaft seals for compressors or blowers specified in 0B001.c.3. and designed for a buffer gas in-leakage rate of less than 1,000 cm^3/min.;

5. Heat exchangers made of aluminium, copper, nickel, or alloys containing more than 60 weight percent nickel, or combinations of these metals as clad tubes, designed to operate at sub-atmospheric pressure with a leak rate that limits the pressure rise to less than 10 Pa per hour under a pressure differential of 100 kPa;

6. Bellow valves made of or protected by "materials resistant to corrosion by UF_6", with a diameter of 40 mm to 1,500 mm;

d. Equipment and components, specially designed or prepared for aerodynamic separation process, as follows:

1. Separation nozzles consisting of slit-shaped, curved channels having a radius of curvature less than 1 mm, resistant to corrosion by UF_6, and having a knife-edge contained within the nozzle which separates the gas flowing through the nozzle into two streams;

2. Tangential inlet flow-driven cylindrical or conical tubes (vortex tubes), made of or protected by "materials resistant to corrosion by UF_6" with a diameter of between 0.5 cm and 4 cm and a length to diameter ratio of 20:1 or less and with one or more tangential inlets;

3. Compressors (positive displacement, centrifugal and axial flow types) or gas blowers with a suction volume capacity of 2 m^3/min, made of or protected by "materials resistant to corrosion by UF_6", and rotary shaft seals therefor;

4. Heat exchangers made of or protected by "materials resistant to corrosion by UF_6";

5. Aerodynamic separation element housings, made of or protected by "materials resistant to corrosion by UF_6" to contain vortex tubes or separation nozzles;

6. Bellows valves made of or protected by "materials resistant to corrosion by UF_6", with a diameter of 40 to 1,500 mm;

7. Process systems for separating UF_6 from carrier gas (hydrogen or helium) to 1 ppm UF_6 content or less, including:

   a. Cryogenic heat exchangers and cryoseparators capable of temperatures of 153 K (-120°C) or less;

   b. Cryogenic refrigeration units capable of temperatures of 153 K (-120°C) or less;

   c. Separation nozzle or vortex tube units for the separation of UF_6 from carrier gas;

   d. UF_6 cold traps capable of temperatures of 253 K (-20°C) or less;

e. Equipment and components, specially designed or prepared for chemical exchange separation process, as follows:

   1. Fast-exchange liquid-liquid pulse columns with stage residence time of 30 seconds or less and resistant to concentrated hydrochloric acid (e.g. made of or protected by suitable plastic materials such as fluorocarbon polymers or glass);

   2. Fast-exchange liquid-liquid centrifugal contactors with stage residence time of 30 seconds or less and resistant to concentrated hydrochloric acid (e.g. made of or protected by suitable plastic materials such as fluorocarbon polymers or glass);

   3. Electrochemical reduction cells resistant to concentrated hydrochloric acid solutions, for reduction of uranium from one valence state to another;

   4. Electrochemical reduction cells feed equipment to take U^{+4} from the organic stream and, for those parts in contact with the process stream, made of or protected by suitable materials (e.g. glass, fluorocarbon polymers, polyphenyl sulphate, polyether sulfone and resin-impregnated graphite);

   5. Feed preparation systems for producing high purity uranium chloride solution consisting of dissolution, solvent extraction and/or ion exchange equipment for purification and electrolytic cells for reducing the uranium U^{+6} or U^{+4} to U^{+3};

   6. Uranium oxidation systems for oxidation of U^{+3} to U^{+4};

f. Equipment and components, specially designed or prepared for ion-exchange separation process, as follows:

   1. Fast reacting ion-exchange resins, pellicular or porous macro-reticulated resins in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure, and other composite structures in any suitable form, including particles or fibres, with diameters of 0.2 mm or less, resistant to concentrated hydrochloric acid and designed to have an exchange rate half-time of less than 10 seconds and capable of operating at temperatures in the range of 373 K (100°C) to 473 K (200°C);

2. Ion exchange columns (cylindrical) with a diameter greater than 1,000 mm, made of or protected by materials resistant to concentrated hydrochloric acid (e.g. titanium or fluorocarbon plastics) and capable of operating at temperatures in the range of 373 K (100°C) to 473 K (200°C) and pressures above 0.7 MPa;

3. Ion exchange reflux systems (chemical or electrochemical oxidation or reduction systems) for regeneration of the chemical reducing or oxidizing agents used in ion exchange enrichment cascades;

g. Equipment and components, specially designed or prepared for atomic vapour "laser" isotope separation process (AVLIS), as follows:

1. High power strip or scanning electron beam guns with a delivered power of more than 2.5 kW/cm for use in uranium vaporization systems;

2. Liquid uranium metal handling systems for molten uranium or uranium alloys, consisting of crucibles, made of or protected by suitable corrosion and heat resistant materials (e.g. tantalum, yttria-coated graphite, graphite coated with other rare earth oxides or mixtures thereof), and cooling equipment for the crucibles;

NB: see also 2A225.

3. Product and tails collector systems made of or lined with materials resistant to the heat and corrosion of uranium metal vapour or liquid, such as yttria-coated graphite or tantalum;

4. Separator module housings (cylindrical or rectangular vessels) for containing the uranium metal vapour source, the electron beam gun and the product and tails collectors;

5. "Lasers" or "laser" systems for the separation of uranium isotopes with a spectrum frequency stabiliser for operation over extended periods of time;

NB: see also 6A005 and 6A205.

h. Equipment and components, specially designed or prepared for molecular "laser" isotope separation process (MLIS) or chemical reaction by isotope selective laser activation (CRISLA), as follows:

1. Supersonic expansion nozzles for cooling mixtures of UF_6 and carrier gas to 150 K (-123°C) or less and made from "materials resistant to corrosion by UF_6";

2. Uranium pentafluoride (UF_5) product collectors consisting of filter, impact, or cyclone-type collectors or combinations thereof, and made of "materials resistant to corrosion by UF_5/UF_6";

3. Compressors made of or protected by "materials resistant to corrosion by UF_6", and rotary shaft seals therefor;

4. Equipment for fluorinating UF_5 (solid) to UF_6 (gas);

5. Process systems for separating UF_6 from carrier gas (e.g. nitrogen or argon) including:

a. Cryogenic heat exchangers and cryoseparators capable of temperatures of 153 K (-120°C) or less;

b. Cryogenic refrigeration units capable of temperatures of 153 K (-120°C) or less;

c. UF_6 cold traps capable of temperatures of 253 K (-20°C) or less;

6. "Lasers" or "laser" systems for the separation of uranium isotopes with a spectrum frequency stabiliser for operation over extended periods of time;

NB: see also 6A005 and 6A205.

i. Equipment and components, specially designed or prepared for plasma separation process, as follows:

1. Microwave power sources and antennae for producing or accelerating ions, with an output frequency greater than 30 GHz and mean power output greater than 50 kW;

2. Radio frequency ion excitation coils for frequencies of more than 100 kHz and capable of handling more than 40 kW mean power;

3. Uranium plasma generation systems;

4. Liquid metal handling systems for molten uranium or uranium alloys, consisting of crucibles, made of or protected by suitable corrosion and heat resistant materials (e.g. tantalum, yttria-coated graphite, graphite coated with other rare earth oxides or mixtures thereof), and cooling equipment for the crucibles;

NB: see also 2A225.

5. Product and tails collectors made of or protected by materials resistant to the heat and corrosion of uranium vapour such as yttria-coated graphite or tantalum;

6. Separator module housings (cylindrical) for containing the uranium plasma source, radio-frequency drive coil and the product and tails collectors and made of a suitable non-magnetic material (e.g. stainless steel);

j. Equipment and components, specially designed or prepared for electromagnetic separation process, as follows:

1. Ion sources, single or multiple, consisting of a vapour source, ionizer, and beam accelerator made of suitable non-magnetic materials (e.g. graphite, stainless steel, or copper) and capable of providing a total ion beam current of 50 mA or greater;

2. Ion collector plates for collection of enriched or depleted uranium ion beams, consisting of two or more slits and pockets and made of suitable non-magnetic materials (e.g. graphite or stainless steel);
3. Vacuum housings for uranium electromagnetic separators made of non-magnetic materials (e.g. stainless steel) and designed to operate at pressures of 0.1 Pa or lower;

4. Magnet pole pieces with a diameter greater than 2 m;

5. High voltage power supplies for ion sources, having all of the following characteristics:

a. Capable of continuous operation;
b. Output voltage of 20,000 V or greater;
c. Output current of 1 A or greater; and
d. Voltage regulation of better than 0.01% over a period of 8 hours;

NB: see also 3A227.

6. Magnet power supplies (high power, direct current) having all of the following characteristics:

a. Capable of continuous operation with a current output of 500 A or greater at a voltage of 100 V or greater; and

b. Current or voltage regulation better than 0.01% over a period of 8 hours.

NB: see also 3A226.

0B002 Specially designed or prepared auxiliary systems, equipment and components, as follows, for isotope separation plant specified in 0B001, made of or protected by "materials resistant to corrosion by UF_6":

a. Feed autoclaves, ovens or systems used for passing UF_6 to the enrichment process;

b. Desublimers or cold traps, used to remove UF_6 from the enrichment process for subsequent transfer upon heating;

c. Product and tails stations for transferring UF_6 into containers;

d. Liquefaction or solidification stations used to remove UF_6 from the enrichment process by compressing, cooling and converting UF_6 to a liquid or solid form;

e. Piping systems and header systems specially designed for handling UF_6 within gaseous diffusion, centrifuge or aerodynamic cascades;

f. 1. Vacuum manifolds or vacuum headers having a suction capacity of $5m^3$/minute or more; or

2. Vacuum pumps specially designed for use in UF_6 bearing atmospheres;

g. UF_6 mass spectrometers/ion sources specially designed or prepared for taking on-line samples of feed, product or tails from UF_6 gas streams and having all of the following characteristics:

1. Unit resolution for mass of more than 320 amu;

2. Ion sources constructed of or lined with nichrome or monel, or nickel plated;

3. Electron bombardment ionization sources; and

4. Collector system suitable for isotopic analysis.

0B003 Plant for the conversion of uranium and equipment specially designed or prepared therefor, as follows:

a. Systems for the conversion of uranium ore concentrates to UO_3;
b. Systems for the conversion of UO_3 to UF_6;
c. Systems for the conversion of UO_3 to UO_2;
d. Systems for the conversion of UO_2 to UF_4;
e. Systems for the conversion of UF_4 to UF_6;
f. Systems for the conversion of UF_4 to uranium metal;
g Systems for the conversion of UF_6 to UO_2;
h. Systems for the conversion of UF_6 to UF_4.

0B004 Plant for the production or concentration of heavy water, deuterium and deuterium compounds and specially designed or prepared equipment and components therefor, as follows:

a. Plant for the production of heavy water, deuterium or deuterium compounds, as follows:

1. Water-hydrogen sulphide exchange plants;
2. Ammonia-hydrogen exchange plants;

b. Equipment and components, as follows:

1. Water-hydrogen sulphide exchange towers fabricated from fine carbon steel (e.g. ASTM A516) with diameters of 6 m to 9 m, capable of operating at pressures greater than or equal to 2 MPa and with a corrosion allowance of 6 mm or greater;

2. Single stage, low head (i.e. 0.2 MPa) centrifugal blowers or compressors for hydrogen sulphide gas circulation (i.e. gas containing more than 70% H_2S) with a throughput capacity greater than or equal to 56 m^3/second when operating at pressures greater than or equal to 1.8 MPa suction and having seals designed for wet H_2S service;

3. Ammonia-hydrogen exchange towers greater than or equal to 35 m in height with diameters of 1.5 m to 2.5 m capable of operating at pressures greater than 15 MPa;

4. Tower internals, including stage contactors, and stage pumps, including those which are submersible, for heavy water production utilizing the ammonia-hydrogen exchange process;

5. Ammonia crackers with operating pressures greater than or equal to 3 MPa for heavy water production utilizing the ammonia-hydrogen exchange process;

6. Infrared absorption analysers capable of on-line hydrogen/deuterium ratio analysis where deuterium concentrations are equal to or greater than 90%;

7. Catalytic burners for the conversion of enriched deuterium gas into heavy water utilizing the ammonia-hydrogen exchange process;

8. Complete heavy water upgrade systems, or columns therefor, for the upgrade of heavy water to reactor-grade deuterium concentration.

0B005 Plant specially designed for the fabrication of "nuclear reactor" fuel elements and specially designed or prepared equipment therefor.

Note: A plant for the fabrication of "nuclear reactor" fuel elements includes equipment which:

a. Normally comes into direct contact with or directly processes or controls the production flow of nuclear materials;
b. Seals the nuclear materials within the cladding;
c. Checks the integrity of the cladding or the seal; or
d. Checks the finish treatment of the solid fuel.

0B006 Plant for the reprocessing of irradiated "nuclear reactor" fuel elements, and specially designed or prepared equipment and components therefor.

Note: 0B006 includes:

a. Plant for the reprocessing of irradiated "nuclear reactor" fuel elements including equipment and components which normally come into direct contact with and directly control the irradiated fuel and the major nuclear material and fission product processing streams;

b. Fuel element chopping or shredding machines, i.e. remotely operated equipment to cut, chop, shred or shear irradiated "nuclear reactor" fuel assemblies, bundles or rods;

c. Dissolvers, critically safe tanks (e.g. small diameter, annular or slab tanks) specially designed or prepared for the dissolution of irradiated "nuclear reactor" fuel, which are capable of withstanding hot, highly corrosive liquids, and which can be remotely loaded and maintained;

d. Counter-current solvent extractors and ion-exchange processing equipment specially designed or prepared for use in a plant for the reprocessing of irradiated "natural uranium", "depleted uranium" or "special fissile materials";

e. Holding or storage vessels specially designed to be critically safe and resistant to the corrosive effects of nitric acid;

Note: Holding or storage vessels may have the following features:

1. Walls or internal structures with a boron equivalent (calculated for all constituent elements as defined in the note to 0C004) of at least two percent;

2. A maximum diameter or 175 mm for cylindrical vessels; or

3. A maximum width of 75 mm for either a slab or annular vessel.

f. Complete systems specially designed or prepared for the conversion of plutonium nitrate to plutonium oxide;

g. Complete systems specially designed or prepared for the production of plutonium metal;

h. Process control instrumentation specially designed or prepared for monitoring or controlling the reprocessing of irradiated "natural uranium", "depleted uranium" or "special fissile materials".

0C Materials

0C001 "Natural uranium" or "depleted uranium" or thorium in the form of metal, alloy, chemical compound or concentrate and any other material containing one or more of the foregoing;

Note: 0C001 does not control the following:

a. Four grammes or less of "natural uranium" or "depleted uranium" when contained in a sensing component in instruments;

b. "Depleted uranium" specially fabricated for the following civil non-nuclear applications:

1. Shielding;
2. Packaging;
3. Ballasts having a mass not greater than 100 Kg;
4. Counter-weights having a mass not greater than 100 Kg;

c. Alloys containing less than 5% thorium;

d. Ceramic products containing thorium, which have been manufactured for non-nuclear use.

0C002 "Special fissile materials".

Note: 0C002 does not control four "effective grammes" or less when contained in a sensing component in instruments.

0C003 Deuterium, heavy water (deuterium oxide) and other compounds of deuterium, and mixtures and solutions containing deuterium, in which the isotopic ratio of deuterium to hydrogen exceeds 1:5,000.

OC004

Graphite, nuclear-grade, having a purity level of less than 5 parts per million 'boron equivalent' and with a density greater than 1,5 g/cm^3.

Note 1: *0C004 does not control the following:*

a. manufactures of graphite having a mass less than 1 kg, other than those specially designed or prepared for use in a nuclear reactor;

b. graphite powder.

Note 2: *In 0C004, 'boron equivalent' (BE) is defined as the sum of BE_Z for impurities (excluding BE_{carbon} since carbon is not considered an impurity) including boron, where:*

BE_Z (ppm) = CF x Concentration of element Z in ppm;

where CF is the conversion factor = $\frac{\sigma_Z A_B}{\sigma_B A_Z}$

and σ_B and σ_Z are the thermal neutron capture cross sections (in barns) for naturally occurring boron and element Z respectively; and A_B and A_Z are the atomic masses of naturally occurring boron and element Z respectively.

0C005 Specially prepared compounds or powders for the manufacture of gaseous diffusion barriers, resistant to corrosion by UF_6 (e.g. nickel or alloy containing 60 weight percent or more nickel, aluminium oxide and fully fluorinated hydrocarbon polymers), having a purity of 99.9 weight percent or more and a mean particle size of less than 10 micrometres measured by American Society for Testing and Materials (ASTM) B330 standard and a high degree of particle size uniformity.

0C006 Nickel powder or porous nickel metal, specially prepared for the manufacture of gaseous diffusion barriers, as follows:

N.B.: SEE ALSO 1C240.

a. Powder with a nickel purity content of 99.9 weight percent or more and a mean particle size of less than 10 micrometres measured by American Society for Testing and Materials (ASTM) B330 standard and a high degree of particle size uniformity; or

b. Porous nickel metal produced from materials specified in 0C006.a.

0D Software

0D001 "Software" specially designed or modified for the "development", "production" or "use" of goods specified in this Category.

0E Technology

0E001 "Technology" according to the Nuclear Technology Note for the "development", "production" or "use" of goods specified in this Category."

CATEGORY 1 - MATERIALS, CHEMICALS, "MICROORGANISMS" & "TOXINS"

1A Systems, Equipment and Components

1A001 Components made from fluorinated compounds, as follows:

a. Seals, gaskets, sealants or fuel bladders specially designed for "aircraft" or aerospace use made from more than 50% by weight of any of the materials specified in 1C009.b. or 1C009.c.;

b. Piezoelectric polymers and copolymers made from vinylidene fluoride materials specified in 1C009.a.:
   1. In sheet or film form; and
   2. With a thickness exceeding 200 μm;

c. Seals, gaskets, valve seats, bladders or diaphragms made from fluoroelastomers containing at least one vinylether monomer, specially designed for "aircraft", aerospace or missile use.

Note: In 1A001.c., "missile" means complete rocket systems and unmanned air vehicle systems.

1A002. "Composite" structures or laminates, having any of the following:
N.B: SEE ALSO 1A202, 9A010 and 9A110

a. An organic "matrix" and made from materials specified in 1C010.c., 1C010.d. or 1C010.e.; or

b. A metal or carbon "matrix" and made from:
   1. Carbon "fibrous or filamentary materials" with:
      a. A "specific modulus" exceeding 10.15×10^6 m; and
      b. A "specific tensile" strength exceeding 17.7×10^4 m; or
   2. Materials specified in 1C010.c.

Notes: 1. 1A002 does not control composite structures or laminates made from epoxy resin impregnated carbon "fibrous or filamentary materials" for the repair of aircraft structures or laminates, provided the size does not exceed 1 m^2.

2. 1A002 does not control finished or semi-finished items specially designed for purely civilian applications as follows:
   a. Sporting goods;
   b. Automotive industry;
   c. Machine tool industry;
   d. Medical applications.

1A003. Manufactures of non-fluorinated polymeric substances specified in 1C008.a.3. in film, sheet, tape or ribbon form with either of the following characteristics:
a. With a thickness exceeding 0.254 mm; or
b. Coated or laminated with carbon, graphite, metals or magnetic substances.

Note: 1A003 does not control manufactures when coated or laminated with copper and designed for the production of electronic printed circuit boards.

1A004 Protective and detection equipment and components, other than those specified in military goods controls, as follows:
N.B.: SEE ALSO 2B351 AND 2B352.

a. Gas masks, filter canisters and decontamination equipment therefor designed or modified for defence against biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents and specially designed components therefor;

b. Protective suits, gloves and shoes specially designed or modified for defence against biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents;

c. Nuclear, biological and chemical (NBC) detection systems specially designed or modified for detection or identification of biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents and specially designed components therefor.

Note: 1A004 does not control :

a. Personal radiation monitoring dosimeters;

b. Equipment limited by design or function to protect against hazards specific to civil industries, such as mining, quarrying, agriculture, pharmaceuticals, medical, veterinary, environmental, waste management, or to the food industry.

1A005 Body armour, and specially designed components therefor, other than those manufactured to military standards or specifications or to their equivalents in performance.
N.B.: SEE ALSO MILITARY GOODS CONTROLS.

Notes:

1. *1A005 does not control individual suits of body armour and accessories therefor, when accompanying their users for his/her own personal protection.*
2. *1A005 does not control body armour designed to provide frontal protection only from both fragment and blast from non-military explosive devices.*

1A102 Resaturated pyrolized carbon-carbon materials designed for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

1A202 Composite structures, other than those specified in 1A002, in the form of tubes with an inside diameter of between 75 mm and 400 mm made with any of the "fibrous or filamentary materials" specified in 1C010.a. or b. or 1C210.a. or with carbon prepreg materials specified in 1C210.c.
N.B.: SEE ALSO 9A010 AND 9A110.

1A225 Platinized catalysts specially designed or prepared for promoting the hydrogen isotope exchange reaction between hydrogen and water for the recovery of tritium from heavy water or for the production of heavy water.

1A226 Specialized packings for use in separating heavy water from ordinary water and made of phosphor bronze mesh (chemically treated to improve wettability) and designed for use in vacuum distillation towers.

1A227 High-density (lead glass or other) radiation shielding windows greater than 0.09 m^2 on cold area and with a density greater than 3 g/cm^3 and a thickness of 100 mm or greater; and specially designed frames therefor.

1B Test, Inspection and Production Equipment

1B001 Equipment for the production of fibres, prepregs, preforms or "composites" specified in 1A002 or 1C010., as follows, and specially designed components and accessories therefor:
N.B.:SEE ALSO 1B101 AND 1B201.

a. Filament winding machines of which the motions for positioning, wrapping and winding fibres are coordinated and programmed in three or more axes, specially designed for the manufacture of "composite" structures or laminates from "fibrous or filamentary materials";

b. Tape-laying or tow-placement machines of which the motions for positioning and laying tape, tows or sheets are coordinated and programmed in two or more axes, specially designed for the manufacture of "composite" airframe or "missile" structures;

Note: In 1B001.b., "missile" means complete rocket systems and unmanned air vehicle systems.

c. Multidirectional, multidimensional weaving machines or interlacing machines, including adapters and modification kits, for weaving, interlacing or braiding fibres to manufacture "composite" structures;

Note: 1B001.c. does not control textile machinery not modified for the above end-uses.

d. Equipment specially designed or adapted for the production of reinforcement fibres, as follows:
   1. Equipment for converting polymeric fibres (such as polyacrylonitrile, rayon, pitch or polycarbosilane) into carbon fibres or silicon carbide fibres, including special equipment to strain the fibre during heating;
   2. Equipment for the chemical vapour deposition of elements or compounds on heated filamentary substrates to manufacture silicon carbide fibres;
   3. Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide);
   4. Equipment for converting aluminium containing precursor fibres into alumina fibres by heat treatment;

e. Equipment for producing prepregs specified in 1C010.e. by the hot melt method;

f. Non-destructive inspection equipment capable of inspecting defects three dimensionally, using ultrasonic or X-ray tomography and specially designed for "composite" materials.

1B002 Systems and components therefor, specially designed to avoid contamination and specially designed for producing metal alloys, metal alloy powder or alloyed materials specified in 1C002.a.2., 1C002.b. or 1C002.c.

1B003 Tools, dies, moulds or fixtures, for "superplastic forming" or "diffusion bonding" titanium or aluminium or their alloys, specially designed for the manufacture of:

a. Airframe or aerospace structures;

b. "Aircraft" or aerospace engines; or

c. Specially designed components for those structures or engines.

1B101 Equipment, other than that specified in 1B001, for the "production" of structural composites as follows; and specially designed components and accessories therefor:
N.B.:SEE ALSO 1B201.

Note: Components and accessories specified in 1B101 include moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.

a. Filament winding machines of which the motions for positioning, wrapping and winding fibres can be coordinated and programmed in three or more axes, designed to fabricate composite structures or laminates from fibrous or filamentary materials, and coordinating and programming controls;

b. Tape-laying machines of which the motions for positioning and laying tape and sheets can be coordinated and programmed in two or more axes, designed for the manufacture of composite airframe and "missile" structures;

c. Equipment designed or modified for the "production" of "fibrous or filamentary materials" as follows:
   1. Equipment for converting polymeric fibres (such as polyacrylonitrile, rayon or polycarbosilane) including special provision to strain the fibre during heating;
   2. Equipment for the vapour deposition of elements or compounds on heated filament substrates; and
   3. Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide);

d. Equipment designed or modified for special fibre surface treatment or for producing prepregs and preforms specified in entry 9A110.

Note: *Equipment covered in 1B101.d includes rollers, tension stretchers, coating equipment, cutting equipment and clicker dies.*

1B115 Equipment for the "production", handling and acceptance testing of propellants or propellant constituents specified in 1C011.a., 1C011.b., 1C111 or in the Military Goods Controls, and specially designed components therefor.

Notes: 1. *The only mixers specified in 1B115 are those which have provision for mixing under vacuum in the range of zero to 13.326 kPa and with temperature control capability of the mixing chamber:*
   a. *Batch mixers having a total volumetric capacity of 110 litres or more and at least one mixing/kneading shaft mounted off centre;*
   b. *Continuous mixers having two or more mixing/kneading shafts and capability to open the mixing chamber.*
2. *For equipment specially designed for the production of military goods, see the Military Goods Controls.*
3. *1B115 does not control equipment for the "production", handling and acceptance testing of boron carbide.*

1B116 Specially designed nozzles for producing pyrolitically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1573 K (1300°C) to 3173 K (2900°C) temperature range at pressures of 130 Pa to 20 kPa.

1B201 Filament winding machines, other than those specified in 1B001 or 1B101, in which the motions for positioning, wrapping, and winding fibres are coordinated and programmed in two or more axes, specially designed to fabricate composite structures or laminates from "fibrous or filamentary materials" and capable of winding cylindrical rotors of diameter between 75 mm and 400 mm and lengths of 600 mm or greater and coordinating and programming controls and precision mandrels therefor.

1B225 Electrolytic cells for fluorine production with a production capacity greater than 250 g of fluorine per hour.

1B226 Electromagnetic isotope separators, designed for or equipped with, single or multiple ion sources capable of providing a total ion beam current of 50 mA or greater.

Note: *1B226 includes separators:*
   a. *Capable of enriching stable isotopes;*
   b. *With the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.*

1B227 Ammonia synthesis converters or ammonia synthesis units in which the synthesis gas (nitrogen and hydrogen) is withdrawn from an ammonia/hydrogen high-pressure exchange column and the synthesized ammonia is returned to said column.

1B228 Hydrogen-cryogenic distillation columns having all of the following characteristics:

a. Designed to operate with internal temperatures of 35 K (-238°C) or less;
b. Designed to operate at an internal pressure of 0.5 to 5 MPa (5 to 50 atmospheres);
c. Constructed of "fine-grain stainless steels" of the 300 series with low sulphur content or equivalent cryogenic and H_2-compatible materials; and
d. With internal diameters of 1 m or greater and effective lengths of 5 m or greater.

Technical Note:
"Fine-grain stainless steels" in 1B228 are defined to be fine-grain austenitic stainless steels with an ASTM (or equivalent standard) grain size number of 5 or greater.

1B229 Water-hydrogen sulphide exchange tray columns constructed from fine carbon steel with a diameter of 1.8 m or greater, which can operate at a nominal pressure of 2 MPa or greater, and internal contactors therefor.

Notes: 1. *For columns which are specially designed or prepared for the production of heavy water see 0B004.*
2. *Internal contactors of the columns are segmented trays which have an effective assembled diameter of 1.8 m or greater, are designed to facilitate countercurrent contacting and are constructed of materials resistant to corrosion by hydrogen sulphide/water mixtures. These may be sieve trays, valve trays, bubble cap trays, or turbogrid trays.*
3. *"Fine Carbon steel" in 1B229 is defined to be steel with the austenitic ASTM (or equivalent standard) grain size number of 5 or greater.*
4. *Materials resistant to corrosion by hydrogen sulphide/water mixtures in 1B229 are defined to be stainless steels with a carbon content of 0.03% or less.*

1B230 Pumps circulating solutions of diluted or concentrated potassium amide catalyst in liquid ammonia (KNH_2/NH_3), with all of the following characteristics:

a. Airtight (i.e., hermetically sealed);

b. For concentrated potassium amide solutions (1% or greater), operating pressure of 1.5-60 MPa (15-600 atmospheres); for dilute potassium amide solutions (less than 1%), operating pressure of 20-60 MPa (200-600 atmospheres); and

c. A capacity greater than 8.5 m^3/hr.

1B231 Tritium facilities, plant or equipment, as follows:

a. Facilities or plant for the production, recovery, extraction, concentration, or handling of tritium;
b. Equipment for tritium facilities or plant, as follows:
1. Hydrogen or helium refrigeration units capable of cooling to 23 K (-250°C) or less, with heat removal capacity greater than 150 watts; or
2. Hydrogen isotope storage and purification systems using metal hydrides as the storage, or purification medium.

1B232 Turboexpanders or turboexpander-compressor sets designed for operation below 35 K (-238°C) and a throughput of hydrogen gas of 1000 kg/hr or greater.

1B233 Lithium isotope separation facilities, plant or equipment, as follows:

a. Facilities or plant for the separation of lithium isotopes;

b. Equipment for the separation of lithium isotopes, as follows:
1. Packed liquid-liquid exchange columns specially designed for lithium amalgams;
2. Mercury and/or lithium amalgam pumps;
3. Lithium amalgam electrolysis cells;
4. Evaporators for concentrated lithium hydroxide solution.

1C Materials

Technical Note:

Metals and alloys:
Unless provision to the contrary is made, the words "metals" and "alloys" in 1C001 to 1C012 cover crude and semi-fabricated forms, as follows:

Crude forms:
Anodes, balls, bars (including notched bars and wire bars), billets, blocks, blooms, brickets, cakes, cathodes, crystals, cubes, dice, grains, granules, ingots, lumps, pellets, pigs, powder, rondelles, shot, slabs, slugs, sponge, sticks;

Semi-fabricated forms (whether or not coated, plated, drilled or punched):

a. Wrought or worked materials fabricated by rolling, drawing, extruding, forging, impact extruding, pressing, graining, atomising, and grinding, i.e.: angles, channels, circles, discs, dust, flakes, foils and leaf, forging, plate, powder, pressings and stampings, ribbons, rings, rods (including bare welding rods, wire rods, and rolled wire), sections, shapes, sheets, strip, pipe and tubes (including tube rounds, squares, and hollows), drawn or extruded wire;

b. Cast material produced by casting in sand, die, metal, plaster or other types of moulds, including high pressure castings, sintered forms, and forms made by powder metallurgy.

The object of the control should not be defeated by the export of non-listed forms alleged to be finished products but representing in reality crude forms or semi-fabricated forms.

1C001 Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers, as follows:

N.B.:SEE ALSO 1C101.

a. Materials for absorbing frequencies exceeding 2 x 10^8 Hz but less than 3 x 10^{12} Hz;

Notes: 1. 1C001.a. does not control:

a. Hair type absorbers, constructed of natural or synthetic fibres, with non-magnetic loading to provide absorption;

b. Absorbers having no magnetic loss and whose incident surface is non-planar in shape, including pyramids, cones, wedges and convoluted surfaces;

c. Planar absorbers, having all of the following characteristics:

1. Made from any of the following:

a. Plastic foam materials (flexible or non-flexible) with carbon-loading, or organic materials, including binders, providing more than 5% echo compared with metal over a bandwidth exceeding ±15% of the centre frequency of the incident energy, and not capable of withstanding temperatures exceeding 450 K (177 °C); or

b. Ceramic materials providing more than 20% echo compared with metal over a bandwidth exceeding ±15% of the centre frequency of the incident energy, and not capable of withstanding temperatures exceeding 800 K (527 °C);

Technical Note:

Absorption test samples for 1C001.a. Note: 1.c.1. should be a square at least 5 wavelengths of the centre frequency on a side and positioned in the far field of the radiating element.

2. Tensile strength less than 7 x 10^6 N/m^2; and

3. Compressive strength less than 14 x 10^6 N/m^2;

d. Planar absorbers made of sintered ferrite, having:

1. A specific gravity exceeding 4.4; and

2. A maximum operating temperature of 548 K (275 °C).

2. Nothing in 1C001.a. releases magnetic materials to provide absorption when contained in paint.

b. Materials for absorbing frequencies exceeding 1.5 x 10^{14} Hz but less than 3.7 x 10^{14} Hz and not transparent to visible light;

c. Intrinsically conductive polymeric materials with a bulk electrical conductivity exceeding 10,000 S/m (Siemens per metre) or a sheet (surface) resistivity of less than 100 ohms/square, based on any of the following polymers:

1. Polyaniline;
2. Polypyrrole;
3. Polythiophene;
4. Poly phenylene-vinylene; or
5. Poly thienylene-vinylene.

Technical Note:

Bulk electrical conductivity and sheet (surface) resistivity should be determined using ASTM D-257 or national equivalents.

1C002 Metal alloys, metal alloy powder and alloyed materials, as follows:
N.B.:SEE ALSO 1C202.

Note: 1C002 does not control metal alloys, metal alloy powder and alloyed materials for coating substrates.

a. Metal alloys, as follows:
   1. Nickel or titanium-based alloys in the form of aluminides, as follows, in crude or semi-fabricated forms:
      a. Nickel aluminides containing a minimum of 15 weight percent aluminium, a maximum of 38 weight percent aluminium and at least one additional alloying element;
      b. Titanium aluminides containing 10 weight percent or more aluminium and at least one additional alloying element;
   2. Metal alloys, as follows, made from metal alloy powder or particulate material specified in 1C002.b.:
      a. Nickel alloys with:
         1. A stress-rupture life of 10,000 hours or longer at 923 K (650°C) at a stress of 676 MPa; or
         2. A low cycle fatigue life of 10,000 cycles or more at 823 K (550°C) at a maximum stress of 1,095 MPa;
      b. Niobium alloys with:
         1. A stress-rupture life of 10,000 hours or longer at 1,073 K (800°C) at a stress of 400 MPa; or
         2. A low cycle fatigue life of 10,000 cycles or more at 973 K (700°C) at a maximum stress of 700 MPa;
      c. Titanium alloys with:
         1. A stress-rupture life of 10,000 hours or longer at 723 K (450°C) at a stress of 200 MPa; or
         2. A low cycle fatigue life of 10,000 cycles or more at 723 K (450°C) at a maximum stress of 400 MPa;
      d. Aluminium alloys with a tensile strength of:
         1. 240 MPa or more at 473 K (200°C); or
         2. 415 MPa or more at 298 K (25°C);

      e. Magnesium alloys with a tensile strength of 345 MPa or more and a corrosion rate of less than 1 mm/year in 3% sodium chloride aqueous solution measured in accordance with ASTM standard G-31 or national equivalents;

Technical Notes:
1. *The metal alloys in 1C002.a. are those containing a higher percentage by weight of the stated metal than of any other element.*
2. *Stress-rupture life should be measured in accordance with ASTM standard E-139 or national equivalents.*
3. *Low cycle fatigue life should be measured in accordance with ASTM Standard E-606 "Recommended Practice for Constant-Amplitude Low-Cycle Fatigue Testing" or national equivalents. Testing should be axial with an average stress ratio equal to 1 and a stress-concentration factor (K_t) equal to 1. The average stress is defined as maximum stress minus minimum stress divided by maximum stress.*

b. Metal alloy powder or particulate material for materials specified in 1C002.a., as follows:
   1. Made from any of the following composition systems:

      Technical Note:
      X in the following equals one or more alloying elements.
      a. Nickel alloys (Ni-Al-X, Ni-X-Al) qualified for turbine engine parts or components, i.e. with less than 3 non-metallic particles (introduced during the manufacturing process) larger than 100 µm in 10^9 alloy particles;

b. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);
c. Titanium alloys (Ti-Al-X or Ti-X-Al);
d. Aluminium alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); or
e. Magnesium alloys (Mg-Al-X or Mg-X-Al); and

2. Made in a controlled environment by any of the following processes:
a. "Vacuum atomisation";
b. "Gas atomisation";
c. "Rotary atomisation";
d. "Splat quenching";
e. "Melt spinning" and "comminution";
f. "Melt extraction" and "comminution"; or
g. "Mechanical alloying";

c. Alloyed materials, in the form of uncomminuted flakes, ribbons or thin rods produced in a controlled environment by "splat quenching", "melt spinning" or "melt extraction", used in the manufacture of metal alloy powder or particulate material specified in 1C002.b.

1C003 Magnetic metals, of all types and of whatever form, having any of the following characteristics:

a. Initial relative permeability of 120,000 or more and a thickness of 0.05 mm or less;
Technical Note:
Measurement of initial permeability must be performed on fully annealed materials.

b. Magnetostrictive alloys, having any of the following characteristics:
1. A saturation magnetostriction of more than 5×10^{-4}; or
2. A magnetomechanical coupling factor (k) of more than 0.8; or

c. Amorphous or nanocrystalline alloy strips, having all of the following characteristics:
1. A composition having a minimum of 75 weight percent of iron, cobalt or nickel;
2. A saturation magnetic induction (B_s) of 1.6 T or more; and
3. Any of the following:
a. A strip thickness of 0.02 mm or less; or
b. An electrical resistivity of 2×10^{-4} ohm cm or more.

Technical Note:
"Nanocrystalline" materials in 1C003.c. are those materials having a crystal grain size of 50 nm or less, as determined by X-ray diffraction.

1C004 Uranium titanium alloys or tungsten alloys with a "matrix" based on iron, nickel or copper, having all of the following:
a. A density exceeding 17.5 g/cm^3;
b. An elastic limit exceeding 1,250 MPa;
c. An ultimate tensile strength exceeding 1,270 MPa; and
d. An elongation exceeding 8%.

1C005 "Superconductive" "composite" conductors in lengths exceeding 100 m or with a mass exceeding 100 g, as follows:

a. Multifilamentary "superconductive" "composite" conductors containing one or more niobium-titanium filaments:
1. Embedded in a "matrix" other than a copper or copper-based mixed "matrix"; or
2. Having a cross-section area less than 0.28×10^{-4} mm^2 (6 μm in diameter for circular filaments);

b. "Superconductive" "composite" conductors consisting of one or more "superconductive" filaments other than niobium-titanium, having all of the following:

1. A "critical temperature" at zero magnetic induction exceeding 9.85 K (-263.31°C) but less than 24 K (-249.16°C);
2. A cross-section area less than 0.28×10^{-4} mm^2; and
3. Remaining in the "superconductive" state at a temperature of 4.2 K (-268.96°C) when exposed to a magnetic field corresponding to a magnetic induction of 12 T.

1C006 Fluids and lubricating materials, as follows:

a. Hydraulic fluids containing, as their principal ingredients, any of the following compounds or materials:
   1. Synthetic hydrocarbon oils or silahydrocarbon oils, having all of the following:
      Note: For the purpose of 1C006.a.1., silahydrocarbon oils contain exclusively silicon, hydrogen and carbon.
      a. A flash point exceeding 477 K (204°C);
      b. A pour point at 239 K (-34°C) or less;
      c. A viscosity index of 75 or more; and
      d. A thermal stability at 616 K (343°C); or

   2. Chlorofluorocarbons, having all of the following:
      Note: For the purpose of 1C006.a.2., chlorofluorocarbons contain exclusively carbon, fluorine and chlorine.
      a. No flash point;
      b. An autogenous ignition temperature exceeding 977 K (704°C);
      c. A pour point at 219 K (-54°C) or less;
      d. A viscosity index of 80 or more; and
      e. A boiling point at 473 K (200°C) or higher;

b. Lubricating materials containing, as their principal ingredients, any of the following compounds or materials:
   1. Phenylene or alkylphenylene ethers or thio-ethers, or their mixtures, containing more than two ether or thio-ether functions or mixtures thereof; or
   2. Fluorinated silicone fluids with a kinematic viscosity of less than 5,000 mm^2/s (5,000 centistokes) measured at 298 K (25°C);

c. Damping or flotation fluids with a purity exceeding 99.8%, containing less than 25 particles of 200 µm or larger in size per 100 ml and made from at least 85% of any of the following compounds or materials:
   1. Dibromotetrafluoroethane;
   2. Polychlorotrifluoroethylene (oily and waxy modifications only); or
   3. Polybromotrifluoroethylene;

d. Fluorocarbon electronic cooling fluids, having all of the following characteristics:
   1. Containing 85% by weight or more of any of the following, or mixtures thereof:
      a. Monomeric forms of perfluoropolyalkylether-triazines or perfluoroaliphatic-ethers;
      b. Perfluoroalkylamines;
      c. Perfluorocycloalkanes; or
      d. Perfluoroalkanes;
   2. Density at 298 K (25°C) of 1.5 g/ml or more;
   3. In a liquid state at 273 K (0°C); and
   4. Containing 60% or more by weight of fluorine.

Technical Note:
For the purpose of 1C006:

a. Flash point is determined using the Cleveland Open Cup Method described in ASTM D-92 or national equivalents;
b. Pour point is determined using the method described in ASTM D-97 or national equivalents;
c. Viscosity index is determined using the method described in ASTM D-2270 or national equivalents;

d. *Thermal stability is determined by the following test procedure or national equivalents:*
Twenty ml of the fluid under test is placed in a 46 ml type 317 stainless steel chamber containing one each of 12.5 mm (nominal) diameter balls of M-10 tool steel, 52100 steel and naval bronze (60% Cu, 39% Zn, 0.75% Sn);

The chamber is purged with nitrogen, sealed at atmospheric pressure and the temperature raised to and maintained at 644± 6 K (371± 6 °C) for six hours;
The specimen will be considered thermally stable if, on completion of the above procedure, all of the following conditions are met:
1. *The loss in weight of each ball is less than 10 mg/mm^2 of ball surface;*
2. *The change in original viscosity as determined at 311 K (38 °C) is less than 25%; and*
3. *The total acid or base number is less than 0.40;*

e. *Autogenous ignition temperature is determined using the method described in ASTM E-659 or national equivalents.*

1C007 Ceramic base materials, non-"composite" ceramic materials, ceramic-"matrix" "composite" materials and precursor materials, as follows:
N.B.: SEE ALSO 1C107.

a. Base materials of single or complex borides of titanium having total metallic impurities, excluding intentional additions, of less than 5,000 ppm, an average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm;

b. Non-"composite" ceramic materials in crude or semi-fabricated form, composed of borides of titanium with a density of 98% or more of the theoretical density;
Note: 1C007.b. does not control abrasives.

c. Ceramic-ceramic "composite" materials with a glass or oxide-"matrix" and reinforced with fibres made from any of the following systems:
1. Si-N;
2. Si-C;
3. Si-Al-O-N; or
4. Si-O-N;
having a specific tensile strength exceeding 12.7 x 10^3 m;

d. Ceramic-ceramic "composite" materials, with or without a continuous metallic phase, incorporating particles, whiskers or fibres, where carbides or nitrides of silicon, zirconium or boron form the "matrix";

e. Precursor materials (i.e., special purpose polymeric or metallo-organic materials) for producing any phase or phases of the materials specified in 1C007.c., as follows:
1. Polydiorganosilanes (for producing silicon carbide);
2. Polysilazanes (for producing silicon nitride);
3. Polycarbosilazanes (for producing ceramics with silicon, carbon and nitrogen components);

f. Ceramic-ceramic "composite" materials with an oxide or glass "matrix" reinforced with continuous fibres from any of the following systems:
1. Al_2O_3; or
2. Si-C-N.
Note: 1C007.f. does not control "composites" containing fibres from these systems with a fibre tensile strength of less than 700 MPa at 1,273 K (1,000 °C) or fibre tensile creep resistance of more than 1% creep strain at 100 MPa load and 1,273 K (1,000 °C) for 100 hours.

1C008 Non-fluorinated polymeric substances, as follows:

a. 1. Bismaleimides;
2. Aromatic polyamide-imides;
3. Aromatic polyimides;

4. Aromatic polyetherimides having a glass transition temperature (T_g) exceeding 513 K (240° C) determined using the dry method described in ASTM D 3418;

Note: 1C008.a. does not control non-fusible compression moulding powders or moulded forms.

b. Thermoplastic liquid crystal copolymers having a heat distortion temperature exceeding 523 K (250°C) measured according to ASTM D-648, method A, or national equivalents, with a load of 1.82 N/mm^2 and composed of:
   1. Any of the following:
      a. Phenylene, biphenylene or naphthalene; or
      b. Methyl, tertiary-butyl or phenyl substituted phenylene, biphenylene or naphthalene; and
   2. Any of the following acids:
      a. Terephthalic acid;
      b. 6-hydroxy-2 naphthoic acid; or
      c. 4-hydroxybenzoic acid;

c. Polyarylene ether ketones, as follows:
   1. Polyether ether ketone (PEEK);
   2. Polyether ketone ketone (PEKK);
   3. Polyether ketone (PEK);
   4. Polyether ketone ether ketone ketone (PEKEKK);

d. Polyarylene ketones;

e. Polyarylene sulphides, where the arylene group is biphenylene, triphenylene or combinations thereof;

f. Polybiphenylenethersulphone.

Technical Note:
The glass transition temperature (Tg) for 1C008 materials is determined using the method described in ASTM D 3418 using the dry method.

1C009 Unprocessed fluorinated compounds, as follows:

a. Copolymers of vinylidene fluoride having 75% or more beta crystalline structure without stretching;
b. Fluorinated polyimides containing 10% by weight or more of combined fluorine;
c. Fluorinated phosphazene elastomers containing 30% by weight or more of combined fluorine.

1C010 "Fibrous or filamentary materials" which may be used in organic "matrix", metallic "matrix" or carbon "matrix" "composite" structures or laminates, as follows:
N.B.: SEE ALSO 1C210.

a. Organic "fibrous or filamentary materials", having all of the following:
   1. A specific modulus exceeding 12.7 x 10^6 m; and
   2. A specific tensile strength exceeding 23.5 x 10^4 m;
   Note: 1C010.a. does not control polyethylene.

b. Carbon "fibrous or filamentary materials", having all of the following:
   1. A specific modulus exceeding 12.7 x 10^6 m; and
   2. A specific tensile strength exceeding 23.5 x 10^4 m;

   Technical Note:
   Properties for materials described in 1C010.b. should be determined using SACMA recommended methods SRM 12 to 17, or national equivalent tow tests, such as Japanese Industrial Standard JIS-R-7601, Paragraph 6.6.2., and based on lot average.

Note: *1C010.b. does not control fabric made from "fibrous or filamentary materials" for the repair of aircraft structures or laminates, in which the size of individual sheets does not exceed 50 cm x 90 cm.*

c. Inorganic "fibrous or filamentary materials", having all of the following:
   1. A specific modulus exceeding 2.54 x 10^6 m; and
   2. A melting, softening, decomposition or sublimation point exceeding 1,922 K (1,649°C) in an inert environment;

   Note: *1C010.c. does not control:*
   1. *Discontinuous, multiphase, polycrystalline alumina fibres in chopped fibre or random mat form, containing 3 weight percent or more silica, with a specific modulus of less than 10 x 10^6 m;*
   2. *Molybdenum and molybdenum alloy fibres;*
   3. *Boron fibres;*
   4. *Discontinuous ceramic fibres with a melting, softening, decomposition or sublimation point lower than 2,043 K (1,770 °C) in an inert environment.*

d. "Fibrous or filamentary materials":
   1. Composed of any of the following:
      a. Polyetherimides specified in 1C008.a.; or
      b. Materials specified in 1C008.b. to 1C008.f.; or
   2. Composed of materials specified in 1C010.d.1.a. or 1C010.d.1.b.; and "commingled" with other fibres specified in 1C010.a., 1C010.b. or 1C010.c.;

e. Resin-impregnated or pitch-impregnated fibres (prepregs), metal or carbon-coated fibres (preforms) or "carbon fibre preforms", as follows:
   1. Made from "fibrous or filamentary materials" specified in 1C010.a., 1C010.b. or C010.c.;
   2. Made from organic or carbon "fibrous or filamentary materials":
      a. With a "specific tensile strength" exceeding 17.7 x 10^4 m;
      b. With a "specific modulus" exceeding 10.15 x 10^6 m;
      c. Not controlled by 1C010.a. or 1C010.b.; and
      d. When impregnated with materials specified in 1C008 or 1C009.b., having a glass transition temperature (T_g) exceeding 383 K (110°C) or with phenolic or epoxy resins, having a glass transition temperature (T_g) equal to or exceeding 418 K (145°C).

   Notes: *1C010.e. does not control:*
   1. *Epoxy resin "matrix" impregnated carbon "fibrous or filamentary materials" (prepregs) for the repair of aircraft structures or laminates, in which the size of individual sheets of prepreg does not exceed 50 cm x 90 cm;*
   2. *Prepregs when impregnated with phenolic or epoxy resins having a glass transition temperature (Tg) less than 433 K (160 °C) and a cure temperature lower than the glass transition temperature.*

   Technical Note:
   The glass transition temperature (Tg) for 1C010.e. materials is determined using the method described in ASTM D 3418 using the dry method. The glass transition temperature for phenolic and epoxy resins is determined using the method described in ASTM D 4065 at a frequency of 1 Hz and a heating rate of 2 K (°C) per minute using the dry method.

1C011 Metals and compounds, as follows:
N.B.: SEE ALSO MILITARY GOODS CONTROLS and 1C111.

a. Metals in particle sizes of less than 60 µm whether spherical, atomised, spheroidal, flaked or ground, manufactured from material consisting of 99% or more of zirconium, magnesium and alloys of these;
   N.B.: *The metals or alloys listed in 1C011.a. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.*

b. Boron or boron carbide of 85% purity or higher and a particle size of 60 μm or less;
N.B.: The metals or alloys listed in 1C011.b. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

c. Guanidine nitrate.

1C012 Materials for nuclear heat sources, as follows:

a. Plutonium in any form with a plutonium isotopic assay of plutonium-238 of more than 50% by weight;
Note: 1C012.a. does not control:
1. Shipments with a plutonium content of 1 g or less;
2. Shipments of 3 "effective grammes" or less when contained in a sensing component in instruments.

b. "Previously separated" neptunium-237 in any form.
Note: 1C012.b. does not control shipments with a neptunium-237 content of 1 g or less.

1C101 Materials and devices for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures, other than those specified in 1C001, usable in "missiles" and their subsystems.

Notes: 1. 1C101 includes:
a. Structural materials and coatings specially designed for reduced radar reflectivity;
b. Coatings, including paints, specially designed for reduced or tailored reflectivity or emissivity in the microwave, infra red or ultra violet regions of the electromagnetic spectrum.
2. 1C101 does not include coatings when specially used for the thermal control of satellites.

1C107 Graphite and ceramic materials, other than those specified in 1C007, as follows:

a. Fine grain recrystallised bulk graphites having a bulk density of 1.72 g/cm^3 or greater, measured at 288 K (15°C), and having a particle size of 100 micrometres or less, pyrolytic or fibrous reinforced graphites, usable for rocket nozzles and reentry vehicle nose tips;

b. Ceramic composite materials (dielectric constant less than 6 at frequencies from 100 Hz to 10,000 MHz), also usable for radomes, and bulk machinable silicon-carbide reinforced unfired ceramic, usable for nose tips.

1C111 Propellants and constituent chemicals for propellants, other than those specified in 1C011, as follows:

a. Propulsive substances:

1. Spherical aluminium powder, other than that specified in the Military Goods Controls, with particles of uniform diameter of less than 500 micrometre and an aluminium content of 97% by weight or greater;
2. Metal fuels, other than that specified in the Military Goods Controls, in particle sizes of less than 500 micrometres, whether spherical, atomized, spheroidal, flaked or ground, consisting 97% or more by weight of any of the following:
   a. Zirconium;
   b. Beryllium;
   c. Boron;
   d. Magnesium; or
   e. Alloys of the metals specified by a. to d. above;

3. Liquid oxidisers, the following:
   a. Dinitrogen trioxide;

b. Nitrogen dioxide/dinitrogen tetroxide;
c. Dinitrogen pentoxide;

b. Polymeric substances:

1. Carboxy-terminated polybutadiene (CTPB);
2. Hydroxy-terminated polybutadiene (HTPB), other than that specified in the Military Goods Controls;
3. Polybutadiene-acrylic acid (PBAA);
4. Polybutadiene-acrylic acid-acrylonitrile (PBAN);

c. Other propellant additives and agents:
1. "SEE MILITARY GOODS CONTROLS FOR Butacene";
2. Triethylene glycol dinitrate (TEGDN);
3. 2-Nitrodiphenylamine.
4. Trimethylolethane trinitrate (TMETN);
5. Diethylene glycol dinitrate (DEGDN).
6. Ferrocene derivatives other than those specified in the Military Goods Controls.

Note: For propellants and constituent chemicals for propellants not specified in 1C111, see the Military Goods Controls.

1C116 Maraging steels (steels generally characterised by high nickel, very low carbon content and the use of substitutional elements or precipitates to produce age-hardening) having an ultimate tensile strength of 1500 MPa or greater, measured at 293 K (20°C), in the form of sheet, plate or tubing with a wall or plate thickness equal to or less than 5 mm.
N.B.: SEE ALSO 1C216.

1C117 Tungsten, molybdenum and alloys of these metals in the form of uniform spherical or atomized particles of 500 micrometre diameter or less with a purity of 97% or greater for fabrication of rocket motor components, i.e., heat shields, nozzle substrates, nozzle throats and thrust vector control surfaces.

1C202 Alloys, other than those specified in 1C002.a.2.c. or d., as follows:

a. Aluminium "alloys capable of" an ultimate tensile strength of 460 MPa or more at 293 K (20°C), in the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm;

b. Titanium "alloys capable of" an ultimate tensile strength of 900 MPa or more at 293 K (20°C) in the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm.

Technical Note:
The phrase "alloys capable of" encompasses alloys before or after heat treatment.

1C210 "Fibrous or filamentary materials" or prepregs, other than those specified in 1C010.a., b. or e., as follows:

a. Carbon or aramid "fibrous or filamentary materials" having a "specific modulus" of 12.7×10^6 m or greater or a "specific tensile strength" of 235×10^3 m or greater;
except:
Aramid "fibrous or filamentary materials" having 0.25 percent or more by weight of an ester based fibre surface modifier;

b. Glass "fibrous or filamentary materials" having a "specific modulus" of 3.18×10^6 m or greater and a "specific tensile strength" of 76.2×10^3 m or greater; or

c. Thermoset resin impregnated continuous "yarns", "rovings", "tows" or "tapes" with a width no greater than 15 mm (prepregs), made from carbon or glass "fibrous or filamentary materials" specified in 1C210.a. or b.

Technical Note:
The resin forms the matrix of the composite.
Note: In 1C210, "fibrous or filamentary materials" is restricted to continuous "monofilaments", "yarns", "rovings", "tows" or "tapes".

1C216 Maraging steel, other than that specified in 1C116, capable of an ultimate tensile strength of 2,050 MPa or more, at 293 K (20°C);
except:
Forms in which no linear dimension exceeds 75 mm.

Technical Note:
The phrase "maraging steel capable of" encompasses maraging steel before or after heat treatment.

1C225 Boron and boron compounds, mixtures and loaded materials in which the boron-10 isotope is more than 20% by weight of the total boron content.

1C226 Tungsten, as follows: parts made of tungsten, tungsten carbide, or tungsten alloys (greater than 90% tungsten) having a mass greater than 20 kg and a hollow cylindrical symmetry (including cylinder segments) with an inside diameter greater than 100 mm but less than 300 mm;
except:
Parts specially designed for use as weights or gamma-ray collimators.

1C227 Calcium (high purity) containing both less than 1,000 parts per million by weight of metallic impurities other than magnesium and less than 10 parts per million of boron.

1C228 Magnesium (high purity) containing both less than 200 parts per million by weight of metallic impurities other than calcium and less than 10 parts per million of boron.

1C229 High purity (99.99% or greater) bismuth with very low silver content (less than 10 parts per million).

1C230 Beryllium metal, alloys containing more than 50% of beryllium by weight, beryllium compounds, or manufactures thereof;
except:
a. Metal windows for X-ray machines, or for bore-hole logging devices;
b. Oxide shapes in fabricated or semi-fabricated forms specially designed for electronic component parts or as substrates for electronic circuits;
c. Beryl (silicate of beryllium and aluminium) in the form of emeralds or aquamarines.
Note: 1C230 includes waste and scrap containing beryllium as defined above.

1C231 Hafnium metal, alloys and compounds of hafnium containing more than 60% hafnium by weight and manufactures thereof.

1C232 Helium-3 or helium isotopically enriched in the helium-3 isotope, mixtures containing helium-3, or products or devices containing any of the foregoing;
except:
A product or device containing less than 1 g of helium-3.

1C233 Lithium enriched in the 6 isotope (^{6}Li) to greater than 7.5 atom percent, alloys, compounds or mixtures containing lithium enriched in the 6 isotope, or products or devices containing any of the foregoing;
except:
Thermoluminescent dosimeters.

Technical Note:
The natural occurrence of the 6 isotope in lithium is 7.5 atom percent.

1C234 Zirconium with a hafnium content of less than 1 part hafnium to 500 parts zirconium by weight, in the form of metal, alloys containing more than 50% zirconium by weight, or compounds, or manufactures wholly thereof;
except:
Zirconium in the form of foil having a thickness not exceeding 0.10 mm.

Note: 1C234 includes waste and scrap containing zirconium as defined here.

1C235 Tritium, tritium compounds, mixtures containing tritium in which the ratio of tritium to hydrogen by atoms exceeds 1 part in 1000, or products or devices containing any of the foregoing;
except:
A product or device containing not more than 1.48×10^3 GBq (40 Ci) of tritium in any form.

1C236 Alpha-emitting radionuclides having an alpha half-life of 10 days or greater but less than 200 years, compounds or mixtures containing any of these radionuclides with a total alpha activity of 37 GBq/kg (1 Ci/kg) or greater, or products or devices containing any of the foregoing;
except:
A product or device containing less than 3.7 GBq (100 millicuries) of alpha activity.

1C237 Radium-226, radium-226 compounds, mixtures containing radium-226, or products or devices containing any of the foregoing;
except:
a. Medical applicators;
b. A product or device containing not more than 0.37 GBq (10 millicuries) of radium-226 in any form.

1C238 Chlorine trifluoride (ClF_3).

1C239 High explosives, other than those specified in the Military Goods Controls, or substances or mixtures containing more than 2% thereof, with a crystal density greater than 1.8 gm per cm^3 and having a detonation velocity greater than 8,000 m/s.

1C240 Nickel powder or porous nickel metal, other than those specified in 0C006, as follows:
a. Powder with a nickel purity content of 99.0% by weight or greater and a mean particle size of less than 10 micrometres measured by American Society for Testing and Materials (ASTM) B330 standard;
except:
Filamentary nickle powders;

b. Porous nickle powder produced from materials specified in 1C240.a.;
except:
Single porous nickle sheets not exceeding 1,000 cm^2 per sheet.

Note: 1C240.b. refers to porous metal formed by compacting and sintering the materials in 1C240.a. to form a metal material with fine pores interconnected throughout the structure.

1C350 Chemicals, which may be used as precursors for toxic chemical agents, as follows:

N.B.: SEE ALSO 1C450

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

1. Thiodiglycol (111-48-8);
2. Phosphorus oxychloride (10025-87-3);
3. Dimethyl methylphosphonate (756-79-6);
4. **SEE MILITARY GOODS CONTROLS FOR Methyl phosphonyldifluoride (676-99-3);**
5. Methyl phosphonyl dichloride (676-97-1);

6. Dimethylphosphite (868-85-9);
7. Phosphorus trichloride (7719-12-2);
8. Trimethyl phosphite (121-45-9);
9. Thionyl chloride (7719-09-7);
10. 3-Hydroxy-1-methylpiperidine (3554-74-3);
11. N,N-Diisopropyl-(beta)-aminoethyl chloride (96-79-7);
12. N,N-Diisopropyl-(beta)-aminoethane thiol (5842-07-9);
13. 3-Quinuclidinol (1619-34-7);
14. Potassium fluoride (7789-23-3);
15. 2-Chloroethanol (107-07-3);
16. Dimethylamine (124-40-3);
17. Diethyl ethylphosphonate (78-38-6);
18. Diethyl-N,N-dimethylphosphoramidate (2404-03-7);
19. Diethyl phosphite (762-04-9);
20. Dimethylamine hydrochloride (506-59-2);
21. Ethyl phosphinyl dichloride (1498-40-4);
22. Ethyl phosphonyl dichloride (1066-50-8);
23. Ethyl phosphonyl difluoride (753-98-0);
24. Hydrogen fluoride (7664-39-3);
25. Methyl benzilate (76-89-1);
26. Methyl phosphinyl dichloride (676-83-5);
27. N,N-Diisopropyl-(beta)-amino ethanol (96-80-0);
28. Pinacolyl alcohol (464-07-3);
29. **SEE MILITARY GOODS CONTROLS FOR o-Ethyl-2-diisopropylaminoethyl methylphosphonite (57856-11-8);**
30. Triethyl phosphite (122-52-1);
31. Arsenic trichloride (7784-34-1);
32. Benzilic acid (76-93-7);
33. Diethyl methylphosphonite (15715-41-0);
34. Dimethyl ethylphosphonate (6163-75-3);
35. Ethyl phosphinyl difluoride (430-78-4);
36. Methyl phosphinyl difluoride (753-59-3);
37. 3-Quinuclidone (3731-38-2);
38. Phosphorus pentachloride (10026-13-8);
39. Pinacolone (75-97-8);
40. Potassium cyanide (151-50-8);
41. Potassium bifluoride (7789-29-9);
42. Ammonium hydrogen fluoride (1341-49-7);
43. Sodium fluoride (7681-49-4);
44. Sodium bifluoride (1333-83-1);
45. Sodium cyanide (143-33-9);
46. Triethanolamine (102-71-6);
47. Phosphorus pentasulphide (1314-80-3);
48. Di-isopropylamine (108-18-9);
49. Diethylaminoethanol (100-37-8);
50. Sodium sulphide (1313-82-2);
51. Sulphur monochloride (10025-67-9);
52. Sulphur dichloride (10545-99-0);
53. Triethanolamine hydrochloride (637-39-8);
54. N,N-Diisopropyl-(Beta)-aminoethyl chloride hydrochloride (4261-68-1).

1C351 Human pathogens, zoonoses and "toxins", as follows:

a. Viruses, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
   1. Chikungunya virus;
   2. Congo-Crimean haemorrhagic fever virus;
   3. Dengue fever virus;

4. Eastern equine encephalitis virus;
5. Ebola virus;
6. Hantaan virus;
7. Junin virus;
8. Lassa fever virus;
9. Lymphocytic choriomeningitis virus;
10. Machupo virus;
11. Marburg virus;
12. Monkey pox virus;
13. Rift Valley fever virus;
14. Tick-borne encephalitis virus
(Russian Spring-Summer encephalitis virus);
15. Variola virus;
16. Venezuelan equine encephalitis virus;
17. Western equine encephalitis virus;
18. White pox;
19. Yellow fever virus;
20. Japanese encephalitis virus;

b. Rickettsiae, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
1. Coxiella burnetii;
2. Bartonella quintana (Rochalimaea quintana, Rickettsia quintana);
3. Rickettsia prowasecki;
4. Rickettsia rickettsii;

c. Bacteria, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
1. Bacillus anthracis;
2. Brucella abortus;
3. Brucella melitensis;
4. Brucella suis;
5. Chlamydia psittaci;
6. Clostridium botulinum;
7. Francisella tularensis;
8. Burkholderia mallei (Pseudomonas mallei);
9. Burkholderia pseudomallei (Pseudomonas pseudomallei);
10. Salmonella typhi;
11. Shigella dysenteriae;
12. Vibrio cholerae;
13. Yersinia pestis;

d. "Toxins", as follows, and "sub-unit of toxins" thereof:
1. Botulinum toxins;
2. Clostridium perfringens toxins;
3. Conotoxin;
4. Shiga toxin;
5. Staphylococcus aureus toxins;
6. Tetrodotoxin;
7. Verotoxin;
8. Microcystin (Cyanginosin);
9. Aflatoxins

except:
Any goods specified in 1C351 in the form of a "vaccine" or "immunotoxin".

1C352 Animal pathogens, as follows:

a. Viruses, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. African swine fever virus;
2. Avian influenza virus, which are:
    a. Uncharacterised; or
    b. Defined in EC Directive 92/40/EC (O.J. L.16 23.1.92 p.19) as having high pathogenicity, as follows:
        1. Type A viruses with an IVPI (intravenous pathogenicity index) in 6 week old chickens of greater than 1.2; or
        2. Type A viruses H5 or H7 subtype for which nucletide sequencing has demonstrated multiple basic amino acids at the cleavage site of haemagglutinin;
3. Bluetongue virus;
4. Foot and mouth disease virus;
5. Goat pox virus;
6. Porcine herpes virus (Aujeszky's disease);
7. Swine fever virus (Hog cholera virus);
8. Lyssa virus;
9. Newcastle disease virus;
10. Peste des petits ruminants virus;
11. Porcine enterovirus type 9 (swine vesicular disease virus);
12. Rinderpest virus;
13. Sheep pox virus;
14. Teschen disease virus;
15. Vesicular stomatitis virus;

b. Mycoplasma mycoides, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such Mycoplasma mycoides.

except:
Any goods specified in 1C352 in the form of a "vaccine".

1C353 Genetically-modified "microorganisms", as follows:

a. Genetically modified "microorganisms" or genetic elements that contain nucleic acid sequences associated with pathogenicity of organisms specified in 1C351.a. to c. or 1C352 or 1C354;

b. Genetically modified "microorganisms" or genetic elements that contain nucleic acid sequences coding for any of the "toxins" specified in 1C351.d. or "sub-units of toxins" thereof.

1C354 Plant pathogens, as follows:

a. Bacteria, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material which has been deliberately inoculated or contaminated with such cultures, as follows:
    1. Xanthomonas albilineans;
    2. Xanthomonas campestris pv. citri including strains referred to as Xanthomonas campestris pv. citri types A,B,C,D,E or otherwise classified as Xanthomonas citri, Xanthomonas campestris pv. aurantifolia or Xanthomonas campestris pv. citrumelo;

b. Fungi, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material which has been deliberately inoculated or contaminated with such cultures, as follows:
    1. Colletotrichum coffeanum var. virulans (Colletotrichum kahawae);
    2. Cochliobolus miyabeanus (Helminthosporium oryzae);
    3. Microcyclus ulei (syn. Dothidella ulei);

4. Puccinia graminis (syn. Puccinia graminis f. sp. tritici);
5. Puccinia striiformis (syn. Puccinia glumarum);
6. Magnaporthe grisea (pyricularia grisea/pyricularia oryzae).

"1C450 Toxic chemicals and toxic chemicals precursors, as follows:

N.B.: **SEE ALSO 1C350, 1C351.d. AND MILITARY GOODS CONTROLS.**

a. Toxic chemicals, as follows:

1. Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate (78-53-5) and corresponding alkylated or protonated salts;

2. PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8);

3. **SEE MILITARY GOODS CONTROLS FOR BZ: 3-Quinuclidinyl benzilate (6581-06-2);**

4. Phosgene: carbonyl dichloride (75-44-5);

5. Cyanogen chloride (506-77-4);

6. Hydrogen cyanide (74-90-8);

7. Chloropicrin: trichloronitromethane (76-06-2);

b. Toxic chemicals precursors, as follows:

1. Chemicals, other than those specified in the Military Goods Controls or in 1C350, containing a phosphorus atom to which is bonded one methyl, ethyl or propyl (normal or iso) group but not further carbon atoms;

<u>except</u>:

Fonofos: O-Ethyl S-phenyl ethylphosphonothiolothionate (944-22-9);

2. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] phosphoramidic dihalides;

3. Dialkyl [methyl, ethyl or propyl (normal or iso)] N,N-dialkyl [methyl, ethyl or propyl (normal or iso)]-phosphoramidates, other than diethyl-N,N-dimethylphosphoramidate which is specified in 1C350;

4. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethyl-2-chlorides and corresponding protonated salts, other than N,N-Diisopropyl-(beta)-aminoethyl chloride or N,N-Diisopropyl-(beta)-aminoethyl chloride hydrochloride which are specified in 1C350;

5. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethane-2-ols and corresponding protonated salts, other than N,N-Diisopropyl-(beta)-aminoethanol (96-80-0) and N,N-Diethylaminoethanol (100-37-8) which are specified in 1C350;

<u>except</u>:

a. N,N-Dimethylaminoethanol (108-01-0) and corresponding protonated salts;

b. Protonated salts of N,N-Diethylaminoethanol (100-37-8);

6. N,N-dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethane-2-thiols and corresponding protonated salts, other than N,N-diisopropyl-(beta)-aminoethane thiol which is specified in 1C350;

7. Ethyldiethanolamine (139-87-7);

8. Methyldiethanolamine (105-59-9).".

1D Software

1D001 "Software" specially designed or modified for the "development", "production" or "use" of equipment specified in 1B001 to 1B003.

1D002 "Software" for the "development" of organic "matrix", metal "matrix" or carbon "matrix" laminates or "composites".

1D101 "Software" specially designed for the "use" of goods specified in 1B101.

1D103 "Software" specially designed for analysis of reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures.

1D201 "Software" specially designed for the "use" of goods specified in 1B201.

1E Technology

1E001 "Technology" according to the General Technology Note: for the "development" or "production" of equipment or materials specified in 1A001.b., 1A001.c., 1A002 to 1A005, 1B or 1C.

1E002 Other "technology", as follows:

a. "Technology" for the "development" or "production" of polybenzothiazoles or polybenzoxazoles;

b. "Technology" for the "development" or "production" of fluoroelastomer compounds containing at least one vinylether monomer;

c. "Technology" for the design or "production" of the following base materials or non-"composite" ceramic materials:
   1. Base materials having all of the following characteristics:
      a. Any of the following compositions:
         1. Single or complex oxides of zirconium and complex oxides of silicon or aluminium;
         2. Single nitrides of boron (cubic crystalline forms);
         3. Single or complex carbides of silicon or boron; or
         4. Single or complex nitrides of silicon;
      b. Total metallic impurities, excluding intentional additions, of less than:
         1. 1,000 ppm for single oxides or carbides; or
         2. 5,000 ppm for complex compounds or single nitrides;
         and
      c. Having any of the following:
         1. Average particle size equal to or less than 5 μm and no more than 10% of the particles larger than 10 μm; or
            Note: For zirconia, these limits are 1 μm and 5 μm respectively;

2. Having all of the following:
   a. Platelets with a length to thickness ratio exceeding 5;
   b. Whiskers with a length to diameter ratio exceeding 10 for diameters less than 2 μm; and
   c. Continuous or chopped fibres less than 10 μm in diameter.

2. Non-"composite" ceramic materials composed of the materials described in 1E002.c.1;
   Note: 1E002.c.2. does not control technology for the design or production of abrasives.

d. "Technology" for the "production" of aromatic polyamide fibres;

e. "Technology" for the installation, maintenance or repair of materials specified in 1C001;

f. "Technology" for the repair of "composite" structures, laminates or materials specified in 1A002, 1C007.c. or 1C007.d.
   Note: 1E002.f. does not control "technology" for the repair of "civil aircraft" structures using carbon "fibrous or filamentary materials" and epoxy resins, contained in aircraft manufacturers' manuals.

1E101 "Technology" according to the General Technology Note for the "use" of goods specified in 1A102, 1B001, 1B101, 1B115, 1B116, 1C001, 1C101, 1C107, 1C111 to 1C117, 1D101 or 1D103.

1E102 "Technology" according to the General Technology Note for the "development" of "software" specified in 1D001, 1D101 or 1D103.

1E103 "Technology" for the regulation of temperature, pressure or atmosphere in autoclaves or hydroclaves, when used for the "production" of "composites" or partially processed "composites".

1E104 "Technology" relating to the "production" of pyrolitically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1,573 K (1,300°C) to 3,173 K (2,900°C) temperature range at pressures of 130 Pa to 20 kPa.

Note: 1E104 includes "technology" for the composition of precursor gases, flow-rates and process control schedules and parameters.

1E201 "Technology" according to the General Technology Note for the "use" of goods specified in 1A002, 1A202, 1A225 to 1A227, 1B201, 1B225 to 1B233, 1C002.a.2.c. or d., 1C010.b., 1C202, 1C210, 1C216, 1C225 to 1C240 or 1D201.

1E202 "Technology" according to the General Technology Note for the "development" or "production" of goods specified in 1A202 or 1A225 to 1A227.

1E203 "Technology" according to the General Technology Note for the "development" of "software" specified in 1D201.

CATEGORY 2 - MATERIALS PROCESSING

2A Systems, Equipment and Components

(For quiet running bearings, see the Military Goods Controls.)

2A001 Anti-friction bearings and bearing systems, as follows, and components therefor:

Note: 2A001 does not control balls with tolerances specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse.

a. Ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC7, ABEC7P, ABEC7T or ISO Standard Class 4 or better (or national equivalents), and having rings, balls or rollers made from monel or beryllium;

Note; 2A001.a. does not control tapered roller bearings.

b. Other ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC9, ABEC9P or ISO Standard Class 2 or better (or national equivalents);

Note: 2A001.b. does not control tapered roller bearings.

c. Active magnetic bearing systems using any of the following:
   1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;
   2. All-electromagnetic 3D homopolar bias designs for actuators; or
   3. High temperature (450 K (177°C) and above) position sensors.

2A225 Crucibles made of materials resistant to liquid actinide metals, as follows:

a. Crucibles with a volume of between 150 ml and 8 litres and made of or coated with any of the following materials having a purity of 98% or greater:
   1. Calcium fluoride (CaF_2);
   2. Calcium zirconate (metazirconate) (Ca_2ZrO_3);
   3. Cerium sulphide (Ce_2S_3);
   4. Erbium oxide (erbia) (Er_2O_3);
   5. Hafnium oxide (hafnia) (HfO_2);
   6. Magnesium oxide (MgO);
   7. Nitrided niobium-titanium-tungsten alloy (approximately 50% Nb, 30%Ti, 20%W);
   8. Yttrium oxide (yttria) (Y_2O_3); or
   9. Zirconium oxide (zirconia) (ZrO_2);

b. Crucibles with a volume of between 50 ml and 2 litres and made of or lined with tantalum, having a purity of 99.9% or greater;

c. Crucibles with a volume of between 50 ml and 2 litres and made of or lined with tantalum (having a purity of 98% or greater) coated with tantalum carbide, nitride or boride (or any combination of these).

2A226 Valves 5 mm or greater in 'nominal size', with a bellows seal, wholly made of or lined with aluminium, aluminium alloy, nickel, or alloy containing 60% or more nickel, either manually or automatically operated.

Note: For valves with different inlet and outlet diameters, the 'nominal size' above refers to the smallest diameter.

2B Test, Inspection and Production Equipment

Technical Notes:

1. Secondary parallel contouring axes, (e.g., the w-axis on horizontal boring mills or a secondary rotary axis the centre line of which is parallel to the primary rotary axis) are not counted in the total number of contouring axes.

N.B. Rotary axes need not rotate over 360°. A rotary axis can be driven by a linear device (e.g., a screw or a rack-and-pinion).

2. *Axis nomenclature shall be in accordance with International Standard ISO 841, 'Numerical Control Machines – Axis and Motion Nomenclature'.*

3. *For the purposes of 2B001 to 2B009 a "tilting spindle" is counted as a rotary axis.*

4. *Guaranteed positioning accuracy levels instead of individual test protocols may be used for each machine tool model using the agreed ISO test procedure.*

5. *The positioning accuracy of "numerically controlled" machine tools is to be determined and presented in accordance with ISO 230/2.*

2B001 Machine tools, as follows, and any combination thereof, for removing (or cutting) metals, ceramics or "composites", which, according to the manufacturer's technical specification, can be equipped with electronic devices for "numerical control":
N.B.: SEE ALSO 2B201.

a. Machine tools for turning, having all of the following characteristics:
   1. Positioning accuracy with all compensations available of less (better) than 6 µm along any linear axis (overall positioning); and
   2. Two or more axes which can be coordinated simultaneously for "contouring control";

   Note: 2B001.a does not control turning machines specially designed for the production of contact lenses.

b. Machine tools for milling, having any of the following characteristics:
   1. a. Positioning accuracy with all compensations available of less (better) than 6 µm along any linear axis (overall positioning); and
      b. Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control";
   2. Five or more axes which can be coordinated simultaneously for "contouring control"; or
   3. A positioning accuracy for jig boring machines, with all compensations available, of less (better) than 4 µm along any linear axis (overall positioning);

c. Machine tools for grinding, having any of the following characteristics:
   1. a. Positioning accuracy with all compensations available of less (better) than 4 µm along any linear axis (overall positioning); and
      b. Three or more axes which can be coordinated simultaneously for "contouring control"; or

   2. Five or more axes which can be coordinated simultaneously for "contouring control";

   Note: 2B001.c. does not control grinding machines, as follows:
      1. Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:
         a. Limited to cylindrical grinding; and
         b. Limited to a maximum workpiece capacity of 150 mm outside diameter or length.
      2. Machines designed specifically as jig grinders having any of the following characteristics:
         a. The c-axis is used to maintain the grinding wheel normal to the work surface; or
         b. The a-axis is configured to grind barrel cams.
      3. Tool or cutter grinding machines shipped as complete systems with "software" specially designed for the production of tools or cutters.
      4. Crank shaft or cam shaft grinding machines.
      5. Surface grinders.

d. Electrical discharge machines (EDM) of the non-wire type which have two or more rotary axes which can be coordinated simultaneously for "contouring control";

e. Machine tools for removing metals, ceramics or "composites":
   1. By means of:
      a. Water or other liquid jets, including those employing abrasive additives;
      b. Electron beam; or
      c. "Laser" beam; and
   2. Having two or more rotary axes which:
      a. Can be coordinated simultaneously for "contouring control"; and
      b. Have a positioning accuracy of less (better) than 0.003°;

f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5,000 mm and specially designed components therefor.

2B003 "Numerically controlled" or manual machine tools, and specially designed components, controls and accessories therefor, specially designed for the shaving, finishing, grinding or honing of hardened (R_c = 40 or more) spur, helical and
double-helical gears with a pitch diameter exceeding 1,250 mm and a face width of 15% of pitch diameter or larger finished to a quality of AGMA 14 or better (equivalent to ISO 1328 class3).

2B004 Hot "isostatic presses", having all of the following, and specially designed dies, moulds, components, accessories and controls therefor:
N.B.: SEE ALSO 2B104 and 2B204.

a. A controlled thermal environment within the closed cavity and possessing a chamber cavity with an inside diameter of 406 mm or more; and
b. Any of the following:
   1. A maximum working pressure exceeding 207 MPa;
   2. A controlled thermal environment exceeding 1,773 K (1,500°C); or
   3. A facility for hydrocarbon impregnation and removal of resultant gaseous degradation products.

Technical Note:
The inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

2B005 Equipment specially designed for the deposition, processing and in-process control of inorganic overlays, coatings and surface modifications, as follows, for non-electronic substrates, by processes shown in the Table and associated Notes following 2E003.f., and specially designed automated handling, positioning, manipulation and control components therefor:

a. "Stored programme controlled" chemical vapour deposition (CVD) production equipment having all of the following:
   1. Process modified for one of the following:
      a. Pulsating CVD;
      b. Controlled nucleation thermal decomposition (CNTD); or
      c. Plasma enhanced or plasma assisted CVD; and
   2. Any of the following:
      a. Incorporating high vacuum (equal to or less than 0.01 Pa) rotating seals; or
      b. Incorporating *in situ* coating thickness control;
b. "Stored programme controlled" ion implantation production equipment having beam currents of 5 mA or more;

c. "Stored programme controlled" electron beam physical vapour deposition (EB-PVD) production equipment incorporating all of the following:
   1. Power systems rated for over 80 kW;
   2. A liquid pool level "laser" control system which regulates precisely the ingots feed rate; and

3. A computer controlled rate monitor operating on the principle of photo-luminescence of the ionised atoms in the evaporant stream to control the deposition rate of a coating containing two or more elements;

d. "Stored programme controlled" plasma spraying production equipment having any of the following characteristics:

1. Operating at reduced pressure controlled atmosphere (equal to or less than 10 kPa measured above and within 300 mm of the gun nozzle exit) in a vacuum chamber capable of evacuation down to 0.01 Pa prior to the spraying process; or

2. Incorporating *in situ* coating thickness control;

e. "Stored programme controlled" sputter deposition production equipment capable of current densities of 0.1 mA/mm^2 or higher at a deposition rate of 15 µm/h or more;

f. "Stored programme controlled" cathodic arc deposition production equipment incorporating a grid of electromagnets for steering control of the arc spot on the cathode;

g. "Stored programme controlled" ion plating production equipment allowing for the *in situ* measurement of any of the following:
1. Coating thickness on the substrate and rate control; or
2. Optical characteristics.

Note: 2B005 does not control chemical vapour deposition, cathodic arc, sputter deposition, ion plating or ion implantation equipment specially designed for cutting or machining tools.

2B006 Dimensional inspection or measuring systems and equipment, as follows:

a. Computer controlled, "numerically controlled" or "stored programme controlled" dimensional inspection machines, having a three dimensional length (volumetric) "measurement uncertainty" equal to or less (better) than (1.7+L/1,000) µm (L is the measured length in mm) tested according to ISO 10360-2;
N.B.:SEE ALSO 2B206.

b. Linear and angular displacement measuring instruments, as follows:
1. Linear measuring instruments having any of the following:
a. Non-contact type measuring systems with a "resolution" equal to or less (better) than 0.2 µm within a measuring range up to 0.2 mm;
b. Linear voltage differential transformer systems having all of the following characteristics:
1. "Linearity" equal to or less (better) than 0.1% within a measuring range up to 5 mm; and
2. Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ±1 K; or
c. Measuring systems having all of the following:
1. Containing a "laser"; and
2. Maintaining, for at least 12 hours, over a temperature range of ±1 K around a standard temperature and at a standard pressure, all of the following:
a. A "resolution" over their full scale of 0.1 µm or less (better); and
b. A "measurement uncertainty" equal to or less (better) than (0.2 + L/2,000) µm (L is the measured length in mm);

Note: 2B006.b.1. does not control measuring interferometer systems, without closed or open loop feedback, containing a "laser" to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

2. Angular measuring instruments having an "angular position deviation" equal to or less (better) than 0.00025°;

Note: 2B006.b.2. does not control optical instruments, such as autocollimators, using collimated light to detect angular displacement of a mirror.

c. Equipment for measuring surface irregularities, by measuring optical scatter as a function of angle, with a sensitivity of 0.5 nm or less (better).

Notes:
1. *Machine tools which can be used as measuring machines are controlled if they meet or exceed the criteria specified for the machine tool function or the measuring machine function.*
2. *A machine described in 2B006 is controlled if it exceeds the control threshold anywhere within its operating range.*

2B007 "Robots" having any of the following characteristics and specially designed controllers and "end-effectors" therefor:
N.B.: SEE ALSO 2B207.

a. Capable in real time of full three-dimensional image processing or full three-dimensional scene analysis to generate or modify "programmes" or to generate or modify numerical programme data;

Note: The scene analysis limitation does not include approximation of the third dimension by viewing at a given angle, or limited grey scale interpretation for the perception of depth or texture for the approved tasks (2 1/2 D).

b. Specially designed to comply with national safety standards applicable to explosive munitions environments;

c. Specially designed or rated as radiation-hardened to withstand greater than $5x10^3$ Gy(Si) without operational degradation; or

d. Specially designed to operate at altitudes exceeding 30,000 m.

2B008 Assemblies, units or inserts specially designed for machine tools, or for equipment specified in 2B006 or 2B007, as follows:

a. Linear position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an overall "accuracy" less (better) than (800 + (600 x L x 10^{-3})) nm (L equals the effective length in mm);

Note: For "laser" systems see also Note to 2B006.b.1.

b. Rotary position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an "accuracy" less (better) than 0.00025°;

Note: For "laser" systems see also Note to 2B006.b.1.

c. "Compound rotary tables" and "tilting spindles", capable of upgrading, according to the manufacturer's specifications, machine tools to or above the levels specified in 2B.

2B009 Spin-forming machines and flow-forming machines, which, according to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control and having all of the following:
N.B.:SEE ALSO 2B109 AND 2B209.

a. Two or more controlled axes of which at least two can be coordinated simultaneously for "contouring control"; and

b. A roller force more than 60 kN.

Technical Note:
Machines combining the function of spin-forming and flow-forming are for the purpose of 2B009 regarded as flow-forming machines.

2B104 Equipment and process controls designed or modified for densification and pyrolysis of structural composite rocket nozzles and reentry vehicle nose tips.

Note: The only "isostatic presses" and furnaces specified in 2B104 are as follows:

a. "Isostatic presses", other than those specified in 2B004, having all the following characteristics:
1. Maximum working pressure of 69 MPa or greater;
2. Designed to achieve and maintain a controlled thermal environment of 873 K (600°C) or greater; and
3. Possessing a chamber cavity with an inside diameter of 254 mm or greater;

b. CVD Furnaces designed or modified for the densification of carbon-carbon composites.

2B109 Flow-forming machines, other than those specified in 2B009, and specially designed components therefor, which:

N.B.: SEE ALSO 2B209.

a. According to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control, even when not equipped with such units; and

b. With more than two axes which can be coordinated simultaneously for "contouring control".

Technical Notes:
1. Machines combining the function of spin-forming and flow-forming are for the purpose of 2B109 regarded as flow-forming machines.
2. 2B109 does not control machines that are not usable in the production of propulsion components and equipment (e.g. motor cases) for systems specified in 9A005, 9A007.a. or 9A105.a."

2B116 Vibration test systems, equipment and components therefor, as follows:

a. Vibration test systems employing feedback or closed loop techniques and incorporating a digital controller, capable of vibrating a system at 10 g rms or more over the entire range 20 Hz to 2000 Hz and imparting forces of 50 kN, measured 'bare table', or greater;

b. Digital controllers, combined with specially designed vibration test software, with a "real-time bandwidth" greater than 5 kHz designed for use with vibration test systems specified in 2B116.a.;

c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 50 kN, measured 'bare table', or greater and usable in vibration test systems specified in 2B116.a.;

d. Test piece support structures and electronic units designed to combine multiple shaker units in a system capable of providing an effective combined force of 50 kN, measured 'bare table', or greater, and usable in vibration systems specified in 2B116.a.

Note: In 2B116, 'bare table' means a flat table, or surface, with no fixture or fittings.

2B201 Machine tools, other than those specified in 2B001, as follows, for removing or cutting metals, ceramics or "composites", which, according to the manufacturer's technical specification, can be equipped with electronic devices for simultaneous "contouring control" in two or more axes:

a. Machine tools for milling, having any of the following characteristics:
   1. Positioning accuracies with all compensations available less (better) than 0.006 mm along any linear axis (overall positioning); or
   2. Two or more contouring rotary axes;

Note: 2B201.a. does not control milling machines having the following characteristics:
   a. X-axis travel greater than 2 m; and
   b. Overall positioning accuracy on the x-axis more (worse) than 0.030 mm.

b. Machine tools for grinding, having any of the following characteristics:
   1. Positioning accuracies with all compensations available less (better) than 0.004 mm along any linear axis (overall positioning); or
   2. Two or more contouring rotary axes.

Note: 2B201.b. does not control the following grinding machines:
   a. Cylindrical external, internal, and external-internal grinding machines having all of the following characteristics:
      1. Limited to cylindrical grinding;
      2. A maximum workpiece outside diameter or length of 150 mm.
      3. Not more than two axes that can be coordinated simultaneously for "contouring control"; and
      4. No contouring c axis;
   b. Jig grinders with axes limited to x, y, c and a where c axis is used to maintain the grinding wheel normal to the work surface , and the a axis is configured to grind barrel cams;
   c. Tool or cutter grinding machines with "software" specially designed for the production of tools or cutters; or
   d. Crankshaft or camshaft grinding machines.

2B204 "Isostatic presses", other than those specified in 2B004 or 2B104, capable of achieving a maximum working pressure of 69 MPa or greater and having a chamber cavity with an inside diameter in excess of 152 mm, and specially designed dies, moulds or controls therefor.

Technical Note:
The inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

2B206 Dimensional inspection machines, devices or systems, other than those specified in 2B006, as follows:

a. Computer controlled or numericaly controlled dimensional inspection machines having both of the following characteristics:
   1. Two or more axes; and
   2. A one-dimensional length "measurement uncertainty" equal to or less (better) than (1.25 + L/1000) µm tested with a probe of an "accuracy" of less (better) than 0.2µm (L is the measured length in millimeters) (Ref.:VDI/VDE 2617 Parts 1 and 2);

b. Systems for simultaneously linear-angular inspection of hemishells, having both of the following characteristics:
   1. "Measurement uncertainty" along any linear axis equal to or less (better) than 3.5 µm per 5 mm; and
   2. "Angular position deviation" equal to or less than 0.02°.

Technical Note:
1. Machine tools that can be used as measuring machines are controlled if they meet or exceed the criteria specified for the machine tool function or the measuring machine function.
2. A machine specified in 2B206 is controlled if it exceeds the control threshold anywhere within its operating range.

3. *The probe used in determining the measurement uncertainty of a dimensional inspection system shall be described in VDI/VDE 2617 parts 2, 3 and 4.*

2B207 "Robots" or "end-effectors", other than those specified in 2B007, specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives) and specially designed controllers therefor.

2B209 Flow forming machines, or spin forming machines capable of flow forming functions, other than those specified in 2B009 or 2B109, or mandrels, as follows:

a. 1. Having three or more rollers (active or guiding); and
2. According to the manufacturer's technical specification can be equipped with "numerical control" units or a computer control;

b. Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 mm and 400 mm.

Note: 2B209 includes machines which have only a single roller designed to deform metal plus two auxiliary rollers which support the mandrel, but do not participate directly in the deformation process.

2B225 Remote manipulators that can be used to provide remote actions in radiochemical separation operations and hot cells, as follows:

a. Having a capability of penetrating 0.6 m or more of hot cell wall (through-the-wall operation); or
b. Having a capability of bridging over the top of a hot cell wall with a thickness of 0.6 m or more (over-the-wall operation).

Note: Remote manipulators provide translation of human operator actions to a remote operating arm and terminal fixture. They may be of 'master/slave' type or operated by joystick or keypad.

2B226 Vacuum or controlled environment (inert gas) induction furnaces capable of operation above 1,123 K (850°C) and having induction coils 600 mm or less in diameter, and designed for power inputs of 5 kW or more, and power supplies specially designed therefor with a specified power output of 5 kW or more.
N.B: SEE ALSO 3B.

Note: 2B226 does not control furnaces designed for the processing of semiconductor wafers.

2B227 Vacuum and controlled atmosphere metallurgical melting and casting furnaces as follows; and specially configured computer control and monitoring systems therefor:

a. Arc remelt and casting furnaces with consumable electrode capacities between 1000 cm^3 and 20,000 cm^3, capable of operating with melting temperatures above 1973 K (1700°C);

b. Electron beam melting and plasma atomization and melting furnaces, with a power of 50 kW or greater, capable of operating with melting temperatures above 1473 K (1200°C).

2B228 Rotor fabrication and assembly equipment and bellows-forming mandrels and dies, as follows:

a. Rotor assembly equipment for assembly of gas centrifuge rotor tube sections, baffles and end caps, including associated precision mandrels, clamps and shrink fit machines;

b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis;

Technical Note:
Normally such equipment will consist of precision measuring probes linked to a computer that subsequently controls the action of, for example, pneumatic rams used for aligning the rotor tube sections.

c. Bellows-forming mandrels and dies for producing single-convolution bellows (bellows made of high-strength aluminium alloys, maraging steel or high strength filamentary materials). The bellows have all of the following dimensions:
   1. 75 mm to 400 mm inside diameter;
   2. 12.7 mm or more in length; and
   3. Single convolution depth more than 2 mm.

2B229 Centrifugal multiplane balancing machines, fixed or portable, horizontal or vertical, as follows:

a. Centrifugal balancing machines designed for balancing flexible rotors having a length of 600 mm or more and having all of the following characteristics:
   1. A swing or journal diameter of 75 mm or more;
   2. Mass capability of from 0.9 to 23 kg; and
   3. Capable of balancing speed of revolution more than 5000 r.p.m.;

b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:
   1. A journal diameter of 75 mm or more;
   2. Mass capability of from 0.9 to 23 kg;
   3. Capable of balancing to a residual imbalance of 0.01 kg mm/kg per plane or better; and
   4. Belt drive type.

2B230 "Pressure transducers" which are capable of measuring absolute pressure at any point in the range 0 to 13 kPa, with pressure sensing elements made of or protected by nickel, nickel alloys with more than 60% nickel by weight, aluminium or aluminium alloys, having any of the following:
a. A full scale of less than 13 kPa and an 'accuracy' of better than + 1% (full-scale); or
b. A full scale of 13 kPa or greater and an 'accuracy' of better than + 130 Pa.

Technical Note:
For the purposes of 2B230, 'accuracy' includes non-linearity, hysteresis and repeatability at ambient temperature.

2B231 Vacuum pumps with an input throat size of 380 mm or greater with a pumping speed of 15,000 litres/s or greater and capable of producing an ultimate vacuum better than 13 mPa.

Technical Notes:
1. The ultimate vacuum is determined at the input of the pump with the input of the pump blocked off.
2. The pumping speed is determined at the measurement point with nitrogen gas or air.

2B232 Multistage light gas gun or other high-velocity gun systems (coil, electromagnetic, electrothermal or other advanced systems) capable of accelerating projectiles to 2 km/s or greater.

2B350 Chemical manufacturing facilities and equipment, as follows:

a. Reaction vessels or reactors, with or without agitators, with total internal (geometric) volume greater than 0.1 m^3 (100 litres) and less than 20 m^3 (20,000 litres), where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight;
   2. Fluoropolymers;
   3. Glass (including vitrified or enamelled coating or glass lining);
   4. Nickel or alloys with more than 40% nickel by weight;
   5. Tantalum or tantalum alloys;
   6. Titanium or titanium alloys; or
   7. Zirconium or zirconium alloys;

b. Agitators for use in reaction vessels or reactors where all surfaces of the agitator that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight;
   2. Fluoropolymers;
   3. Glass (including vitrified or enamelled coatings or glass lining);
   4. Nickel or alloys with more than 40% nickel by weight;
   5. Tantalum or tantalum alloys;
   6. Titanium or titanium alloys; or
   7. Zirconium or zirconium alloys;

c. Storage tanks, containers or receivers with a total internal (geometric) volume greater than 0.1 m^3 (100 litres) where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight;
   2. Fluoropolymers;
   3. Glass (including vitrified or enamelled coatings or glass lining);
   4. Nickel or alloys with more than 40% nickel by weight;
   5. Tantalum or tantalum alloys;
   6. Titanium or titanium alloys; or
   7. Zirconium or zirconium alloys;

d. Heat exchangers or condensers with a heat transfer surface area of less than 20 m^2, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight;
   2. Fluoropolymers;
   3. Glass (including vitrified or enamelled coatings or glass lining);
   4. Graphite;
   5. Nickel or alloys with more than 40% nickel by weight;
   6. Tantalum or tantalum alloys;
   7. Titanium or titanium alloys; or
   8. Zirconium or zirconium alloys;

e. Distillation or absorption columns of internal diameter greater than 0.1 m, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight;
   2. Fluoropolymers;
   3. Glass (including vitrified or enamelled coatings or glass lining);
   4. Graphite;
   5. Nickel or alloys with more than 40% nickel by weight;
   6. Tantalum or tantalum alloys;
   7. Titanium or titanium alloys; or
   8. Zirconium or zirconium alloys;

f. Remotely operated filling equipment in which all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight; or
   2. Nickel or alloys with more than 40% nickel by weight;

g. Multiple seal valves incorporating a leak detection port, bellows-seal valves, non-return (check) valves or diaphragm valves, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
   1. Alloys with more than 25% nickel and 20% chromium by weight;
   2. Fluoropolymers;
   3. Glass (including vitrified or enamelled coatings or glass lining);
   4. Nickel or alloys with more than 40% nickel by weight;
   5. Tantalum or tantalum alloys;

6. Titanium or titanium alloys; or
7. Zirconium or zirconium alloys;

h. Multi-walled piping incorporating a leak detection port, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
1. Alloys with more than 25% nickel and 20% chromium by weight;
2. Fluoropolymers;
3. Glass (including vitrified or enamelled coatings or glass lining);
4. Graphite;
5. Nickel or alloys with more than 40% nickel by weight;
6. Tantalum or tantalum alloys;
7. Titanium or titanium alloys; or
8. Zirconium or zirconium alloys;

i. Multiple-seal, canned drive, magnetic drive, bellows or diaphragm pumps, with manufacturer's specified maximum flow-rate greater than 0.6 m^3/hour, or vacuum pumps with manufacturer's specified maximum flow-rate greater than 5 m^3/hour (under standard temperature (273 K (0°C)) and pressure (101.3 kPa) conditions), in which all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:
1. Alloys with more than 25% nickel and 20% chromium by weight;
2. Ceramics;
3. Ferrosilicon;
4. Fluoropolymers;
5. Glass (including vitrified or enamelled coatings or glass lining);
6. Graphite;
7. Nickel or alloys with more than 40% nickel by weight;
8. Tantalum or tantalum alloys;
9. Titanium or titanium alloys; or
10. Zirconium or zirconium alloys;

j. Incinerators designed to destroy chemicals specified in entry 1C350, having specially designed waste supply systems, special handling facilities and an average combustion chamber temperature greater than 1273 K (1000°C), in which all surfaces in the waste supply system that come into direct contact with the waste products are made from or lined with any of the following materials:
1. Alloys with more than 25% nickel and 20% chromium by weight;
2. Ceramics; or
3. Nickel or alloys with more than 40% nickel by weight.

2B351 Toxic gas monitoring systems, as follows; and dedicated detectors therefor:

a. Designed for continuous operation and usable for the detection of chemical warfare agents, chemicals specified in 1C350 or organic compounds containing phosphorus, sulphur, fluorine or chlorine, at concentrations of less than 0.3 mg/m^3; or
b. Designed for the detection of cholinesterase-inhibiting activity.

2B352 Equipment capable of use in handling biological materials, as follows:

a. Complete biological containment facilities at P3, P4 containment level;
Technical Note:
P3 or P4 (BL3, BL4, L3, L4) containment levels are as specified in the WHO Laboratory Biosafety manual (Geneva, 1983).

b. Fermenters capable of cultivation of pathogenic "microorganisms", viruses or capable of toxin production, without the propagation of aerosols, and having a total capacity of 100 litres or more;
Technical Note:
Fermenters include bioreactors, chemostats and continuous-flow systems.

c. Centrifugal separators, capable of continuous separation without the propagation of aerosols, having all the following characteristics:
   1. Flow rate exceeding 100 litres per hour;
   2. Components of polished stainless steel or titanium;
   3. Double or multiple sealing joints within the steam containment area; and
   4. Capable of in-situ steam sterilisation in a closed state;

   Technical Note:
   Centrifugal separators include decanters.

d. Cross-flow filtration equipment, capable of continuous separation without the propagation of aerosols, having both of the following characteristics:
   1. Equal to or greater than 5 m^2; and
   2. Capable of in-situ sterilization;

e. Steam sterilisable freeze drying equipment with a condenser capacity exceeding 50 kg of ice in 24 hours and less than 1,000 kg of ice in 24 hours;

f. Equipment that incorporates or is contained in P3 or P4 containment housing, as follows:
   1. Independently ventilated protective full or half suits;
   2. Biological safety cabinets or isolators, which allow manual operations to be performed within, whilst providing an environment equivalent to Class III biological protection;

      Note: In 2B352.f.2., isolators include flexible isolators, dry boxes, anaerobic chambers and glove boxes.

g. Chambers designed for aerosol challenge testing with "microorganisms" or "toxins" and having a capacity of 1 m^3 or greater.

2C Materials

None.

2D Software

2D001 "Software" specially designed or modified for the "development", "production" or "use" of equipment specified in 2A001or 2B001 to 2B009.

2D002 "Software" for electronic devices, even when residing in an electronic device or system, enabling such devices or systems to function as a "numerical control" unit, capable of any of the following:

a. Coordinating simultaneously more than four axes for "contouring control"; or

b. "Real time processing" of data to modify tool path, feed rate and spindle data, during the machining operation, by any of the following:
   1. Automatic calculation and modification of part program data for machining in two or more axes by means of measuring cycles and access to source data; or
   2. "Adaptive control" with more than one physical variable measured and processed by means of a computing model (strategy) to change one or more machining instructions to optimize the process.

Note: 2D002 does not control "software" specially designed or modified for the operation of machine tools not controlled by Category 2.

2D101 "Software" specially designed for the "use" of equipment specified in 2B104, 2B109 or 2B116.
N.B.: SEE ALSO 9D004.

2D201 "Software" specially designed for the "use" of equipment specified in 2B204, 2B206, 2B207, 2B209, 2B227 or 2B229.

2D202 "Software" specially designed or modified for the "development", "production" or "use" of equipment specified in 2B201.

2E Technology

2E001 "Technology" according to the General Technology Note for the "development" of equipment or "software" specified in 2A, 2B or 2D.

2E002 "Technology" according to the General Technology Note for the "production" of equipment specified in 2A or 2B.

2E003 Other "technology", as follows:

a. "Technology" for the "development" of interactive graphics as an integrated part in "numerical control" units for preparation or modification of part programmes;

b. "Technology" for metal-working manufacturing processes, as follows:
   1. "Technology" for the design of tools, dies or fixtures specially designed for any of the following processes:
      a. "Superplastic forming";
      b. "Diffusion bonding"; or
      c. "Direct-acting hydraulic pressing";

   2. Technical data consisting of process methods or parameters as listed below used to control:
      a. "Superplastic forming" of aluminium alloys, titanium alloys or "superalloys":
         1. Surface preparation;
         2. Strain rate;
         3. Temperature;
         4. Pressure;
      b. "Diffusion bonding" of "superalloys" or titanium alloys:
         1. Surface preparation;
         2. Temperature;
         3. Pressure;
      c. "Direct-acting hydraulic pressing" of aluminium alloys or titanium alloys:
         1. Pressure;
         2. Cycle time;

      d. "Hot isostatic densification" of titanium alloys, aluminium alloys or "superalloys":
         1. Temperature;
         2. Pressure;
         3. Cycle time;

c. "Technology" for the "development" or "production" of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;

d. "Technology" for the "development" of generators of machine tool instructions (e.g., part programmes) from design data residing inside "numerical control" units;

e. "Technology for the development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into "numerical control" units;

f. "Technology" for the application of inorganic overlay coatings or inorganic surface modification coatings (specified in column 3 of the following table) to non-electronic substrates (specified in column 2 of the following table), by processes specified in column 1 of the following table and defined in the Technical Note.

TABLE – DEPOSITION TECHNIQUES

1. Coating Process (1)*	2. Substrate	3. Resultant Coating
A. Chemical Vapour Deposition (CVD)	"Superalloys"	Aluminides for internal passages
	Ceramics and Low-expansion glasses (14)	Silicides Carbides Dielectric layers (15)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Aluminides Alloyed aluminides (2)
	Cemented tungsten carbide (16), Silicon carbide	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15)
B. Thermal-Evaporation Physical Vapour Deposition (TE-PVD)		
1. Physical Vapour Deposition (PVD): Electron-Beam (EB-PVD)	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5) Modified zirconia (12) Silicides Aluminides Mixtures thereof (4)

* The numbers in parenthesis refer to the Notes following this Table.

TABLE – DEPOSITION TECHNIQUES

1. Coating Process (1)	2. Substrate	3. Resultant Coating
B.1. (continued)	Ceramics and Low-expansion glasses (14)	Dielectric layers (15)
	Corrosion resistant steel (7)	MCrAlX (5) Modified zirconia (12) Mixtures thereof (4)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15)
	Cemented tungsten carbide (16), Silicon carbide	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15) Borides
	Sensor window materials (9)	Dielectric layers (15)
	Titanium alloys (13)	Borides Nitrides
B.2. Ion assisted resistive heating Physical Vapour Deposition (Ion Plating)	Ceramics and Low-expansion glasses (14)	Dielectric layers (15)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Dielectric layers (15)

TABLE – DEPOSITION TECHNIQUES

1. Coating Process (1)	2. Substrate	3. Resultant Coating
B.2. (continued)	Cemented tungsten carbide (16), Silicon carbide	Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15)
B.3. Physical Vapour Deposition: "laser" evaporation	Ceramics and Low-expansion glasses (14)	Silicides Dielectric layers (15)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Dielectric layers (15)
	Cemented tungsten carbide (16), Silicon carbide	Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15) Diamond-like carbon
B.4. Physical Vapour Deposition: cathodic arc discharge	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5)
	Polymers (11) and Organic "matrix" "composites"	Borides Carbides Nitrides

TABLE – DEPOSITION TECHNIQUES

1.	Coating Process (1)	2. Substrate	3. Resultant Coating
C.	Pack cementation (see A above for out-of-pack cementation) (10)	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Mixtures thereof (4)
		Titanium alloys (13)	Silicides Aluminides Alloyed aluminides (2)
		Refractory metals and alloys (8)	Silicides Oxides
D.	Plasma spraying	"Superalloys" MCrAlX (5)	Modified zirconia (12) Mixtures thereof (4) Abradable Nickel-Graphite Abradable Ni-Cr-Al-Bentonite Abradable Al-Si-Polyester Alloyed aluminides (2)
		Aluminium alloys (6)	MCrAlX (5) Modified zirconia (12) Silicides Mixtures thereof (4)
		Refractory metals and alloys (8)	Aluminides Silicides Carbides
		Corrosion resistant steel (7)	Modified zirconia (12) Mixtures thereof (4)

TABLE – DEPOSITION TECHNIQUES

1. Coating Process (1)	2. Substrate	3. Resultant Coating
D. (continued)	Titanium alloys (13)	Carbides Aluminides Silicides Alloyed aluminides (2) Abradable Nickel-Graphite Abradable Ni-Cr-Al-Bentonite Abradable Al-Si-Polyester Polyester
E. Slurry Deposition and alloys (8)	Refractory metals	Fused silicides Fused aluminides except for resistance heating elements
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Mixtures thereof (4)
F. Sputter Deposition	"Superalloys"	Alloyed silicides Alloyed aluminides (2) Noble metal modified aluminides (3) MCrAlX (5) Modified zirconia (12) Platinum Mixtures thereof (4)
	Ceramics and Low-expansion glasses (14)	Silicides Platinum Mixtures thereof (4) Dielectic layers (15)
	Titanium alloys (13)	Borides Nitrides Oxides Silicides Aluminides Alloyed aluminides (2) Carbides

TABLE – DEPOSITION TECHNIQUES

1. Coating Process (1)	2. Substrate	3. Resultant Coating
F. (continued)	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15)
	Cemented tungsten carbide (16), Silicon carbide	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Borides Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15)
	Refractory metals and alloys (8)	Aluminides Silicides Oxides Carbides
G. Ion Implantation	High temperature bearing steels	Additions of Chromium, Tantalum or Niobium (Columbium)
	Titanium alloys (13)	Borides Nitrides
	Beryllium and Beryllium alloys	Borides
	Cemented tungsten carbide (16)	Carbides Nitrides

TABLE – DEPOSITION TECHNIQUES – NOTES

1. The term 'coating process' includes coating repair and refurbishing as well as original coating.

2. The term 'alloyed aluminide coating' includes single or multiple-step coatings in which an element or elements are deposited prior to or during application of the aluminide coating, even if these elements are deposited by another coating process. It does not, however, include the multiple use of single-step pack cementation processes to achieve alloyed aluminides.

3. The term 'noble metal modified aluminide' coating includes multiple-step coatings in which the noble metal or noble metals are laid down by some other coating process prior to application of the aluminide coating.

4. Mixtures consist of infiltrated material, graded compositions, co-deposits and multilayer deposits and are obtained by one or more of the coating processes specified in the Table.

5. MCrAlX refers to a coating alloy where M equals cobalt, iron, nickel or combinations thereof and X equals hafnium, yttrium, silicon, tantalum in any amount or other intentional additions over 0.01weight percent in various proportions and combinations, except:
   a. CoCrAlY coatings which contain less than 22 weight percent of chromium, less than 7 weight percent of aluminium and less than 2weight percent of yttrium;
   b. CoCrAlY coatings which contain 22 to 24 weight percent of chromium, 10 to 12 weight percent of aluminium and 0.5 to 0.7 weight percent of yttrium; or
   c. NiCrAlY coatings which contain 21 to 23 weight percent of chromium, 10 to 12 weight percent of aluminium and 0.9 to 1.1 weight percent of yttrium.

6. The term 'aluminium alloys' refers to alloys having an ultimate tensile strength of 190 MPa or more measured at 293 K (20°C).

7. The term 'corrosion resistant steel' refers to AISI (American Iron and Steel Institute) 300 series or equivalent national standard steels.

8. Refractory metals consist of the following metals and their alloys: niobium (columbium), molybdenum, tungsten and tantalum.

9. Sensor window materials, as follows: alumina, silicon, germanium, zinc sulphide, zinc selenide, gallium arsenide and the following metal halides: potassium iodide, potassium fluoride, or sensor window materials of more than 40 mm diameter for thallium bromide and thallium chlorobromide.

10. "Technology" for single-step pack cementation of solid airfoils is not controlled by Category 2.

11. Polymers, as follows: polyimide, polyester, polysulphide, polycarbonates and polyurethanes.

12. Modified zirconia refers to additions of other metal oxides (e.g., calcia, magnesia, yttria, hafnia, rare earth oxides) to zirconia in order to stabilise certain crystallographic phases and phase compositions. Thermal barrier coatings made of zirconia, modified with calcia or magnesia by mixing or fusion, are not controlled.

13. Titanium alloys refers to aerospace alloys having an ultimate tensile strength of 900 MPa or more measured at 293 K (20°C).

14. Low-expansion glasses refers to glasses which have a coefficient of thermal expansion of $1x10^{-7}K^{-1}$ or less measured at 293 K (20°C).

15. Dielectric layers are coatings constructed of multi-layers of insulator materials in which the interference properties of a design composed of materials of various refractive indices are used to reflect, transmit or absorb various wavelength bands. Dielectric layers refers to more than four dielectric layers or dielectric/metal "composite" layers.

16. Cemented tungsten carbide does not include cutting and forming tool materials consisting of tungsten carbide/(cobalt, nickle), titanium carbide/(cobalt, nickle), chromium carbide/nickle-chromium and chromium carbide/nickle.

TABLE – DEPOSITION TECHNIQUES – TECHNICAL NOTE

Processes specified in Column 1 of the Table are defined as follows:

a. Chemical Vapour Deposition (CVD) is an overlay coating or surface modification coating process wherein a metal, alloy, "composite", dielectric or ceramic is deposited upon a heated substrate. Gaseous reactants are decomposed or combined in the vicinity of a substrate resulting in the deposition of the desired elemental, alloy or compound material-on the substrate. Energy for this decomposition or chemical reaction process may be provided by the heat of the substrate, a glow discharge plasma, or "laser" irradiation.

N.B.1 CVD includes the following processes: directed gas flow out-of-pack deposition, pulsating CVD, controlled nucleation thermal decomposition (CNTD), plasma enhanced or plasma assisted CVD processes.

N.B.2 Pack denotes a substrate immersed in a powder mixture.

N.B.3 The gaseous reactants used in the out-of-pack process are produced using the same basic reactions and parameters as the pack cementation process, except that the substrate to be coated is not in contact with the powder mixture.

b. Thermal Evaporation-Physical Vapour Deposition (TE-PVD) is an overlay coating process conducted in a vacuum with a pressure less than O.1 Pa wherein a source of thermal energy is used to vaporize the coating material. This process results in the condensation, or deposition, of the evaporated species onto appropriately positioned substrates.

The addition of gases to the vacuum chamber during the coating process to synthesize compound coatings is an ordinary modification of the process.

The use of ion or electron beams, or plasma to activate or assist the coating's deposition is also a common modification in this technique. The use of monitors to provide in-process measurement of optical characteristics and thickness of coatings can be a feature of these processes.

Specific TE-PVD processes are as follows:

1. Electron Beam PVD uses an electron beam to heat and evaporate the material which forms the coating;
2. Resistive Heating PVD employs electrically resistive heating sources capable of producing a controlled and uniform flux of evaporated coating species;
3. "Laser" Evaporation uses either pulsed or continuous wave "laser" beams to heat the material which forms the coating;
4. Cathodic Arc Deposition employs a consumable cathode of the material which forms the coating and has an arc discharge established on the surface by a momentary contact of a ground trigger. Controlled motion of arcing erodes the cathode surface creating a highly ionized plasma. The anode can be either a cone attached to the periphery of the cathode, through an insulator, or the chamber. Substrate biasing is used for non line-of-sight deposition.
   N.B. This definition does not include random cathodic arc deposition with non-biased substrates.

c. Ion Plating is a special modification of a general TE-PVD process in which a plasma or an ion source is used to ionize the species to be deposited, and a negative bias is applied to the substrate in order to facilitate the extraction of the species to be deposited from the plasma. The introduction of reactive species, evaporation of solids within the process chamber, and the use of monitors to provide in-process measurement of optical characteristics and thicknesses of coatings are ordinary modifications of the process.

d. Pack Cementation is a surface modification coating or overlay coating process wherein a substrate is immersed in a powder mixture (a pack), that consists of:

1. The metallic powders that are to be deposited (usually aluminium, chromium, silicon or combinations thereof);
2. An activator (normally a halide salt); and
3. An inert powder, most frequently alumina.

The substrate and powder mixture is contained within a retort which is heated to between 1,030 K (757°C) and 1,375 K (1,102°C) for sufficient time to deposit the coating.

e. Plasma Spraying is an overlay coating process wherein a gun (spray torch) which produces and controls a plasma accepts powder or wire coating materials, melts them and propels them towards a substrate, whereon an integrally bonded coating is formed. Plasma spraying constitutes either low pressure plasma spraying or high velocity plasma spraying carried out under-water.

N.B.1 Low pressure means less than ambient atmospheric pressure.
N.B.2 High velocity refers to nozzle-exit gas velocity exceeding 750 mls calculated at 293 K (20°C) at 0.1 MPa.

f. Slurry Deposition is a surface modification coating or overlay coating process wherein a metallic or ceramic powder with an organic binder is suspended in a liquid and is applied to a substrate by either spraying, dipping or painting, subsequent air or oven drying, and heat treatment to obtain the desired coating.

g. Sputter Deposition is an overlay coating process based on a momentum transfer phenomenon, wherein positive ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on an appropriately positioned substrate.

N.B.1 The Table refers only to triode, magnetron or reactive sputter deposition which is used to increase adhesion of the coating and rate of deposition and to radio frequency (RF) augmented sputter deposition used to permit vapourisation of non-metallic coating materials.

N.B.2 Low-energy ion beams (less than 5 keV) can be used to activate the deposition.

h. Ion Implantation is a surface modification coating process in which the element to be alloyed is ionized, accelerated through a potential gradient and implanted into the surface region of the substrate. This includes processes in which ion implantation is performed simultaneously with electron beam physical vapour deposition or sputter deposition.

2E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 2B004, 2B104, 2B109, 2B116 or 2D101.

2E201 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 2A225, 2A226, 2B001, 2B006, 2B007.b., 2B007.c., 2B008, 2B009, 2B201, 2B204, 2B206, 2B207, 2B209, 2B225 to 2B232, 2D201 or 2D202.

2E301 "Technology" required for the "use" of goods specified in 2B350 to 2B352.

CATEGORY 3 – ELECTRONICS

3A Systems, Equipment and Components

Notes: 1. *The control status of equipment and components described in 3A001 or 3A002, other than those described in 3A001.a.3. to 3A001.a.10. or 3A001.a.12., which are specially designed for or which have the same functional characteristics as other equipment is determined by the control status of the other equipment.*

2. *The control status of integrated circuits described in 3A001.a.3. to 3A001.a.9. or 3A001.a.12. which are unalterably programmed or designed for a specific function for another equipment is determined by the control status of the other equipment.*

N.B.: When the manufacturer or applicant cannot determine the control status of the other equipment, the control status of the integrated circuits is determined in 3A001.a.3. to 3A001.a.9. and 3A001.a.12.
If the integrated circuit is a silicon-based "microcomputer microcircuit" or microcontroller microcircuit described in 3A001.a.3. having an operand (data) word length of 8 bit or less, the control status of the integrated circuit is determined in 3A001.a.3.

3A001 Electronic components, as follows:

a. General purpose integrated circuits, as follows:

Notes: 1. *The control status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 3A001.a.*

2. *Integrated circuits include the following types:*
"Monolithic integrated circuits";
"Hybrid integrated circuits";
"Multichip integrated circuits";
"Film type integrated circuits", including silicon-on-sapphire integrated circuits;
"Optical integrated circuits".

1. Integrated circuits, designed or rated as radiation hardened to withstand any of the following:
   a. A total dose of 5×10^3 Gy (Si) or higher; or
   b. A dose rate upset of 5×10^6 Gy (Si)/s or higher;

2. "Microprocessor microcircuits", "microcomputer microcircuits", microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analogue-to-digital converters, digital-to-analogue converters, electro-optical or "optical integrated circuits" designed for "signal processing", field programmable gate arrays, field programmable logic arrays, neural network integrated circuits, custom integrated circuits for which either the function is unknown or the control status of the equipment in which the integrated circuit will be used is unknown, Fast Fourier Transform (FFT) processors, electrical erasable programmable read-only memories (EEPROMs), flash memories or static random-access memories (SRAMs), having any of the following:
   a. Rated for operation at an ambient temperature above 398 K (125°C);
   b. Rated for operation at an ambient temperature below 218 K (-55°C); or
   c. Rated for operation over the entire ambient temperature range from 218 K (-55°C) to 398 K (125°C);

   Note: 3A001.a.2. does not apply to integrated circuits for civil automobiles or railway train applications.

3. "Microprocessor microcircuits", "micro-computer microcircuits" and microcontroller microcircuits, having any of the following characteristics:
   Note: 3A001.a.3. includes digital signal processors, digital array processors and digital coprocessors.

a. A "composite theoretical performance" ("CTP") of 260 million theoretical operations per second (Mtops) or more and an arithmetic logic unit with an access width of 32 bit or more;
b. Manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz; or
c. More than one data or instruction bus or serial communication port for external interconnection in a parallel processor with a transfer rate exceeding 2.5 Mbyte/s;

4. Storage integrated circuits manufactured from a compound semiconductor;

5. Analogue-to-digital and digital-to-analogue converter integrated circuits, as follows:
a. Analogue-to-digital converters having any of the following:
1. A resolution of 8 bit or more, but less than 12 bit, with a total conversion time to maximum resolution of less than 10 ns;
2. A resolution of 12 bit with a total conversion time to maximum resolution of less than 200 ns; or
3. A resolution of more than 12 bit with a total conversion time to maximum resolution of less than 2 μs;
b. Digital-to-analogue converters with a resolution of 12 bit or more, and a "settling time" of less than 10 ns;

6. Electro-optical and "optical integrated circuits" designed for "signal processing" having all of the following:
a. One or more than one internal "laser" diode;
b. One or more than one internal light detecting element; and
c. Optical waveguides;

7. Field programmable gate arrays having any of the following:
a. An equivalent usable gate count of more than 30,000 (2 input gates); or
b. A typical "basic gate propagation delay time" of less than 0.4 ns;

8. Field programmable logic arrays having any of the following:
a. An equivalent usable gate count of more than 30,000 (2 input gates); or
b. A toggle frequency exceeding 133 MHz;

9. Neural network integrated circuits;

10. Custom integrated circuits for which the function is unknown, or the control status of the equipment in which the integrated circuits will be used is unknown to the manufacturer, having any of the following:
a. More than 208 terminals;
b. A typical "basic gate propagation delay time" of less than 0.35 ns; or
c. An operating frequency exceeding 3 GHz;

11. Digital integrated circuits, other than those described in 3A001.a.3 to 3A001.a.10. and 3A001.a.12., based upon any compound semiconductor and having any of the following:
a. An equivalent gate count of more than 300 (2 input gates); or
b. A toggle frequency exceeding 1.2 GHz;

12. Fast Fourier Transform (FFT) processors having any of the following:
a. A rated execution time for a 1,024 point complex FFT of less than 1 ms;
b. A rated execution time for an N-point complex FFT of other than 1,024 points of less than $N \log_2 N$ /10,240 ms, where N is the number of points; or
c. A butterfly throughput of more than 5.12 MHz;

b. Microwave or millimetre wave components, as follows:
1. Electronic vacuum tubes and cathodes, as follows:
Note: *3A001.b.1. does not control tubes designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.*

a. Travelling wave tubes, pulsed or continuous wave, as follows:
   1. Operating at frequencies higher than 31 GHz;
   2. Having a cathode heater element with a turn on time to rated RF power of less than 3 seconds;
   3. Coupled cavity tubes, or derivatives thereof, with an "instantaneous bandwidth" of more than 7% or a peak power exceeding 2.5 kW;
   4. Helix tubes, or derivatives thereof, with any of the following characteristics:
      a. An "instantaneous bandwidth" of more than one octave, and average power (expressed in kW) times frequency (expressed in GHz) of more than 0.5;
      b. An "instantaneous bandwidth" of one octave or less, and average power (expressed in kW) times frequency (expressed in GHz) of more than 1; or
      c. Being"space qualified";
b. Crossed-field amplifier tubes with a gain of more than 17 dB;
c. Impregnated cathodes designed for electronic tubes, with any of the following:
   1. A turn on time to rated emission of less than 3 seconds; or
   2. Producing a continuous emission current density at rated operating conditions exceeding 5 A/cm^2;

2. Microwave integrated circuits or modules containing "monolithic integrated circuits" operating at frequencies exceeding 3 GHz;
   Note: 3A001.b.2. does not control circuits or modules for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.
3. Microwave transistors rated for operation at frequencies exceeding 31 GHz;
4. Microwave solid state amplifiers, having any of the following:
   a. Operating frequencies exceeding 10.5 GHz and an "instantaneous bandwidth" of more than half an octave; or
   b. Operating frequencies exceeding 31 GHz;
5. Electronically or magnetically tunable band-pass or band-stop filters having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band (f_{max}/f_{min}) in less than 10 µs having any of the following:
   a. A band-pass bandwidth of more than 0.5% of centre frequency; or
   b. A band-stop bandwidth of less than 0.5% of centre frequency;
6. Microwave assemblies capable of operating at frequencies exceeding 31 GHz;
7. Mixers and converters designed to extend the frequency range of equipment described in 3A002.c., 3A002.e. or 3A002.f. beyond the limits stated therein;
8. Microwave power amplifiers containing tubes specified in 3A001.b. and having all of the following:
   a. Operating frequencies above 3 GHz;
   b. An average output power density exceeding 80 W/kg; and
   c. A volume of less than 400 cm^3;
   Note: 3A001.b.8. does not control equipment designed or rated for operation in an ITU allocated band.

c. Acoustic wave devices, as follows, and specially designed components therefor:
   1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (i.e., "signal processing" devices employing elastic waves in materials), having any of the following:
      a. A carrier frequency exceeding 2.5 GHz;
      b. A carrier frequency exceeding 1 GHz, but not exceeding 2.5 GHz, and having any of the following:
         1. A frequency side-lobe rejection exceeding 55 dB;
         2. A product of the maximum delay time and the bandwidth (time in µs and bandwidth in MHz) of more than 100;
         3. A bandwidth greater than 250 MHz; or
         4. A dispersive delay of more than 10 µs; or

c. A carrier frequency of 1 GHz or less, having any of the following:
   1. A product of the maximum delay time and the bandwidth (time in μs and bandwidth in MHz) of more than 100;
   2. A dispersive delay of more than 10 μs; or
   3. A frequency side-lobe rejection exceeding 55 dB and a bandwidth greater than 50 MHz;

2. Bulk (volume) acoustic wave devices (i.e., "signal processing" devices employing elastic waves) which permit the direct processing of signals at frequencies exceeding 1 GHz;

3. Acoustic-optic "signal processing" devices employing interaction between acoustic waves (bulk wave or surface wave) and light waves which permit the direct processing of signals or images, including spectral analysis, correlation or convolution;

d. Electronic devices and circuits containing components, manufactured from "superconductive" materials specially designed for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents, with any of the following:

1. Electromagnetic amplification:
   a. At frequencies equal to or less than 31 GHz with a noise figure of less than 0.5 dB; or
   b. At frequencies exceeding 31 GHz;
2. Current switching for digital circuits using "superconductive" gates with a product of delay time per gate (in seconds) and power dissipation per gate (in watts) of less than 10^{-14} J; or
3. Frequency selection at all frequencies using resonant circuits with Q-values exceeding 10,000;

e. High energy devices, as follows:
1. Batteries and photovoltaic arrays, as follows:
   Note: 3A001.e.1. does not control batteries with volumes equal to or less than 27 cm^3 (e.g., standard C-cells or R14 batteries).
   a. Primary cells and batteries having an energy density exceeding 480 Wh/kg and rated for operation in the temperature range from below 243 K (-30°C) to above 343 K (70°C);
   b. Rechargeable cells and batteries having an energy density exceeding 150 Wh/kg after 75 charge/discharge cycles at a discharge current equal to C/5 hours (C being the nominal capacity in ampere hours) when operating in the temperature range from below 253 K (-20°C) to above 333 K (60°C);

   Technical Note:
   Energy density is obtained by multiplying the average power in watts (average voltage in volts times average current in amperes) by the duration of the discharge in hours to 75% of the open circuit voltage divided by the total mass of the cell (or battery) in kg.

   c. "Space qualified" and radiation hardened photovoltaic arrays with a specific power exceeding 160 W/m^2 at an operating temperature of 301 K (28°C) under a tungsten illumination of 1 kW/m^2 at 2,800 K (2,527°C);

2. High energy storage capacitors, as follows:
   N.B.: SEE ALSO 3A201.a.
   a. Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) having all of the following:
      1. A voltage rating equal to or more than 5 kV;
      2. An energy density equal to or more than 250 J/kg; and
      3. A total energy equal to or more 25 kJ;

   b. Capacitors with a repetition rate of 10 Hz or more (repetition rated capacitors) having all of the following:
      1. A voltage rating equal to or more than 5 kV;
      2. An energy density equal to or more than 50 J/kg;
      3. A total energy equal to or more than 100 J; and

4. A charge/discharge cycle life equal to or more than 10,000;

3. "Superconductive" electromagnets and solenoids specially designed to be fully charged or discharged in less than one second, having all of the following:
N.B.: SEE ALSO 3A201.b.
a. Energy delivered during the discharge exceeding 10 kJ in the first second;
b. Inner diameter of the current carrying windings of more than 250 mm; and
c. Rated for a magnetic induction of more than 8 T or "overall current density" in the winding of more than 300 A/mm^2;

Note: 3A001.e.3. does not control "superconductive" electromagnets or solenoids specially designed for Magnetic Resonance Imaging (MRI) medical equipment.

f. Rotary input type shaft absolute position encoders having any of the following:
1. A resolution of better than 1 part in 265,000 (18 bit resolution) of full scale; or
2. An accuracy better than ± 2.5 seconds of arc.

3A002 General purpose electronic equipment, as follows:

a. Recording equipment, as follows, and specially designed test tape therefor:
1. Analogue instrumentation magnetic tape recorders, including those permitting the recording of digital signals (e.g., using a high density digital recording (HDDR) module), having any of the following:
a. A bandwidth exceeding 4 MHz per electronic channel or track;
b. A bandwidth exceeding 2 MHz per electronic channel or track and having more than 42 tracks; or
c. A time displacement (base) error, measured in accordance with applicable IRIG or EIA documents, of less than ± 0.1 μs;

Note: Analogue magnetic tape recorders specially designed for civilian video purposes are not considered to be instrumentation tape recorders.

2. Digital video magnetic tape recorders having a maximum digital interface transfer rate exceeding 180 Mbit/s;
Note: 3A002.a.2. does not control digital video magnetic tape recorders specially designed for television recording using a signal format standardised or recommended by the CCIR or the IEC for civil television applications.
3. Digital instrumentation magnetic tape data recorders employing helical scan techniques or fixed head techniques, having any of the following:
a. A maximum digital interface transfer rate exceeding 175 Mbit/s; or
b. Being "space qualified".

Note: 3A002.a.3 does not control analogue magnetic tape recorders equipped with HDDR conversion electronics and configured to record only digital data.

4. Equipment, having a maximum digital interface transfer rate exceeding 175 Mbit/s, designed to convert digital video magnetic tape recorders for use as digital instrumentation data recorders;
5. Waveform digitisers and transient recorders having all of the following:
N.B.: SEE ALSO 3A202.
a. Digitising rates equal to or more than 200 million samples per second and a resolution of 10 bits or more; and
b. A continuous throughput of 2 Gbit/s or more;

Technical Note:
For those instruments with a parallel bus architecture, the continuous throughput rate is the highest word rate multiplied by the number of bits in a word.
Continuous throughput is the fastest data rate the instrument can output to mass storage without the loss of any information whilst sustaining the sampling rate and analogue-to-digital conversion.

b. "Frequency synthesiser" "electronic assemblies" having a "frequency switching time" from one selected frequency to another of less than 1 ms;

c. "Signal analysers", as follows:
   1. "Signal analysers" capable of analysing frequencies exceeding 31 GHz;
   2. "Dynamic signal analysers" having a "real-time bandwidth" exceeding 25.6 kHz;

      Note: *3A002.c.2. does not control those "dynamic signal analysers" using only constant percentage bandwidth filters.*

      Technical Note:

      Constant percentage bandwidth filters are also known as octave or fractional octave filters.

d. Frequency synthesised signal generators producing output frequencies, the accuracy and short term and long term stability of which are controlled, derived from or disciplined by the internal master frequency, and having any of the following:
   1. A maximum synthesised frequency exceeding 31 GHz;
   2. A "frequency switching time" from one selected frequency to another of less than 1 ms; or
   3. A single sideband (SSB) phase noise better than $-(126 + 20 \log_{10}F - 20 \log_{10}f)$ in dBc/Hz, where F is the off-set from the operating frequency in Hz and f is the operating frequency in MHz;

   Note: *3A002.d. does not control equipment in which the output frequency is either produced by the addition or subtraction of two or more crystal oscillator frequencies, or by an addition or subtraction followed by a multiplication of the result.*

e. Network analysers with a maximum operating frequency exceeding 40 GHz;

f. Microwave test receivers having all of the following:
   1. A maximum operating frequency exceeding 40 GHz; and
   2. Being capable of measuring amplitude and phase simultaneously;

g. Atomic frequency standards having any of the following:
   1. Long-term stability (aging) less (better) than 1×10^{-11}/month; or
   2. Being "space qualified".

   Note: *3A002.g.1. does not control non-"space qualified" rubidium standards.*

3A101 Electronic equipment, devices and components, other than those specified in 3A001, as follows:

a. Analog-to-digital converters, usable in "missiles", designed to meet military specifications for ruggedized equipment;

b. Accelerators capable of delivering electromagnetic radiation produced by bremsstrahlung from accelerated electrons of 2 Mev or greater, and systems containing those accelerators.

Note: *3A101.b. above does not specify equipment specially designed for medical purposes.*

3A201 Electronic components, other than those specified in 3A001, as follows;

a. Capacitors with the following characteristics:
   1. Voltage rating greater than 1.4 kV, energy storage greater than 10 J, capacitance greater than 0.5 µF and series inductance less than 50 nH; or
   2. Voltage rating greater than 750 V, capacitance greater than 0.25 µF and series inductance less than 10 nH;

b. Superconducting solenoidal electromagnets with all of the following characteristics:
   1. Capable of creating magnetic fields of more than 2 teslas (20 kilogauss);
   2. With an L/D ratio (length divided by inner diameter) greater than 2;
   3. With an inner diameter of more than 300 mm; and

4. With a magnetic field uniform to better than 1% over the central 50% of the inner volume;

Note: 3A201.b. does not specify magnets specially designed for and exported as parts of medical nuclear magnetic resonance (NMR) imaging systems. The phrase 'as part of' does not necessarily mean physical part in the same shipment; separate shipments from different sources are allowed, provided the related export documents clearly specify that the shipments are dispatched "as part of" the imaging systems.

c. Flash X-ray generators or pulsed electron accelerators with peak energy of 500 keV or greater, as follows;
except:
Accelerators that are component parts of devices designed for purposes other than electron beam or X-ray radiation (electron microscopy, for example) and those designed for medical purposes:

1. Having an accelerator peak electron energy of 500 keV or greater but less than 25 MeV and with a figure of merit (K) of 0.25 or greater, where K is defined as:

$$K = 1.7 \times 10^3 V^{2.65} Q,$$

where V is the peak electron energy in million electron volts and Q is the total accelerated charge in coulombs if the accelerator beam pulse duration is less than or equal to 1 microsecond; if the accelerator beam pulse duration is greater than 1 microsecond, Q is the maximum accelerated charge in 1 microsecond [Q equals the integral of i with respect to t, over the lesser of 1 microsecond or the time duration of the beam pulse (Q = [integral] idt), where i is beam current in amperes and t is time in seconds]; or

2. Having an accelerator peak electron energy of 25 MeV or greater and a peak power greater than 50 MW. [Peak power = (peak potential in volts) x (peak beam current in amperes)].

Technical Notes:
a. Time duration of the beam pulse - In machines, based on microwave accelerating cavities, the time duration of the beam pulse is the lesser of 1 microsecond or the duration of the bunched beam packet resulting from one microwave modulator pulse.
b. Peak beam current – In machines based on microwave accelerating cavities, the peak beam current is the average current in the time duration of a bunched beam packet.

3A225 Frequency changers (also known as converters or inverters) or generators, other than those specified in 0B001.c.11., having all of the following characteristics:

a. A multiphase output capable of providing a power of 40 W or more;

b. Capable of operating in the frequency range between 600 and 2000 Hz;

c. Total harmonic distortion below 10%; and

d. Frequency control better than 0.1%.

3A226 Direct current high-power supplies, other than those specified in 0B001.j.6., capable of continuously producing,over a time period of 8 hours, 100 V or greater with current output of 500 A or greater and with current or voltage regulation better than 0.1%.

3A227 High-voltage direct current power supplies, other than those specified in 0B001.j.5., capable of continuously producing, over a time period of 8 hours, 20,000 V or greater with current output of 1 A or greater and with current or voltage regulation better than 0.1%.

3A228 Switching devices, as follows:

a. Cold-cathode tubes (including gas krytron tubes and vacuum sprytron tubes), whether gas filled or not, operating similarly to a spark gap, containing three or more electrodes, and having all of the following characteristics:
   1. Anode peak voltage rating of 2,500 V or more;
   2. Anode peak current rating of 100 A or more; and
   3. Anode delay time of 10 μs or less;

b. Triggered spark-gaps having an anode delay time of 15 μs or less and rated for a peak current of 500 A or more;

c. Modules or assemblies with a fast switching function having all of the following characteristics:
   1. Anode peak voltage rating greater than 2,000 V;
   2. Anode peak current rating of 500 A or more; and
   3. Turn-on time of 1 μs or less.

3A229 Firing sets and equivalent high-current pulse generators (for controlled detonators), as follows:
N.B.: SEE ALSO MILITARY GOODS CONTROLS.

a. Explosive detonator firing sets designed to drive multiple controlled detonators specified in 3A232;

b. Modular electrical pulse generators (pulsers) designed for portable, mobile or ruggedized use (including xenon flash-lamp drivers) having all the following characteristics:
   1. Capable of delivering their energy in less than 15 μs;
   2. Having an output greater than 100 A;
   3. Having a rise time of less than 10 μs into loads of less than 40 ohms (rise time is the time interval from 10% to 90% current amplitude when driving a resistive load);
   4. Enclosed in a dust-tight enclosure;
   5. No dimension greater than 254 mm;
   6. Weight less than 25 kg; and
   7. Specified for use over an extended temperature range (223 K (-50°C) to 373 K (100°C)) or specified as suitable for aerospace use.

3A230 High-speed pulse generators with output voltages greater than 6 volts into a less than 55 ohm resistive load, and with pulse transition times less than 500 picoseconds.

Technical Note:
In 3A230, 'pulse transition time' is defined as the time interval between 10% and 90% voltage amplitude.

3A231 Neutron generator systems, including tubes, designed for operation without an external vacuum system and utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction.

3A232 Detonators and multipoint initiation systems, as follows:
N.B.: SEE ALSO MILITARY GOODS CONTROLS.

a. Electrically driven explosive detonators, the following:
   1. Exploding bridge (EB);
   2. Exploding bridge wire (EBW);
   3. Slapper;
   4. Exploding foil initiators (EFI);

b. Arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface (over greater than 5000 mm^2) from a single firing signal (with an initiation timing spread over the surface of less than 2.5 μs).

Note: 3A232 does not specify detonators using only primary explosives, such as lead azide.

Technical Note:
The detonators of concern all utilise a small electrical conductor (bridge, bridge wire or foil) that explosively vapourises when a fast, high-current electrical pulse is passed through it. In nonslapper types, the exploding conductor starts a chemical detonation in a contacting high-explosive material such as PETN (Pentaerythritoltetranitrate). In slapper detonators, the explosive vapourisation of the electrical conductor drives a flyer or slapper across a gap and the impact of the slapper on an explosive starts a chemical detonation. The slapper in some designs is driven by a magnetic force. The term exploding foil detonator may refer to either an EB or a slapper-type detonator. Also, the word initiator is sometimes used in place of the word detonator.

3A233 Mass spectrometers, other than those specified in 0B002.g., capable of measuring ions of 230 atomic mass units or greater and having a resolution of better than 2 parts in 230, as follows, and ion sources therefor:

a. Inductively coupled plasma mass spectrometers (ICP/MS);

b. Glow discharge mass spectrometers (GDMS);

c. Thermal ionization mass spectrometers (TIMS);

d. Electron bombardment mass spectrometers which have a source chamber constructed from, lined with or plated with materials resistant to UF_6;

e. Molecular beam mass spectrometers as follows:
   1. Which have a source chamber constructed from, lined with or plated with stainless steel or molybdenum and have a cold trap capable of cooling to 193 K (-80°C) or less; or
   2. Which have a source chamber constructed from, lined with or plated with materials resistant to UF_6; or

f. Mass spectrometers equipped with a microfluorination ion source designed for use with actinides or actinide fluorides.

3B Test, Inspection and Production Equipment

3B001 Equipment for the manufacturing of semiconductor devices or materials, as follows, and specially designed components and accessories therefor:

a. "Stored programme controlled" equipment designed for epitaxial growth, as follows:
   1. Equipment capable of producing a layer thickness uniform to less than ± 2.5% across a distance of 75 mm or more;
   2. Metal organic chemical vapour deposition (MOCVD) reactors specially designed for compound semiconductor crystal growth by the chemical reaction between materials specified in 3C003 or 3C004;
   3. Molecular beam epitaxial growth equipment using gas sources;

b. "Stored programme controlled" equipment designed for ion implantation, having any of the following:
   1. An accelerating voltage exceeding 200 keV;
   2. Being specially designed and optimised to operate at an accelerating voltage of less than 10 keV;
   3. Direct write capability; or
   4. Being capable of high energy oxygen implant into a heated semiconductor material "substrate";

c. "Stored programme controlled" anisotropic plasma dry etching equipment, as follows:
   1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
      a. Magnetic confinement; or
      b. Electron cyclotron resonance (ECR);

2. Equipment specially designed for equipment specified in 3B001.e. and having any of the following:
   a. Magnetic confinement; or
   b. ECR;

d. "Stored programme controlled" plasma enhanced CVD equipment, as follows:
   1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
      a. Magnetic confinement; or
      b. ECR;
   2. Equipment specially designed for equipment specified in 3B001.e. and having any of the following:
      a. Magnetic confinement; or
      b. ECR;

e. "Stored programme controlled" automatic loading multi-chamber central wafer handling systems, having all of the following:
   1. Interfaces for wafer input and output, to which more than two pieces of semiconductor processing equipment are to be connected; and
   2. Designed to form an integrated system in a vacuum environment for sequential multiple wafer processing;
      Note: *3B001.e. does not control automatic robotic wafer handling systems not designed to operate in a vacuum environment.*

f. "Stored programme controlled" lithography equipment, as follows:
   1. Align and expose step and repeat equipment for wafer processing using photo-optical or X-ray methods, having any of the following:
      a. A light source wavelength shorter than 400 nm; or
      b. Capable of producing a pattern with a minimum resolvable feature size of 0.7 μm or less;
      Note: *The minimum resolvable feature size is calculated by the following formula:*

$$MRF = \frac{(\text{an exposure light source wavelength in } \mu m) \times (\text{K factor})}{\text{numerical aperture}}$$

where the K factor = 0.7.
MRF = minimum resolvable feature size.

   2. Equipment specially designed for mask making or semiconductor device processing using deflected focussed electron beam, ion beam or "laser" beam, having any of the following:
      a. A spot size smaller than 0.2 μm;
      b. Being capable of producing a pattern with a feature size of less than 1 μm; or
      c. An overlay accuracy of better than ± 0.20 μm (3 sigma);

g. Masks and reticles designed for integrated circuits specified in 3A001;

h. Multi-layer masks with a phase shift layer.

3B002 "Stored programme controlled" test equipment, specially designed for testing finished or unfinished semiconductor devices, as follows, and specially designed components and accessories therefor:

a. For testing S-parameters of transistor devices at frequencies exceeding 31 GHz;
b. For testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than 60 MHz;
   Note: *3B002.b. does not control test equipment specially designed for testing:*
   1. *"electronic assemblies" or a class of "electronic assemblies" for home or entertainment applications;*
   2. *Uncontrolled electronic components, "electronic assemblies" or integrated circuits.*

c. For testing microwave integrated circuits at frequencies exceeding 3 GHz;
Note: 3B002.c. does not control test equipment specially designed for testing microwave integrated circuits for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.

d. Electron beam systems designed for operation at 3 keV or below, or "laser" beam systems, for the non-contactive probing of powered-up semiconductor devices, having all of the following:
1. Stroboscopic capability with either beam-blanking or detector strobing; and
2. An electron spectrometer for voltage measurement with a resolution of less than 0.5 V.
Note: 3B002.d. does not control scanning electron microscopes,
except:
When specially designed and instrumented for the non-contactive probing of powered-up semiconductor devices.

3C Materials

3C001 Hetero-epitaxial materials consisting of a "substrate" having stacked epitaxially grown multiple layers of any of the following:
a. Silicon;
b. Germanium; or
c. III/V compounds of gallium or indium.

Technical Note:
III/V compounds are polycrystalline or binary or complex monocrystalline products consisting of elements of groups IIIA and VA of Mendeleyev's periodic classification table (e.g., gallium arsenide, gallium-aluminium arsenide, indium phosphide).

3C002 Resist materials, as follows, and "substrates" coated with controlled resists:
a. Positive resists designed for semiconductor lithography specially adjusted (optimised) for use at wavelengths below 370 nm ;
b. All resists designed for use with electron beams or ion beams, with a sensitivity of 0.01 μcoulomb/mm^2 or better;
c. All resists designed for use with X-rays, with a sensitivity of 2.5 mJ/mm^2 or better;
d. All resists optimised for surface imaging technologies, including silylated resists.
Technical Note:
Silylation techniques are defined as processes incorporating oxidation of the resist surface to enhance performance for both wet and dry developing.

3C003 Organo-inorganic compounds, as follows:
a. Organo-metallic compounds of aluminium, gallium or indium having a purity (metal basis) better than 99.999%;
b. Organo-arsenic, organo-antimony and organo-phosphorus compounds having a purity (inorganic element basis) better than 99.999%.
Note: 3C003 only controls compounds whose metallic, partly metallic or non-metallic element is directly linked to carbon in the organic part of the molecule.

3C004 Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.
Note: 3C004 does not control hydrides containing 20% molar or more of inert gases or hydrogen.

3D Software

3D001 "Software" specially designed for the "development" or "production" of equipment specified in 3A001.b. to 3A002.g. or 3B.

3D002 "Software" specially designed for the "use" of "stored programme controlled" equipment specified in 3B.

3D003 Computer-aided-design (CAD) "software" designed for semiconductor devices or integrated circuits, having any of the following:

a. Design rules or circuit verification rules;

b. Simulation of the physically laid out circuits; or

c. Lithographic processing simulators for design.
Technical Note:
A lithographic processing simulator is a "software" package used in the design phase to define the sequence of lithographic, etching and deposition steps for translating masking patterns into specific topographical patterns in conductors, dielectrics or semiconductor material.

Note: 3D003 does not control "software" specially designed for schematic entry, logic simulation, placing and routing, layout verification or pattern generation tape.
N.B.: Libraries, design attributes or associated data for the design of semiconductor devices or integrated circuits are considered as "technology".

3D101 "Software" specially designed for the "use" of equipment specified in 3A101.b.

3E Technology

3E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials specified in 3A, 3B or 3C;
Note: 3E001 does not control "technology" for the "development" or "production" of:
a. Microwave transistors operating at frequencies below 31 GHz;
b. Integrated circuits specified in 3A001.a.3. to 3A001.a.12., having all of the following:
1. Using "technology" of 1 μm or more, and
2. Not incorporating multi-layer structures.
N.B.: The term multi-layer structures in Note b.2. to 3E001 does not include devices incorporating a maximum of two metal layers and two polysilicon layers.

3E002 Other "technology" for the "development" or "production" of:
a. Vacuum microelectronic devices;
b. Hetero-structure semiconductor devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well and super lattice devices;
c. "Superconductive" electronic devices;
d. Substrates of films of diamond for electronic components.

3E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 3A001.a.1. or 2., 3A101 or 3D101.

3E102 "Technology" according to the General Technology Note for the "development" of "software" specified in 3D101.

3E201 "Technology" according to the General Technology Note for the "use" of equipment specified in 3A001.e.2., 3A001.e.3., 3A201, 3A202, 3A225 to 3A233.

CATEGORY 4 – COMPUTERS

Notes: *1. Computers, related equipment and "software" performing telecommunications or "local area network" functions must also be evaluated against the performance characteristics of Category 5, Part 1 (Telecommunications).*

N.B. 1. Control units which directly interconnect the buses or channels of central processing units, "main storage" or disk controllers are not regarded as telecommunications equipment described in Category 5, Part 1 (Telecommunications).

2. For the control status of "software" specially designed for packet switching, see Category 5D001 (Telecommunications).

2. Computers, related equipment and "software" performing cryptographic, cryptanalytic, certifiable multi-level security or certifiable user isolation functions, or which limit electromagnetic compatibility (EMC), must also be evaluated against the performance characteristics in Category 5, Part 2 ("Information Security").

4A Systems, Equipment and Components

4A001 Electronic computers and related equipment, as follows, and "electronic assemblies" and specially designed components therefor:
N.B.: SEE ALSO 4A101.

a. Specially designed to have any of the following characteristics:
   1. Rated for operation at an ambient temperature below 228 K (-45°C) or above 358 K (85°C);
      Note: 4A001.a.1. does not apply to computers specially designed for civil automobile or railway train applications.

   2. Radiation hardened to exceed any of the following specifications:
      a. Total Dose $5x10^3$ Gy (Si);
      b. Dose Rate Upset $5x10^6$ Gy (Si)/sec; or
      c. Single Event Upset $1x10^{-7}$ Error/bit/day;

b. Having characteristics or performing functions exceeding the limits in Category 5, Part 2 ("Information Security").

4A002 "Hybrid computers", as follows, and "electronic assemblies" and specially designed components therefor:
N.B.: SEE ALSO 4A102.

a. Containing "digital computers" specified in 4A003;
b. Containing analogue-to-digital converters having all of the following characteristics:
   1. 32 channels or more; and
   2. A resolution of 14 bits (plus sign bit) or more with a conversion rate of 200,000 conversions/s or more.

4A003 "Digital computers", "electronic assemblies", and related equipment therefor, as follows, and specially designed components therefor:

Notes: 1. 4A003 includes the following:
a. Vector processors;
b. Array processors;
c. Digital signal processors;
d. Logic processors;
e. Equipment designed for "image enhancement";
f. Equipment designed for "signal processing".

2. The control status of the "digital computers" and related equipment described in 4A003 is determined by the control status of other equipment or systems provided:

a. The "digital computers" or related equipment are essential for the operation of the other equipment or systems;

b. The "digital computers" or related equipment are not a "principal element" of the other equipment or systems; and

N.B.: 1. The control status of "signal processing" or "image enhancement" equipment specially designed for other equipment with functions limited to those required for the other equipment is determined by the control status of the other equipment even if it exceeds the "principal element" criterion.

2. For the control status of "digital computers" or related equipment for telecommunications equipment, see Category 5, Part 1 (Telecommunications).

c. The "technology" for the "digital computers" and related equipment is determined by 4E.

a. Designed or modified for "fault tolerance";

Note: For the purposes of 4A003.a., "digital computers" and related equipment are not considered to be designed or modified for "fault tolerance" if they utilise any of the following:

1. Error detection or correction algorithms in "main storage";

2. The interconnection of two "digital computers" so that, if the active central processing unit fails, an idling but mirroring central processing unit can continue the system's functioning;

3. The interconnection of two central processing units by data channels or by use of shared storage to permit one central processing unit to perform other work until the second central processing unit fails, at which time the first central processing unit takes over in order to continue the system's functioning; or

4. The synchronisation of two central processing units by "software" so that one central processing unit recognises when the other central processing unit fails and recovers tasks from the failing unit.

b. "Digital computers" having a "composite theoretical performance" ("CTP") exceeding 2,000 million theoretical operations per second (Mtops);

c. "Electronic assemblies" specially designed or modified to be capable of enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4A003.b.;

Notes: 1. 4A003.c. applies only to "electronic assemblies" and programmable interconnections not exceeding the limit in 4A003.b. when shipped as unintegrated "electronic assemblies". It does not apply to "electronic assemblies" inherently limited by nature of their design for use as related equipment specified in 4A003.d., 4A003.e. or 4A003.f.

2. 4A003.c. does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit of 4A003.b.

d. Graphics accelerators and graphics coprocessors exceeding a "three dimensional Vector Rate" of 3,000,000;

e. Equipment performing analogue-to-digital conversions exceeding the limits in 3A001.a.5;

f. Equipment containing "terminal interface equipment" exceeding the limits in 5A001.b.3.;

Note: For the purposes of 4A003.f., "terminal interface equipment" includes "local area network" interfaces and other communications interfaces. "Local area network" interfaces are evaluated as "network access controllers".

g. Equipment specially designed to provide external interconnection of "digital computers" or associated equipment which allows communications at data rates exceeding 80 Mbyte/s.
Note: 4A003.g. does not control internal interconnection equipment (e.g., backplanes, buses) or passive interconnection equipment.

4A004 Computers, as follows, and specially designed related equipment, "electronic assemblies" and components therefor:
a. "Systolic array computers";
b. "Neural computers";
c. "Optical computers".

4A101 Analogue computers, "digital computers" or digital differential analysers, other than those specified in 4A001.a.1. which are ruggedized and designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104."

4A102 "Hybrid computers" specially designed for modelling, simulation or design integration of space launch vehicles specified in 9A004 or sounding rockets specified in 9A104."

Note: This control only applies when the equipment is supplied with software specified in 7D103 or 9D103.

4B Test, Inspection and Production Equipment

None.

4C Materials

None.

4D Software

Note: The control status of "software" for the "development", "production", or "use" of equipment described in other Categories is dealt with in the appropriate Category. The control status of "software" for equipment described in this Category is dealt with herein.

4D001 "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" specified in 4A001 to 4A004, or 4D.

4D002 "Software" specially designed or modified to support "technology" specified in 4E.

4D003 Specific "software", as follows:

a. Operating system "software", "software" development tools and compilers specially designed for "multi-data-stream processing" equipment, in "source code";

b. "Expert systems" or "software" for "expert system" inference engines providing both:
1. Time dependent rules; and
2. Primitives to handle the time characteristics of the rules and the facts;

c. "Software" having characteristics or performing functions exceeding the limits in Category 5, Part 2 ("Information Security");

d. Operating systems specially designed for "real time processing" equipment which guarantees a "global interrupt latency time" of less than 20μs.

4E Technology

4E001 "Technology" according to the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 4A or 4D.

TECHNICAL NOTE ON "COMPOSITE THEORETICAL PERFORMANCE" ("CTP")

Abbreviations used in this Technical Note

"CE"	"computing element" (typically an arithmetic logical unit)
FP	floating point
XP	fixed point
t	execution time
XOR	exclusive OR
CPU	central processing unit
TP	theoretical performance (of a single "CE")
"CTP"	"composite theoretical performance" (multiple "CEs")
R	effective calculating rate
WL	word length
L	word length adjustment
*	multiply

Execution time 't' is expressed in microseconds, TP and "CTP" are expressed in millions of theoretical operations per second (Mtops) and WL is expressed in bits.

Outline of "CTP" calculation method

"CTP" is a measure of computational performance given in Mtops. In calculating the "CTP" of an aggregation of "CEs" the following three steps are required:

1. Calculate the effective calculating rate R for each "CE";
2. Apply the word length adjustment (L) to the effective calculating rate (R), resulting in a Theoretical Performance (TP) for each "CE";
3. If there is more than one "CE", combine the TPs, resulting in a "CTP" for the aggregation.

Details for these steps are given in the following sections.

Note 1 For aggregations of multiple "CEs" which have both shared and unshared memory subsystems, the calculation of "CTP" is completed hierarchically, in two steps: first, aggregate the groups of "CEs" sharing memory; second, calculate the "CTP" of the groups using the calculation method for multiple "CEs" not sharing memory.

Note 2 "CEs" that are limited to input/output and peripheral functions (e.g., disk drive, communication and video display controllers) are not aggregated into the "CTP" calculation.

TECHNICAL NOTE ON "CTP"

The following table shows the method of calculating the Effective Calculating Rate R for each "CE":

Step 1: The effective calculating rate R

For "CEs" Implementing: Note Every "CE" must be evaluated independently.	Effective calculating Rate, R
XP only (R_{xp})	$\frac{1}{3*(t_{xp\ add})}$ if no add is implemented use: $\frac{1}{(t_{xp\ mult})}$ If neither add nor multiply is implemented use the fastest available arithmetic operation as follows: $\frac{1}{3*t_{xp}}$ See Notes X & Z
FP only (R_{fp})	$\max \frac{1}{t_{fp}\ add}, \frac{1}{t_{fp}\ mult}$ See Notes X & Y
Both FP and XP (R)	Calculate both R_{xp}, R_{fp}

For simple logic processors not implementing any of the specified arithmetic operations.	$\frac{1}{3^* t_{log}}$ Where t_{log} is the execute time of the XOR, or for logic hardware not implementing the XOR, the fastest simple logic operation. See Notes X & Z
For special logic processors not using any of the specified arithmetic or logic operations.	R = R' * WL/64 Where R' is the number of results per second, WL is the number of bits upon which the logic operation occurs, and 64 is a factor to normalize to a 64 bit operation.

TECHNICAL NOTE ON "CTP"

Note W For a pipelined "CE" capable of executing up to one arithmetic or logic operation every clock cycle after the pipeline is full, a pipelined rate can be established. The effective calculating rate (R) for such a "CE" is the faster of the pipelined rate or non-pipelined execution rate.

Note X For a "CE" which performs multiple operations of a specific type in a single cycle (e.g., two additions per cycle or two identical logic operations per cycle), the execution time t is given by:

$$t = \frac{\text{cycle time}}{\text{the number of identical operations per machine cycle}}$$

"CEs" which perform different types of arithmetic or logic operations in a single machine cycle are to be treated as multiple separate "CEs" performing simultaneously (e.g., a "CE" performing an addition and a multiplication in one cycle is to be treated as two "CEs", the first performing an addition in one cycle and the second performing a multiplication in one cycle).
If a single "CE" has both scalar function and vector function, use the shorter execution time value.

Note Y For the "CE" that does not implement FP add or FP multiply, but that performs FP divide:

$$R_{fp} = \frac{1}{t_{fpdivide}}$$

If the "CE" implements FP reciprocal but not FP add, FP multiply or FP divide, then

$$R_{fp} = \frac{1}{t_{fpreciprocal}}$$

If none of the specified instructions is implemented, the effective FP rate is 0.

Note Z In simple logic operations, a single instruction performs a single logic manipulation of no more than two operands of given lengths.
In complex logic operations, a single instruction performs multiple logic manipulations to produce one or more results from two or more operands.

TECHNICAL NOTE ON "CTP"

Rates should be calculated for all supported operand lengths considering both pipelined operations (if supported), and non-pipelined operations using the fastest executing instruction for each operand length based on:

1. Pipelined or register-to-register operations. Exclude extraordinarily short execution times generated for operations on a predetermined operand or operands (for example, multiplication by 0 or 1). If no register-to-register operations are implemented, continue with (2).
2. The faster of register-to-memory or memory-to-register operations; if these also do not exist, then continue with (3).
3. Memory-to-memory.

In each case above, use the shortest execution time certified by the manufacturer.

Step 2: TP for each supported operand length WL

Adjust the effective rate R (or R') by the word length adjustment L as follows:

$$TP = R * L,$$
$$\text{where } L = (1/3 + WL/96)$$

Note: The word length WL used in these calculations is the operand length in bits. (If an operation uses operands of different lengths, select the largest word length.)

The combination of a mantissa ALU and an exponent ALU of a floating point processor or unit is considered to be one "CE" with a Word Length (WL) equal to the number of bits in the data representation (typically 32 or 64) for purposes of the "CTP" calculation.

This adjustment is not applied to specialized logic processors which do not use XOR instructions. In this case TP = R.

Select the maximum resulting value of TP for:

Each XP-only "CE" (R_{xp});
Each FP-only "CE" (R_{fp});
Each combined FP and XP "CE" (R);
Each simple logic processor not implementing any of the specified arithmetic operations; and
Each special logic processor not using any of the specified arithmetic or logic operations.

TECHNICAL NOTE ON "CTP"

Step 3: "CTP" for aggregations of "CEs", including CPUs

For a CPU with a single "CE",
"CTP" = TP
(for "CEs" performing both fixed and floating point operations
$TP = \max (TP_{fp}, TP_{xp})$

"CTP" for aggregations of multiple "CEs" operating simultaneously is calculated as follows:

Note 1 For aggregations that do not allow all of the "CEs" to run simultaneously, the possible combination of "CEs" that provides the largest "CTP" should be used. The TP of each contributing "CE" is to be calculated at its maximum value theoretically possible before the "CTP" of the combination is derived.

N.B. To determine the possible combinations of simultaneously operating "CEs", generate an instruction sequence that initiates operations in multiple "CEs", beginning with the slowest "CE" (the one needing the largest number of cycles to complete its operation) and ending with the fastest "CE". At each cycle of the sequence, the combination of "CEs" that are in operation during that cycle is a possible combination. The instruction sequence must take into account all hardware and/or architectural constraints on overlapping operations.

Note 2 A single integrated circuit chip or board assembly may contain multiple "CEs".

Note 3 Simultaneous operations are assumed to exist when the computer manufacturer claims concurrent, parallel or simultaneous operation or execution in a manual or brochure for the computer.

Note 4 "CTP" values are not to be aggregated for "CE" combinations (inter)connected by "Local Area Networks", Wide Area Networks, I/O shared connections/devices, I/O controllers and any communication interconnection implemented by software.

TECHNICAL NOTE ON "CTP"

Note 5 "CTP" values must be aggregated for multiple "CEs" specially designed to enhance performance by aggregation, operating simultaneously and sharing memory,- or multiple memory/"CE"- combinations operating simultaneously utilising specially designed hardware.

This aggregation does not apply to "electronic assemblies" described by 4A003.d.

$$\text{"CTP"} = TP_1 + C_2 * TP_2 + \ldots + C_n * TP_n,$$

where the TPs are ordered by value, with TP_1 being the highest, TP_2 being the second highest, ..., and TP_n being the lowest. C_i is a coefficient determined by the strength of the interconnection between "CEs", as follows:

For multiple "CEs" operating simultaneously and sharing memory:

$$C_2 = C_3 = C_4 = \ldots = C_n = 0.75$$

Note 1 When the "CTP" calculated by the above method does not exceed 194Mtops, the following formula may be used to calculate C_i:

$$C_i \quad \frac{0.75}{\sqrt{m}} \qquad (i = 2,\ldots,n)$$

where m = the number of "CEs" or groups of "CEs" sharing access.

provided:

1. The TP_i of each "CE" or group of "CEs" does not exceed 30Mtops;
2. The "CEs" or groups of "CEs" share access to main memory (excluding cache memory) over a single channel; and
3. Only one "CE" or group of "CEs" can have use of the channel at any given time.

N.B. This does not apply to items controlled under Category 3.

Note 2 "CEs" share memory if they access a common segment of solid state memory. This memory may include cache memory, main memory or other internal memory. Peripheral memory devices such as disk drives, tape drives or RAM disks are not included.

TECHNICAL NOTE ON "CTP"

For Multiple "CEs" or groups of "CEs" not sharing memory, interconnected by one or more data channels:

CS_i = $0.75 * k_i$ (i = 2, ... , 32) (see Note below)
= $0.60 * k_i$ (i = 33, ... , 64)
= $0.45 * k_i$ (i = 65, ... , 256)
= $0.30 * k_i$ (i > 256)

The value of C_i is based on the number of "CE"s, not the number of nodes.

where k_i = min (S_i/K_r, 1), and
K_r = normalizing factor of 20 MByte/s.
S_i = sum of the maximum data rates (in units of MByte/s) for all data channels connected to the i^{th} "CE" or group of "CEs" sharing memory.

When calculating a C_i for a group of "CEs", the number of the first "CE" in a group determines the proper limit for C_i. For example, in an aggregation of groups consisting of 3 "CEs" each, the 22nd group will contain "CE"$_{64}$, "CE"$_{65}$ and "CE"$_{66}$. The proper limit for C_i for this group is 0.60.

Aggregation (of "CEs" or groups of "CEs") should be from the fastest-to-slowest; i.e.:
$TP_1 \geq TP_2 \geq .... \geq TP_n$, and
in the case of $TP_i = TP_{i+1}$, from the largest to smallest; i.e.:
$C_i \geq C_{i+1}$

Note The k_i factor is not to be applied to "CEs" 2 to 12 if the TP_i of the "CE" or group of "CEs" is more than 50 Mtops; i.e., C_i for "CEs" 2 to 12 is 0.75.

CATEGORY 5 - TELECOMMUNICATIONS AND "INFORMATION SECURITY"

Part 1 - TELECOMMUNICATIONS

Notes: 1. *The control status of components, "lasers", test and "production" equipment, materials and "software" therefor which are specially designed for telecommunications equipment or systems is determined in Category 5, Part 1.*

2. *"Digital computers", related equipment or "software", when essential for the operation and support of telecommunications equipment described in this Category, are regarded as specially designed components, provided they are the standard models customarily supplied by the manufacturer. This includes operation, administration, maintenance, engineering or billing computer systems.*

5A1 Systems, Equipment and Components

5A001 a. Any type of telecommunications equipment having any of the following characteristics, functions or features:

1. Specially designed to withstand transitory electronic effects or electromagnetic pulse effects, both arising from a nuclear explosion;
2. Specially hardened to withstand gamma, neutron or ion radiation; or
3. Specially designed to operate outside the temperature range from 218 K (-55°C) to 397 K (124°C).
   Note: 5A001.a.3. applies only to electronic equipment.

Note: 5A001.a.2. and 5A001.a.3. do not apply to equipment on board satellites.

b. Telecommunication transmission equipment and systems, and specially designed components and accessories therefor, having any of the following characteristics, functions or features:

Note: Telecommunication transmission equipment:

a. Categorised as follows, or combinations thereof:
   1. Radio equipment (e.g., transmitters, receivers and transceivers);
   2. Line terminating equipment;
   3. Intermediate amplifier equipment;
   4. Repeater equipment;
   5. Regenerator equipment;
   6. Translation encoders (transcoders);
   7. Multiplex equipment (statistical mutiplex included);
   8. Modulators/demodulators (modems);
   9. Transmultiplex equipment (see CCITT Rec. G701);
   10. "Stored programme controlled" digital crossconnection equipment;
   11. "Gateways" and bridges;
   12. "Media access units"; and

b. Designed for use in single or multi-channel communication via any of the following:
   1. Wire (line);
   2. Coaxial cable;
   3. Optical fibre cable;
   4. Electromagnetic radiation; or
   5. Underwater acoustic wave propagation.

1. Employing digital techniques, including digital processing of analogue signals, and designed to operate at a "digital transfer rate" at the highest multiplex level exceeding 45 Mbit/s or a "total digital transfer rate" exceeding 90 Mbit/s;

Note: 5A001.b.1. does not control equipment specially designed to be integrated and operated in any satellite system for civil use.

2. Being underwater communications systems having any of the following characteristics:
   a. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;
   b. Using an electromagnetic carrier frequency below 30 kHz; or
   c. Using electronic beam steering techniques;

3. Being equipment containing any of the following:
   a. "Network access controllers" and their related common medium having a "digital transfer rate" exceeding 156 Mbit/s; or
   b. "Communication channel controllers" with a digital output having a "data signalling rate" exceeding 2.1 Mbit/s per channel;

   Note: If any uncontrolled equipment contains a "network access controller", it cannot have any type of telecommunications interface;

   except:

   Those described in, but not specified in 5A001.b.3.

4. Employing a "laser" and having any of the following characteristics:
   a. A transmission wavelength exceeding 1,000 nm;
   b. Employing analogue techniques and having a bandwidth exceeding 45 MHz;
      Note: 5A001.b.4.b. does not control commercial TV systems.
   c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);
   d. Employing wavelength division multiplexing techniques; or
   e. Performing "optical amplification";

5. Being radio equipment operating at input or output frequencies exceeding 31 GHz;

   Note: 5A001.b.5. does not specify equipment designed or modified for operation in any ITU allocated band.

6. Being radio equipment employing any of the following:
   a. Quadrature-amplitude-modulation (QAM) techniques above level 4 if the "total digital transfer rate" exceeds 8.5 Mbit/s;
   b. QAM techniques above level 16 if the "total digital transfer rate" is equal to or less than 8.5 Mbit/s; or
   c. Other digital modulation techniques and having a "spectral efficiency" exceeding 3 bit/sec/Hz;

   Notes: 1. 5A001.b.6. does not control equipment specially designed to be integrated and operated in any satellite system for civil use.

   2. 5A001.b.6. does not control radio relay equipment for operation in an ITU allocated band:

   a. 1. Not exceeding 960 MHz; or

   2. With a "total digital transfer rate" not exceeding 8.5 Mbit/s; and

   b. Having a "spectral efficiency" not exceeding 4 bit/sec/Hz.

7. Being radio equipment operating in the 1.5 MHz to 87.5 MHz band and having any of the following characteristics:
   a. Incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; or
   b. Having all of the following:
      1. Automatically predicting and selecting frequencies and "total digital transfer rates" per channel to optimise the transmission; and

2. Incorporating a linear power amplifier configuration having a capability to support multiple signals simultaneously at an output power of 1 kW or more in the 1.5 MHz to 30 MHz frequency range or 250 W or more in the 30 MHz to 87.5 MHz frequency range, over an "instantaneous bandwidth" of one octave or more and with an output harmonic and distortion content of better than -80 dB;

8. Being radio equipment employing "spread spectrum" or "frequency agility" (frequency hopping) techniques having any of the following characteristics:
   a. User programmable spreading codes; or
   b. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz;
      Note: 5A001.b.8.b. does not control cellular radio equipment operating in civil bands.

   Note: 5A001.b.8. does not control equipment operating at an output power of 1.0 Watt or less.

9. Being digitally controlled radio receivers having all of the following:
   a. More than 1,000 channels;
   b. A "frequency switching time" of less than 1 ms;
   c. Automatic searching or scanning of a part of the electromagnetic spectrum; and
   d. Identification of the received signals or the type of transmitter; or

   Note: 5A001.b.9. does not control cellular radio equipment operating in civil bands.

10. Employing functions of digital "signal processing" to provide voice coding at rates of less than 2,400 bit/s.

c. "Stored programme controlled" switching equipment and related signalling systems, having any of the following characteristics, functions or features, and specially designed components and accessories therefor:
   Note: Statistical multiplexers with digital input and digital output which provide switching are treated as "stored programme controlled" switches.

   1. "Common channel signalling" operating in either non-associated or quasi- associated mode of operation;

   2. "Dynamic adaptive routing";
      Note: 5A001.c.2. does not control packet switches or routers with ports or lines not exceeding the limits in 5A001.c.3.

   3. Being packet switches, circuit switches and routers with ports or lines exceeding any of the following:
      a. A "data signalling rate" of 2.1 Mbit/s per channel for a "communications channel controller"; or
         Note: 5A001.c.3.a. does not control multiplexed composite links composed only of communication channels not individually controlled by 5A001.c.3.a.

      b. A "digital transfer rate" of 156 Mbit/s for a "network access controller" and related common medium;
   4. "Optical switching";
   5. Employing "Asynchronous Transfer Mode" ("ATM") techniques.

d. Optical fibre communication cables, optical fibres and accessories, as follows:
   1. Optical fibres and optical fibre cables of more than 50 m in length having any of the following characteristics:
      a. Designed for single mode operation; or
      b. For optical fibres, specified by the manufacturer as being capable of withstanding a proof test tensile stress of 2×10^9 N/m^2 or more;

Technical Note:
Proof Test: on-line or off-line production screen testing that dynamically applies a prescribed tensile stress over a 0.5 to 3 m length of fibre at a running rate of 2 to 5 m/s while passing between capstans approximately 150 mm in diameter. The ambient temperature is a nominal 293 K (20°C) and relative humidity 40%.
N.B.: Equivalent national standards may be used for executing the proof test.

2. Optical fibre cables and accessories designed for underwater use.
Note: 5A001.d.2. does not control standard civil telecommunication cables and accessories.

N.B.: For fibre-optic hull penetrators or connectors, see 8A002.c.

e. "Electronically steerable phased array antennae" operating above 31 GHz.
Note: 5A001.e. does not control "electronically steerable phased array antennae" for landing systems with instruments meeting ICAO standards covering microwave landing systems (MLS).

5A101 Telemetering and telecontrol equipment usable for "missiles".

Note: 5A101 does not control equipment specially designed to be used for remote control of model planes, boats or vehicles and having an electric field strength of not more than 200 microvolts per metre at a distance of 500 metres.

5B1 Test, Inspection and Production Equipment

5B001 Equipment and specially designed components or accessories therefor, specially designed for the "development", "production" or "use" of equipment, materials, functions or features specified in 5A001, 5B001, 5C001, 5D001 or 5E001.
Note: 5B001 does not control optical fibres and "optical fibre preform" characterization equipment not using semiconductor "lasers".

5C1 Materials

5C001 Preforms of glass or of any other material optimised for the manufacture of optical fibres specified in 5A001.d.

5D1 Software

5D001 a. "Software" specially designed or modified for the "development", "production" or "use" of equipment, functions or features specified in 5A001, 5B001 or 5C001.

b. "Software" specially designed or modified to support "technology" specified in 5E001.

c. Specific "software" as follows:

1. "Software", other than in machine-executable form, specially designed or modified for the "use" of digital cellular radio equipment or systems;

2. "Software" specially designed or modified to provide characteristics, functions or features of equipment specified in 5A001 or 5B001;

3. "Software" which provides the capability of recovering "source code" of telecommunications "software" specified in 5A001 or 5B001;

4. "Software", other than in machine-executable form, specially designed for "dynamic adaptive routing".

N.B.: For "software" for "signal processing" see also 4D and 6D.

5E1 Technology

5E001 a. "Technology" according to the General Technology Note for the "development", "production" or "use" (excluding operation) of equipment, functions or features, materials or "software" specified in 5A001, 5B001, 5C001 or 5D001.

b. Specific "technologies", as follows:

1. "Required" "technology" for the "development" or "production" of telecommunications equipment specially designed to be used on board satellites;
2. "Technology" for the "development" or "use" of "laser" communication techniques with the capability of automatically acquiring and tracking signals and maintaining communications through exoatmosphere or sub-surface (water) media;
3. "Technology" for the processing and application of coatings to optical fibre specially designed to make it suitable for underwater use;
4. "Technology" for the "development" of equipment employing "Synchronous Digital Hierarchy" ("SDH") or "Synchronous Optical Network" ("SONET") techniques;
5. "Technology" for the "development" of "switch fabric" exceeding 64,000 bit/s per information channel other than for digital cross connect integrated in the switch;
6. "Technology" for the "development" of centralized network control or "dynamic adaptive routing";
7. "Technology" for the "development" of digital cellular radio systems;
8. "Technology" for the "development" of broadband "Integrated Services Digital Network" ("ISDN");
9. "Technology" for the "development" of QAM techniques, for radio equipment, above level 4;
10. "Technology" for the "development" of "spread spectrum" or "frequency agility" (frequency hopping) techniques.

5E101 "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment specified in 5A101.

Part 2 - "INFORMATION SECURITY"

Note: The control status of "information security" equipment, "software", systems, application specific "electronic assemblies", modules, integrated circuits, components or functions is determined in Category 5, Part 2 even if they are components or "electronic assemblies" of other equipment.

5A2 Systems, Equipment and Components

5A002 a. Systems, equipment, application specific "electronic assemblies", modules and integrated circuits for "information security", as follows, and other specially designed components therefor:

N.B: For the control of global navigation satellite systems receiving equipment containing or employing decryption (i.e. GPS or GLONASS), see 7A005.

1. Designed or modified to use "cryptography" employing digital techniques to ensure "information security";

2. Designed or modified to perform cryptanalytic functions;

3. Designed or modified to use "cryptography" employing analogue techniques to ensure "information security";

Note: 5A002.a.3. does not control the following:

1. *Equipment using "fixed" band scrambling not exceeding 8 bands and in which the transpositions change not more frequently than once every second;*
2. *Equipment using "fixed" band scrambling exceeding 8 bands and in which the transpositions change not more frequently than once every ten seconds;*
3. *Equipment using "fixed" frequency inversion and in which the transpositions change not more frequently than once every second;*
4. *Facsimile equipment;*
5. *Restricted audience broadcast equipment;*
6. *Civil television equipment.*

4. Designed or modified to suppress the compromising emanations of information-bearing signals;

   Note: 5A002.a.4. does not control equipment specially designed to suppress emanations for reasons of health and safety.

5. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" or the hopping code for "frequency agility" systems;

6. Designed or modified to provide certified or certifiable "multilevel security" or user isolation at a level exceeding Class B2 of the Trusted Computer System Evaluation Criteria (TCSEC) or equivalent;

7. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion.

Note: 5A002 does not control:

a. "Personalized smart cards" or specially designed components therefor, with any of the following characteristics:
   1. *Not capable of message traffic encryption or encryption of user-supplied data or related key management functions therefor; or*
   2. *When restricted for use in equipment or systems excluded from control under entries 1. to 6. of the Note to 5A002.a.3. or under entries b. to h. of this Note;*

b. Equipment containing "fixed" data compression or coding techniques;

c. Receiving equipment for radio broadcast, pay television or similar restricted audience television of the consumer type, without digital encryption and where digital decryption is limited to the video, audio or management functions;

d. Portable or mobile radiotelephones for civil use (e.g., for use with commercial civil cellular radiocommunications systems) that are not capable of end-to-end encryption;

e. Decryption functions specially designed to allow the execution of copy-protected "software", provided the decryption functions are not user-accessible;

f. Access control equipment, such as automatic teller machines, self-service statement printers or point of sale terminals, which protects password or personal identification numbers (PIN) or similar data to prevent unauthorized access to facilities but does not allow for encryption of files or text, except as directly related to the password or PIN protection;

g. Data authentication equipment which calculates a Message Authentication Code (MAC) or similar result to ensure no alteration of text has taken place, or to authenticate users, but does not allow for encryption of data, text or other media other than that needed for the authentication;

h. Cryptographic equipment specially designed and limited for use in machines for banking or money transactions, such as automatic teller machines, self-service statement printers or point of sale terminals.

5B2 Test, Inspection and Production Equipment

5B002 a. Equipment specially designed for:

1. The "development" of equipment or functions specified in 5A002, 5B002, 5D002 or 5E002, including measuring or test equipment;
2. The "production" of equipment or functions specified in 5A002, 5B002, 5D002 or 5E002, including measuring, test, repair or production equipment.

b. Measuring equipment specially designed to evaluate and validate the "information security" functions specified in 5A002 or 5D002.

5C2 Materials

None.

5D2 Software

5D002 a. "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" specified in 5A002, 5B002, or 5D002;

b. "Software" specially designed or modified to support "technology" specified in 5E002;

c. Specific "software", as follows:
1. "Software" having the characteristics, or performing or simulating the functions of the equipment specified in 5A002 or 5B002;
2. "Software" to certify "software" specified in 5D002.c.1.

Note: 5D002 does not control:
a. "Software" required for the "use" of equipment excluded from control under the Note to 5A002;
b. "Software" providing any of the functions of equipment excluded from control under the Note to 5A002.

5E2 Technology

5E002 "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment or "software" specified in 5A002, 5B002 or 5D002.

CATEGORY 6 - SENSORS AND LASERS

6A Systems, Equipment and Components

6A001 Acoustics:

a. Marine acoustic systems, equipment and specially designed components therefor, as follows:
1. Active (transmitting or transmitting-and-receiving) systems, equipment and specially designed components therefor, as follows:

Note: 6A001.a.1. does not control:
a. Depth sounders operating vertically below the apparatus, not including a scanning function exceeding ± 20° and limited to measuring the depth of water, the distance of submerged or buried objects or fish finding;
b. Acoustic beacons, as follows:
1. Acoustic emergency beacons;
2. Pingers specially designed for relocating or returning to an underwater position.

a. Wide-swath bathymetric survey systems designed for sea bed topographic mapping, having all of the following:
1. Being designed to take measurements at an angle exceeding 20° from the vertical;
2. Being designed to measure depths exceeding 600 m below the water surface; and
3. Being designed to provide any of the following:
a. Incorporation of multiple beams any of which is less than 1.9°; or
b. Data accuracies of better than 0.3% of water depth across the swath averaged over the individual measurements within the swath;

b. Object detection or location systems having any of the following:
1. A transmitting frequency below 10 kHz;
2. Sound pressure level exceeding 224 dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band from 10 kHz to 24 kHz inclusive;
3. Sound pressure level exceeding 235 dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band between 24 kHz and 30 kHz;
4. Forming beams of less than 1° on any axis and having an operating frequency of less than 100 kHz;
5. Designed to operate with an unambiguous display range exceeding 5,120 m; or
6. Designed to withstand pressure during normal operation at depths exceeding 1,000 m and having transducers with any of the following:
a. Dynamic compensation for pressure; or
b. Incorporating other than lead zirconate titanate as the transduction element;

c. Acoustic projectors, including transducers, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination, having any of the following:

Notes: 1. The control status of acoustic projectors, including transducers, specially designed for other equipment is determined by the control status of the other equipment.
2. 6A001.a.1.c. does not control electronic sources which direct the sound vertically only, or mechanical (e.g., air gun or vapour-shock gun) or chemical (e.g., explosive) sources.

1. An instantaneous radiated acoustic power density exceeding 0.01 mW/mm²/Hz for devices operating at frequencies below 10 kHz;
2. A continuously radiated acoustic power density exceeding 0.001 mW/mm²/Hz for devices operating at frequencies below 10 kHz;

Technical Note:
Acoustic power density is obtained by dividing the output acoustic power by the product of the area of the radiating surface and the frequency of operation.

3. Designed to withstand pressure during normal operation at depths exceeding 1,000 m; or
4. Side-lobe suppression exceeding 22 dB;

d. Acoustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles having any of the following:

Note: 6A001.a.1.d. includes:

a. Equipment using coherent "signal processing" between two or more beacons and the hydrophone unit carried by the surface vessel or underwater vehicle;

b. Equipment capable of automatically correcting speed-of-sound propagation errors for calculation of a point.

1. Designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m; or
2. Designed to withstand pressure at depths exceeding 1,000 m;

2. Passive (receiving, whether or not related in normal application to separate active equipment) systems, equipment and specially designed components therefor, as follows:

a. Hydrophones (transducers) having any of the following characteristics:

1. Incorporating continuous flexible sensors or assemblies of discrete sensor elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;
2. Having any of the following sensing elements:
   a. Optical fibres;
   b. Piezoelectric polymers; or
   c. Flexible piezoelectric ceramic materials;
3. A hydrophone sensitivity better than -180 dB at any depth with no acceleration compensation;
4. When designed to operate at depths not exceeding 35 m, a hydrophone sensitivity better than - 186 dB with acceleration compensation;
5. When designed for normal operation at depths exceeding 35 m, a hydrophone sensitivity better than -192 dB with acceleration compensation;
6. When designed for normal operation at depths exceeding 100 m, a hydrophone sensitivity better than -204 dB; or
7. Designed for operation at depths exceeding 1,000 m;

Technical Note:

Hydrophone sensitivity is defined as twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydrophone sensor, without a pre-amplifier, is placed in a plane wave acoustic field with an rms pressure of 1 μPa. For example, a hydrophone of -160 dB (reference 1 V per μPa) would yield an output voltage of 10^{-8} V in such a field, while one of -180 dB sensitivity would yield only 10^{-9} V output. Thus, -160 dB is better than -180 dB.

b. Towed acoustic hydrophone arrays having any of the following:

1. Hydrophone group spacing of less than 12.5 m;
2. Hydrophone group spacing of 12.5 m to less than 25 m and designed or able to be modified to operate at depths exceeding 35 m;

Technical Note:

'Able to be modified' in 6A001.a.2.b.2. means having provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing or operating depth limits. These provisions are: spare wiring exceeding 10% of the number of wires, hydrophone group spacing adjustment blocks or internal depth limiting devices that are adjustable or that control more than one hydrophone group.

3. Hydrophone group spacing of 25 m or more and designed to operate at depths exceeding 100 m;
4. Heading sensors specified in 6A001.a.2.d.;
5. Longitudinally reinforced array hoses;
6. An assembled array of less than 40 mm in diameter;
7. Multiplexed hydrophone group signals designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; or
8. Hydrophone characteristics specified in 6A001.a.2.a.;

c. Processing equipment, specially designed for towed acoustic hydrophone arrays, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

d. Heading sensors having all of the following:
1. An accuracy of better than ± 0.5°; and
2. Any of the following:
a. Designed to be incorporated within the array hosing and to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; or
b. Designed to be mounted external to the array hosing and having a sensor unit capable of operating with 360° roll at depths exceeding 35 m;

e. Bottom or bay cable systems having any of the following:
1. Incorporating hydrophones specified in 6A001.a.2.a.;
2. Incorporating multiplexed hydrophone group signals designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; or
3. Processing equipment, specially designed for bottom or bay cable systems, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

b. Correlation-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed at distances between the carrier and the sea bed exceeding 500 m.

6A002 Optical sensors
N.B.: SEE ALSO 6A102.

a. Optical detectors, as follows:
Note: 6A002.a. does not control germanium or silicon photodevices.

1. "Space-qualified" solid-state detectors, as follows:
a. "Space-qualified" solid-state detectors, having all of the following:
1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; and
2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;
b. "Space-qualified" solid-state detectors, having all of the following:
1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; and
2. A response "time constant" of 95 ns or less;
c. "Space-qualified" solid-state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

2. Image intensifier tubes and specially designed components therefor, as follows:
   a. Image intensifier tubes having all of the following:
      1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;
      2. A microchannel plate for electron image amplification with a hole pitch (centre-to-centre spacing) of 15 μm or less; and
      3. Photocathodes, as follows:
         a. S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 240 μA/lm;
         b. GaAs or GaInAs photocathodes; or
         c. Other III-V compound semiconductor photocathodes;
            Note: 6A002.a.2.a.3.c. does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.
   b. Specially designed components, as follows:
      1. Microchannel plates having a hole pitch (centre-to-centre spacing) of 15 μm or less;
      2. GaAs or GaInAs photocathodes;
      3. Other III-V compound semiconductor photocathodes;
         Note: 6A002.a.2.b.3. does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.

3. Non-"space-qualified" "focal plane arrays", as follows:

   Technical Note:
   Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays".

   Notes: 1. 6A002.a.3. includes photoconductive arrays and photovoltaic arrays.
   2. 6A002.a.3. does not control silicon "focal plane arrays", multi-element (not to exceed 16 elements) encapsulated photoconductive cells or pyroelectric detectors using any of the following:
      a. Lead sulphide;
      b. Triglycine sulphate and variants;
      c. Lead-lanthanum-zirconium titanate and variants;
      d. Lithium tantalate;
      e. Polyvinylidene fluoride and variants;
      f. Strontium barium niobate and variants; or
      g. Lead selenide.

   a. Non-"space-qualified" "focal plane arrays", having all of the following:
      1. Individual elements with a peak response within the wavelength range exceeding 900 nm but not exceeding 1,050 nm; and
      2. A response "time constant" of less than 0.5 ns;
   b. Non-"space-qualified" "focal plane arrays", having all of the following:
      1. Individual elements with a peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,200 nm; and
      2. A response "time constant" of 95 ns or less;
   c. Non-"space-qualified" "focal plane arrays", having individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm.

b. "Monospectral imaging sensors" and "multispectral imaging sensors" designed for remote sensing applications, having any of the following:
   1. An Instantaneous-Field-Of-View (IFOV) of less than 200 μrad (microradians); or
   2. Being specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all the following;
      a. Providing output imaging data in digital format; and
      b. Being any of the following:
         1. "Space-qualified"; or
         2. Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mrad (milliradians).

c. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating any of the following:
   1. Image intensifier tubes specified in 6A002.a.2.a. ; or
   2. "Focal plane arrays" specified in 6A002.a.3.

   Technical Note:
   'Direct view' refers to imaging equipment, operating in the visible or infrared spectrum, that presents a visual image to a human observer without converting the image into an electronic signal for television display, and that cannot record or store the image photographically, electronically or by any other means.

   Note: 6A002.c. does not control the following equipment incorporating other than GaAs or GaInAs photocathodes:
   a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;
   b. Medical equipment;
   c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;
   d. Flame detectors for industrial furnaces;
   e. Equipment specially designed for laboratory use.

d. Special support components for optical sensors, as follows:
   1. "Space-qualified" cryocoolers;
   2. Non-"space-qualified" cryocoolers, having a cooling source temperature below 218 K (-55°C), as follows:
      a. Closed cycle type with a specified Mean-Time-To-Failure (MTTF), or Mean-Time-Between-Failures (MTBF), exceeding 2,500 hours;
      b. Joule-Thomson (JT) self-regulating minicoolers having bore (outside) diameters of less than 8 mm;
   3. Optical sensing fibres specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive.

e. "Space qualified" "focal plane arrays" having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm.

6A003 Cameras
N.B.: SEE ALSO 6A203.

N.B.: For cameras specially designed or modified for underwater use, see 8A002.d. and 8A002.e.

a. Instrumentation cameras, as follows:
   1. High-speed cinema recording cameras using any film format from 8 mm to 16 mm inclusive, in which the film is continuously advanced throughout the recording period, and that are capable of recording at framing rates exceeding 13,150 frames/s;
      Note: 6A003.a.1. does not control cinema recording cameras for normal civil purposes.
   2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1,000,000 frames/s for the full framing height of 35 mm film, or at proportionately higher rates for lesser frame heights, or at proportionately lower rates for greater frame heights;
   3. Mechanical or electronic streak cameras having writing speeds exceeding 10 mm/μs;
   4. Electronic framing cameras having a speed exceeding 1,000,000 frames/s;
   5. Electronic cameras, having all of the following:
      a. An electronic shutter speed (gating capability) of less than 1 μs per full frame; and
      b. A read out time allowing a framing rate of more than 125 full frames per second.

b. Imaging cameras, as follows:

Note: 6A003.b. does not control television or video cameras specially designed for television broadcasting.

1. Video cameras incorporating solid state sensors, having any of the following:
   a. More than 4 x 10^6 "active pixels" per solid state array for monochrome (black and white) cameras;
   b. More than 4 x 10^6 "active pixels" per solid state array for colour cameras incorporating three solid state arrays; or
   c. More than 12 x 10^6 "active pixels" for solid state array colour cameras incorporating one solid state array;
2. Scanning cameras and scanning camera systems, having all of the following:
   a. Linear detector arrays with more than 8,192 elements per array; and
   b. Mechanical scanning in one direction;
3. Imaging cameras incorporating image intensifiers specified in 6A002.a.2.a.;
4. Imaging cameras incorporating "focal plane arrays" specified in 6A002.a.3.

6A004 Optics

a. Optical mirrors (reflectors), as follows:

1. "Deformable mirrors" having either continuous or multi-element surfaces, and specially designed components therefor, capable of dynamically repositioningportions of the surface of the mirror at rates exceeding 100 Hz;
2. Lightweight monolithic mirrors having an average "equivalent density" of less than 30 kg/m^2 and a total mass exceeding 10 kg;
3. Lightweight "composite" or foam mirror structures having an average "equivalent density" of less than 30 kg/m^2 and a total mass exceeding 2 kg;
4. Beam steering mirrors more than 100 mm in diameter or length of major axis, which maintain a flatness of lambda/2 or better (lambda is equal to 633 nm) having a control bandwidth exceeding 100 Hz.

b. Optical components made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:
1. Exceeding 100 cm^3 in volume; or
2. Exceeding 80 mm in diameter or length of major axis and 20 mm in thickness (depth).

c. "Space-qualified" components for optical systems, as follows:

1. Lightweighted to less than 20% "equivalent density" compared with a solid blank of the same aperture and thickness;
2. Substrates, substrates having surface coatings (single-layer or multi-layer, metallic or dielectric, conducting, semiconducting or insulating) or having protective films;
3. Segments or assemblies of mirrors designed to be assembled in space into an optical system with a collecting aperture equivalent to or larger than a single optic 1 m in diameter;
4. Manufactured from "composite" materials having a coefficient of linear thermal expansion equal to or less than 5 x 10^{-6} in any coordinate direction.

d. Optical control equipment, as follows:
1. Specially designed to maintain the surface figure or orientation of the "space-qualified" components specified in 6A004.c.1. or 6A004.c.3.;
2. Having steering, tracking, stabilisation or resonator alignment bandwidths equal to or more than 100 Hz and an accuracy of 10 µrad (microradians) or less;
3. Gimbals having all of the following:
   a. A maximum slew exceeding 5°;
   b. A bandwidth of 100 Hz or more;
   c. Angular pointing errors of 200 µrad (microradians) or less; and

d. Having any of the following:
1. Exceeding 0.15 m but not exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 2 rad (radians)/s^2; or
2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0.5 rad (radians)/s^2;

4. Specially designed to maintain the alignment of phased array or phased segment mirror systems consisting of mirrors with a segment diameter or major axis length of 1 m or more.

6A005 "Lasers", other than those specified in 0B001.g.5. or 0B001.h.6., components and optical equipment, as follows:
N.B.: SEE ALSO 6A205.

Notes: 1. *Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed.*
2. *Pulse-excited "lasers" include those that run in a continuously excited mode with pulse excitation superimposed.*
3. *The control status of Raman "lasers" is determined by the parameters of the pumping source "lasers". The pumping source "lasers" can be any of the "lasers" described below.*

a. Gas "lasers", as follows:
1. Excimer "lasers", having any of the following:
a. An output wavelength not exceeding 150 nm and having any of the following:
1. An output energy exceeding 50 mJ per pulse; or
2. An average or CW output power exceeding 1 W;
b. An output wavelength exceeding 150 nm but not exceeding 190 nm and having any of the following:
1. An output energy exceeding 1.5 J per pulse; or
2. An average or CW output power exceeding 120 W;
c An output wavelength exceeding 190 nm but not exceeding 360 nm and having any of the following:
1. An output energy exceeding 10 J per pulse; or
2. An average or CW output power exceeding 500 W; or
d. An output wavelength exceeding 360 nm and having any of the following:
1. An output energy exceeding 1.5 J per pulse; or
2. An average or CW output power exceeding 30 W;

2. Metal vapour "lasers", as follows:
a. Copper (Cu) "lasers" having an average or CW output power exceeding 20 W;
b. Gold (Au) "lasers" having an average or CW output power exceeding 5 W;
c. Sodium (Na) "lasers" having an output power exceeding 5 W;
d. Barium (Ba) "lasers" having an average or CW output power exceeding 2 W;

3. Carbon monoxide (CO) "lasers" having any of the following:
a. An output energy exceeding 2J per pulse and a pulsed "peak power" exceeding 5 kW; or
b. An average or CW output power exceeding 5 kW;

4. Carbon dioxide (CO_2) "lasers" having any of the following:
a. A CW output power exceeding 15 kW;
b. A pulsed output having a "pulse duration" exceeding 10 µs and having any of the following:
1. An average output power exceeding 10 kW; or
2. A pulsed "peak power" exceeding 100 kW; or
c. A pulsed output having a "pulse duration" equal to or less than 10 µs; and having any of the following:
1. A pulse energy exceeding 5 J per pulse; or
2. An average output power exceeding 2.5 kW;

5. "Chemical lasers", as follows:
   a. Hydrogen Fluoride (HF) "lasers";
   b. Deuterium Fluoride (DF) "lasers";
   c. "Transfer lasers", as follows:
      1. Oxygen Iodine (O_2-I) "lasers";
      2. Deuterium Fluoride-Carbon dioxide (DF-CO_2) "lasers";

6. Gas discharge and ion "lasers" (i.e., krypton ion or argon ion "lasers") having any of the following:
   a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 50 W; or
   b. An average or CW output power exceeding 50 W;

7. Other gas "lasers", having any of the following:
   Note: 6A005.a.7. does not control nitrogen "lasers".
   a. An output wavelength not exceeding 150 nm and having any of the following:
      1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
      2. An average or CW output power exceeding 1 W;
   b. An output wavelength exceeding 150 nm but not exceeding 800 nm and having any of the following:
      1. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; or
      2. An average or CW output power exceeding 30 W;
   c. An output wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:
      1. An output energy exceeding 0.25 J per pulse and a pulsed "peak power" exceeding 10 W; or
      2. An average or CW output power exceeding 10 W; or
   d. An output wavelength exceeding 1,400 nm and an average or CW output power exceeding 1 W.

b. Individual, multiple-transverse mode semiconductor "lasers" and arrays of individual semiconductor "lasers", having any of the following:
   1. An output energy exceeding 500 µJ per pulse and a pulsed "peak power" exceeding 10 W; or
   2. An average or CW output power exceeding 10 W.

Technical Note:
Semiconductor "lasers" are commonly called "laser" diodes.

Notes: 1. 6A005.b. includes semiconductor "lasers" having optical output connectors (e.g. fibre optic pigtails).
2. The control status of semiconductor "lasers" specially designed for other equipment is determined by the control status of the other equipment.

c. Solid state "lasers", as follows:
   1. "Tunable" "lasers" having any of the following:
      Note: 6A005.c.1. includes titanium - sapphire(Ti: Al_2O_3), thulium - YAG (Tm: YAG), thulium - YSGG (Tm:YSGG), alexandrite (Cr: $BeAl_2O_4$) and colour centre "lasers".

      a. An output wavelength less than 600 nm and having any of the following:
         1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
         2. An average or CW output power exceeding 1 W;
      b. An output wavelength of 600 nm or more but not exceeding 1,400 nm and having any of the following:
         1. An output energy exceeding 1 J per pulse and a pulsed "peak power" exceeding 20 W; or
         2. An average or CW output power exceeding 20 W; or

c. An output wavelength exceeding 1,400 nm and having any of the following:
   1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
   2. An average or CW output power exceeding 1 W;

2. Non-"tunable" "lasers", as follows:

Note: *6A005.c.2. includes atomic transition solid state "lasers".*

a. Neodymium glass "lasers", as follows:
   1. "Q-switched lasers" having any of the following:
      a. An output energy exceeding 20 J but not exceeding 50 J per pulse and an average output power exceeding 10 W; or
      b. An output energy exceeding 50 J per pulse;
   2. Non-"Q-switched lasers" having any of the following:
      a. An output energy exceeding 50 J but not exceeding 100 J per pulse and an average output power exceeding 20 W; or
      b. An output energy exceeding 100 J per pulse;

b. Neodymium-doped (other than glass) "lasers", having an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm, as follows:

N.B.: *For neodymium-doped (other than glass) "lasers" having an output wavelength not exceeding 1,000 nm or exceeding 1,100 nm, see 6A005.c.2.c.*

   1. Pulse-excited, mode-locked, "Q-switched lasers" having a "pulse duration" of less than 1 ns and having any of the following:
      a. A "peak power" exceeding 5 GW;
      b. An average output power exceeding 10 W; or
      c. A pulsed energy exceeding 0.1 J;
   2. Pulse-excited, "Q-switched lasers" having a pulse duration equal to or more than 1 ns, and having any of the following:
      a. A single-transverse mode output having:
         1. A "peak power" exceeding 100 MW;
         2. An average output power exceeding 20 W; or
         3. A pulsed energy exceeding 2 J; or
      b. A multiple-transverse mode output having:
         1. A "peak power" exceeding 400 MW;
         2. An average output power exceeding 2 kW; or
         3. A pulsed energy exceeding 2 J;
   3. Pulse-excited, non-"Q-switched lasers", having:
      a. A single-transverse mode output having:
         1. A "peak power" exceeding 500 kW; or
         2. An average output power exceeding 150 W; or
      b. A multiple-transverse mode output having:
         1. A "peak power" exceeding 1 MW; or
         2. An average power exceeding 2 kW;
   4. Continuously excited "lasers" having:
      a. A single-transverse mode output having:
         1. A "peak power" exceeding 500 kW; or
         2. An average or CW output power exceeding 150 W; or

b. A multiple-transverse mode output having:
   1. A "peak power" exceeding 1 MW; or
   2. An average or CW output power exceeding 2 kW;

c. Other non-"tunable" "lasers", having any of the following:
   1. A wavelength less than 150 nm and having any of the following:
      a. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
      b. An average or CW output power exceeding 1 W;
   2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
      a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; or
      b. An average or CW output power exceeding 30 W;
   3. A wavelength exceeding 800 nm but not exceeding 1,400 nm, as follows:
      a. "Q-switched lasers" having:
         1. An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 50 W; or
         2. An average output power exceeding:
            a. 10 W for single-mode "lasers";
            b. 30 W for multimode "lasers";
      b. Non-"Q-switched lasers" having:
         1. An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 50 W; or
         2. An average or CW output power exceeding 50 W; or
   4. A wavelength exceeding 1,400 nm and having any of the following:
      a. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
      b. An average or CW output power exceeding 1 W;

d. Dye and other liquid "lasers", having any of the following:
   1. A wavelength less than 150 nm and:
      a. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
      b. An average or CW output power exceeding 1 W;
   2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
      a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 20 W;
      b. An average or CW output power exceeding 20 W; or
      c. A pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the "pulse duration" is less than 100 ns;
   3. A wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:
      a. An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 10W; or
      b. An average or CW output power exceeding 10 W; or
   4. A wavelength exceeding 1,400 nm and having any of the following:
      a. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
      b. An average or CW output power exceeding 1 W;

e. Components, as follows:
   1. Mirrors cooled either by active cooling or by heat pipe cooling;
      Technical Note:
      Active cooling is a cooling technique for optical components using flowing fluids within the subsurface (nominally less than 1 mm below the optical surface) of the optical component to remove heat from the optic.
   2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components specially designed for use with controlled "lasers";

f. Optical equipment, as follows:

(For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see the Military Goods Lists.)

1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having any of the following:
   a. Frame rates equal to or more than 100 Hz and phase discrimination of at least 5% of the beam's wavelength; or
   b. Frame rates equal to or more than 1,000 Hz and phase discrimination of at least 20% of the beam's wavelength;
2. "Laser" diagnostic equipment capable of measuring "SHPL" system angular beam steering errors of equal to or less than 10 μrad;
3. Optical equipment and components specially designed for a phased-array "SHPL" system for coherent beam combination to an accuracy of lambda/10 at the designed wavelength, or 0.1 μm, whichever is the smaller;
4. Projection telescopes specially designed for use with "SHPL" systems.

6A006 "Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers" and compensation systems, and specially designed components therefor, as follows:

Note: 6A006 does not control instruments specially designed for biomagnetic measurements for medical diagnostics.

a. "Magnetometers" using "superconductive", optically pumped or nuclear precession (proton/Overhauser) "technology" having a "noise level" (sensitivity) lower (better) than 0.05 nT rms per square root Hz;

b. Induction coil "magnetometers" having a "noise level" (sensitivity) lower (better) than any of the following:
   1. 0.05 nT rms/square root Hz at frequencies of less than 1 Hz;
   2. 1×10^{-3} nT rms/square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; or
   3. 1×10^{-4} nT rms/square root Hz at frequencies exceeding 10 Hz;

c. Fibre optic "magnetometers" having a "noise level" (sensitivity) lower (better) than 1 nT rms per square root Hz;

d. "Magnetic gradiometers" using multiple "magnetometers" specified in 6A006.a., 6A006.b. or 6A006.c.;

e. Fibre optic "intrinsic magnetic gradiometers" having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.3 nT/m rms per square root Hz;

f. "Intrinsic magnetic gradiometers", using "technology" other than fibre-optic "technology", having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.015 nT/m rms per square root Hz;

g. Magnetic compensation systems for magnetic sensors designed for operation on mobile platforms;

h. "Superconductive" electromagnetic sensors, containing components manufactured from "superconductive" materials:
   1. Designed for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents (including Josephson effect devices or "superconductive" quantum interference devices (SQUIDS));
   2. Designed for sensing electromagnetic field variations at frequencies of 1 kHz or less; and:

3. Having any of the following characteristics:
   a. Incorporating thin-film SQUIDS with a minimum feature size of less than 2 μm and with associated input and output coupling circuits;
   b. Designed to operate with a magnetic field slew rate exceeding 1 x 10^6 magnetic flux quanta per second;
   c. Designed to function without magnetic shielding in the earth's ambient magnetic field; or
   d. Having a temperature coefficient less (smaller) than 0.1 magnetic flux quantum/K.

6A007 Gravity meters (gravimeters) and gravity gradiometers, as follows:
N.B.: SEE ALSO 6A107.

a. Gravity meters for ground use having a static accuracy of less (better) than 10 μgal;
   Note: 6A007.a. does not control ground gravity meters of the quartz element (Worden) type.

b. Gravity meters for mobile platforms for ground, marine, submersible, space or airborne use, having all of the following:
   1. A static accuracy of less (better) than 0.7 mgal; and
   2. An in-service (operational) accuracy of less (better) than 0.7 mgal having a time-to-steady-state registration of less than 2 minutes under any combination of attendant corrective compensations and motional influences;

c. Gravity gradiometers.

6A008 Radar systems, equipment and assemblies having any of the following characteristics, and specially designed components therefor:
N.B.: SEE ALSO 6A108.

Note: 6A008 does not control:
   a. Secondary surveillance radar (SSR);
   b. Car radar designed for collision prevention;
   c. Displays or monitors used for air traffic control (ATC) having no more than 12 resolvable elements per mm;
   d. Meteorological (weather) radar.

a. Operating at frequencies from 40 GHz to 230 GHz and having an average output power exceeding 100 mW;

b. Having a tunable bandwidth exceeding ± 6.25% of the centre operating frequency;
   Technical Note:
   The centre operating frequency equals one half of the sum of the highest plus the lowest specified operating frequencies.

c. Capable of operating simultaneously on more than two carrier frequencies;

d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode;

e. Incorporating "electronically steerable phased array antennae";

f. Capable of heightfinding non-cooperative targets;
   Note: 6A008.f. does not control precision approach radar (PAR) equipment conforming to ICAO standards.

g. Specially designed for airborne (balloon or airframe mounted) operation and having Doppler "signal processing" for the detection of moving targets;

h. Employing processing of radar signals using any of the following:
   1. "Radar spread spectrum" techniques; or
   2. "Radar frequency agility" techniques;

i. Providing ground-based operation with a maximum "instrumented range" exceeding 185 km;
Note: *6A008.i. does not control:*
a. Fishing ground surveillance radar;
b. Ground radar equipment specially designed for enroute air traffic control, provided that all the following conditions are met:
1. It has a maximum "instrumented range" of 500 km or less;
2. It is configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centres;
3. It contains no provisions for remote control of the radar scan rate from the enroute ATC centre; and
4. It is to be permanently installed;
c. Weather balloon tracking radars.

j. Being "laser" radar or Light Detection and Ranging (LIDAR) equipment, having any of the following:
1. "Space-qualified"; or
2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20 μrad (microradians);
Note: *6A008.j. does not control LIDAR equipment specially designed for surveying or for meteorological observation.*

k. Having "signal processing" sub-systems using "pulse compression", with any of the following:
1. A "pulse compression" ratio exceeding 150; or
2. A pulse width of less than 200 ns; or

l. Having data processing sub-systems with any of the following:
1. "Automatic target tracking" providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage;
Note: *6A008.l.1. does not control conflict alert capability in ATC systems, or marine or harbour radar.*
2. Calculation of target velocity from primary radar having non-periodic (variable) scanning rates;
3. Processing for automatic pattern recognition (feature extraction) and comparison with target characteristic data bases (waveforms or imagery) to identify or classify targets; or
4. Superposition and correlation, or fusion, of target data from two or more "geographically dispersed" and "interconnected radar sensors" to enhance and discriminate targets.
Note: *6A008.l.4. does not control systems, equipment and assemblies used for marine traffic control.*

6A102 Radiation hardened detectors, other than those specified in 6A002, for use in protecting against nuclear effects (e.g. electromagnetic pulse (EMP), X-rays, combined blast and thermal effects) and usable for "missiles", designed or rated to withstand radiation levels which meet or exceed a total irradiation dose of 5×10^5 rads (Si).

Technical Note:
In 6A102, a detector is defined as a mechanical, electrical, optical or chemical device that automatically identifies and records, or registers a stimulus such as an environmental change in pressure or temperature, an electrical or electromagnetic signal or radiation from a radioactive material.

6A107 Gravity meters (gravimeters) and components for gravity meters and gravity gradiometers, as follows:

a. Gravity meters, other than those specified in 6A007.b., designed or modified for airborne or marine use, and having a static or operational accuracy of 0.7 mgal or less (better), and having a time-to-steady-state registration of two minutes or less;

b. Specially designed components for gravity meters specified in 6A007.b. or 6A107.a. and gravity gradiometers specified in 6A007.c."

6A108 Radar systems and tracking systems, other than those specified in entry 6A008, as follows:

a. Radar and laser radar systems designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;

b. Precision tracking systems, usable for "missiles", as follows:
   1. Tracking systems which use a code translator in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;
   2. Range instrumentation radars including associated optical/infrared trackers with all of the following capabilities:
      a. Angular resolution better than 3 milliradians (0.5 mils);
      b. Range of 30 km or greater with a range resolution better than 10 m rms;
      c. Velocity resolution better than 3 m/s.

6A202 Photomultiplier tubes with a photocathode area of greater than 20 cm^2 having an anode pulse rise time of less than 1 ns.

6A203 Cameras and components, other than those specified in 6A003, as follows:

a. Mechanical rotating mirror cameras, as follows, and specially designed components therefor:
   1. Framing cameras with recording rates greater than 225,000 frames per second; or
   2. Streak cameras with writing speeds greater than 0.5 mm per microsecond;

   Note: Components of such cameras include their synchronizing electronic units and rotor assemblies consisting of turbines, mirrors and bearings.

b. Electronic streak and framing cameras and tubes, as follows:
   1. Electronic streak cameras capable of 50 ns or less time resolution and streak tubes therefor;
   2. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;
   3. Framing tubes and solid-state imaging devices for use with cameras specified in 6A203.b.2., as follows:
      a. Proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;
      b. Gate silicon intensifier target (SIT) videcon tubes, where a fast system allows gating the photoelectrons from the photocathode before they impinge on the SIT plate;
      c. Kerr or pocket cell electro-optical shuttering; or
      d. Other framing tubes and solid-state imaging devices having a fast-image gating time of less than 50 ns specially designed for cameras specified in 6A203.b.2;

c. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand greater than 50×10^3 grays (Silicon) (5×10^6 rad (Silicon)) without operational degradation.

6A205 "Lasers", other than those specified in 0B001.g.5., 0B001.h.6 and 6A005; as follows:

a. Argon ion "lasers" with greater than 40 W average output power operating at wavelengths between 400 nm and 515 nm;

b. Tunable pulsed single-mode dye oscillators capable of an average power output of greater than 1 W, a repetition rate greater than 1 kHz, a pulse less than 100 ns, and a wavelength between 300 nm and 800 nm;

c. Tunable pulsed dye laser amplifiers and oscillators, with an average power output of greater than 30 W, a repetition rate greater than 1 kHz, a pulse width less than 100 ns, and a wavelength between 300 nm and 800 nm;

except:
Single mode oscillators;

d. Pulsed carbon dioxide "lasers" with a repetition rate greater than 250 Hz, an average power output of greater than 500 W, and a pulse of less than 200 ns operating at wavelengths between 9,000 nm and 11,000 nm;

e. Para-hydrogen Raman shifters designed to operate at 16 micrometre output wavelength and at a repetition rate greater than 250 Hz.

f. Pulse -excited, Q-switched Neodymium-doped (other than glass) "lasers", having all of the following:
   1. an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm,
   2. a pulse duration equal to or more than 1 ns, and
   3. A multiple-transverse mode output having an average power exceeding 50 W.

6A225 Velocity interferometers for measuring velocities in excess of 1 km/s during time intervals of less than 10 microsecond (VISARs, Doppler laser interferometers (DLIs), etc.).

6A226 Pressure sensors, as follows:

a. Manganin gauges for pressures greater than 100 kilobars; or
b. Quartz pressure transducers for pressures greater than 100 kilobars.

6B Test, Inspection and Production Equipment

6B004 Optical equipment, as follows:

a. Equipment for measuring absolute reflectance to an accuracy of ± 0.1% of the reflectance value;

b. Equipment other than optical surface scattering measurement equipment, having an unobscured aperture of more than 10 cm, specially designed for the non-contact optical measurement of a non-planar optical surface figure (profile) to an "accuracy" of 2 nm or less (better) against the required profile.

Note: 6B004 does not control microscopes.

6B007 Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of better than 0.1 mgal.

6B008 Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.
N.B.: SEE ALSO 6B108.

6B108 Systems, other than those specified in 6B008, specially designed for radar cross section measurement usable for "missiles" and other subsystems.

6C Materials

6C002 Optical sensor materials, as follows:

a. Elemental tellurium (Te) of purity levels of 99.9995% or more;

b. Single crystals of cadmium telluride (CdTe), cadmium zinc telluride (CdZnTe) or mercury cadmium telluride (HgCdTe) of any purity level, including epitaxial wafers thereof.

6C004 Optical materials, as follows:

a. Zinc selenide (ZnSe) and zinc sulphide (ZnS) "substrate blanks" produced by the chemical vapour deposition process, having any of the following:
   1. A volume greater than 100 cm^3; or
   2. A diameter greater than 80 mm having a thickness of 20 mm or more;

b. Boules of the following electro-optic materials:
   1. Potassium titanyl arsenate (KTA);
   2. Silver gallium selenide ($AgGaSe_2$);
   3. Thallium arsenic selenide (Tl_3AsSe_3, also known as TAS);

c. Non-linear optical materials, having all of the following:
   1. Third order susceptibility (chi 3) of 10^{-6} m^2/V^2 or more; and
   2. A response time of less than 1 ms;

d. "Substrate blanks" of silicon carbide or beryllium beryllium (Be/Be) deposited materials exceeding 300 mm in diameter or major axis length;

e. Glass, including fused silica, phosphate glass, fluorophosphate glass, zirconium fluoride (ZrF_4) and hafnium fluoride (HfF_4), having all of the following:
   1. A hydroxyl ion (OH-) concentration of less than 5 ppm;
   2. Integrated metallic purity levels of less than 1 ppm; and
   3. High homogeneity (index of refraction variance) less than 5×10^{-6};

f. Synthetically produced diamond material with an absorption of less than 10^{-5} cm^{-1} for wavelengths exceeding 200 nm but not exceeding 14,000 nm.

6C005 Synthetic crystalline "laser" host material in unfinished form, as follows:

a. Titanium doped sapphire;
b. Alexandrite.

6D Software

6D001 "Software" specially designed for the "development" or "production" of equipment specified in 6A004, 6A005, 6A008 or 6B008.

6D002 "Software" specially designed for the "use" of equipment specified in 6A002.b., 6A008 or 6B008.

6D003 Other "software", as follows:

a. 1. "Software" specially designed for acoustic beam forming for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;
   2. "Source code" for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;
   3. "Software" specially designed for bottom or bay cable systems and having beamforming or "source code" for "real time processing" of acoustic data for passive reception;

b. 1. "Software" specially designed for magnetic compensation systems for magnetic sensors designed to operate on mobile platforms;
   2. "Software" specially designed for magnetic anomaly detection on mobile platforms;

c. "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;

d. 1. Air Traffic Control "software" application "programmes" hosted on general purpose computers located at Air Traffic Control centres and capable of any of the following:
      a. Processing and displaying more than 150 simultaneous "system tracks"; or

b. Accepting radar target data from more than four primary radars;

2. "Software" for the design or "production" of radomes which:
   a. Are specially designed to protect the "electronically steerable phased array antennae" specified in 6A008.e.; and
   b. Result in an antenna pattern having an 'average side lobe level' more than 40 dB below the peak of the main beam level.

   Technical Note:
   'Average side lobe level' in 6D003.d.2.b. is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam.

6D102 "Software" specially designed for the "use" of goods specified in 6A108.

6D103 "Software" which processes post-flight, recorded data, obtained from the systems specified in 6A108.b., enabling determination of vehicle position throughout its flight path.

6E Technology

6E001 "Technology" according to the General Technology Note for the "development" of equipment, materials or "software" specified in 6A., 6B., 6C. or 6D.

6E002 "Technology" according to the General Technology Note for the "production" of equipment or materials specified in 6A., 6B. or 6C.

6E003 Other "technology", as follows:

a. 1. Optical surface coating and treatment "technology" "required" to achieve uniformity of 99.5% or better for optical coatings 500 mm or more in diameter or major axis length and with a total loss (absorption and scatter) of less than 5×10^{-3};
   N.B.: See also 2E003.f.

   2. Optical fabrication "technology" using single point diamond turning techniques to produce surface finish accuracies of better than 10 nm rms on non-planar surfaces exceeding 0.5 m^2;

b. "Technology" "required" for the "development", "production" or "use" of specially designed diagnostic instruments or targets in test facilities for "SHPL" testing or testing or evaluation of materials irradiated by "SHPL" beams;

c. "Technology" "required" for the "development" or "production" of fluxgate "magnetometers" or fluxgate "magnetometer" systems, having any of the following:
   1. A "noise level" of less than 0.05 nT rms per square root Hz at frequencies of less than 1 Hz; or
   2. A "noise level" of less than 1×10^{-3} nT rms per square root Hz at frequencies of 1Hz or more.

6E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 6A002, 6A007.b. and c., 6A008, 6A102, 6A107, 6A108, 6B108, 6D102 or 6D103.

Note: 6E101 only specifies "technology" for equipment specified in 6A008 when it is designed for airborne applications and is usable in "missiles".

6E201 "Technology" according to the General Technology Note for the "use" of equipment specified in 6A003, 6A005.a.1.c., 6A005.a.2.a., 6A005.c.1.b., 6A005.c.2.c.2., 6A005.c.2.d.2.b., 6A202, 6A203, 6A205, 6A225 or 6A226.

CATEGORY 7 - NAVIGATION AND AVIONICS

7A Systems, Equipment and Components

N.B.: For automatic pilots for underwater vehicles, see Category 8.
For radar, see Category 6.

7A001 Accelerometers designed for use in inertial navigation or guidance systems and having any of the following characteristics, and specially designed components therefor:
N.B.:SEE ALSO 7A101.

a. A "bias" "stability" of less (better) than 130 microg with respect to a fixed calibration value over a period of one year;
b. A "scale factor" "stability" of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year; or
c. Specified to function at linear acceleration levels exceeding 100 g.

7A002 Gyros having any of the following characteristics, and specially designed components therefor:
N.B.:SEE ALSO 7A102.

a. A "drift rate" "stability", when measured in a 1g environment over a period of three months and with respect to a fixed calibration value, of:
   1. Less (better) than 0.1° per hour when specified to function at linear acceleration levels below 10 g; or
   2. Less (better) than 0.5° per hour when specified to function at linear acceleration levels from 10 g to 100 g inclusive; or
b. Specified to function at linear acceleration levels exceeding 100 g.

7A003 Inertial navigation systems (gimballed or strapdown) and inertial equipment designed for "aircraft", land vehicle or "spacecraft" for attitude, guidance or control having any of the following characteristics, and specially designed components therefor:
N.B.:SEE ALSO 7A103.

a. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (50% Circular Error Probable (CEP)) or less (better); or
   Note: The parameters of 7A003.a are applicable with any of the following environmental conditions.
   1. Input random vibration with an overall magnitude of 7.7 g rms in the first half hour and a total test duration of one and one half hour per axis in each of the three perpendicular axes, when the random vibration meets the following:
      a. A constant power spectral density (PSD) value of 0.04 g^2/Hz over a frequency interval of 15 to 1,000 Hz; and
      b. The PSD attenuates with frequency from 0.04 g^2/Hz to 0.01 g^2/Hz over a frequency interval from 1,000 to 2,000 Hz, or
   2. A roll and yaw rate of equal to or more than + 2.62 radian/S (150 deg/S);
   or
   3. According to national standards equivalent to 1. or 2. above.
b. Specified to function at linear acceleration levels exceeding 10 g.

Note: 7A003 does not control inertial navigation systems which are certified for use on "civil aircraft" by civil authorities of a "participating state".

7A004 Gyro-astro compasses, and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites, with an azimuth accuracy of equal to or less (better) than 5 seconds of arc.
N.B.: SEE ALSO 7A104.

7A005 Global navigation satellite systems (i.e. GPS or GLONASS) receiving equipment having any of the following characteristics, and specially designed components therefor:
N.B.: SEE ALSO 7A105.

a. Employing decryption; or
b. A null-steerable antenna.

7A006 Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive, having any of the following characteristics:
N.B.: SEE ALSO 7A106.

a. "Power management"; or
b. Using phase shift key modulation.

7A007 Direction finding equipment operating at frequencies above 30 MHz and having all of the following characteristics, and specially designed components therefor:
a. "Instantaneous bandwidth" of 1 MHz or more;
b. Parallel processing of more than 100 frequency channels; and
c. Processing rate of more than 1,000 direction finding results per second and per frequency channel.

7A101 Accelerometers, other than those specified in 7A001, with a threshold of 0.05 g or less, or a linearity error within 0.25% of full scale output, or both, which are designed for use in inertial navigation systems or in guidance systems of all types and specially designed components therefor.

Note: 7A101 does not specify accelerometers which are specially designed and developed as MWD (Measurement While Drilling) Sensors for use in downhole well service operations.

7A102 All types of gyros, other than those specified in 7A002, usable in "missiles", with a rated "drift rate" "stability" of less than 0.5° (1 sigma or rms) per hour in a 1 g environment and specially designed components therefor.

7A103 Instrumentation, navigation equipment and systems, other than those specified in 7A003, as follows; and specially designed components therefor:

a. Inertial or other equipment using accelerometers or gyros specified in 7A001, 7A002, 7A101 or 7A102 and systems incorporating such equipment;

Note: 7A103.a. does not specify equipment containing accelerometers specified in 7A001 where such accelerometers are specially designed and developed as MWD (Measurement While Drilling) sensors for use in down-hole well services operations.

b. Integrated flight instrument systems, which include gyrostabilisers or automatic pilots, designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104."

7A104 Gyro-astro compasses and other devices, other than those specified in 7A004, which derive position or orientation by means of automatically tracking celestial bodies or satellites and specially designed components therefor.

7A105 Global Positioning Systems (GPS) or similar satellite receivers, other than those specified in 7A005, capable of providing navigation information under the following operational conditions and designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104

a. At speeds in excess of 515 m/s; and

b. At altitudes in excess of 18 km.

7A106 Altimeters, other than those specified in 7A006, of radar or laser radar type, designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104."

7A115 Passive sensors for determining bearing to specific electromagnetic source (direction finding equipment) or terrain characteristics, designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

Note: 7A115 includes sensors for the following equipment:

a. Terrain contour mapping equipment;
b. Imaging sensor equipment;
c. Interferometer equipment.

7A116 Flight control systems, as follows; designed or modified for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104

a. Hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire types);

b. Attitude control equipment.

7A117 "Guidance sets", usable in "missiles", capable of achieving system accuracy of 3.33% or less of the range (e.g., a "CEP" of 10 km or less at a range of 300 km).

7B Test, Inspection and Production Equipment

7B001 Test, calibration or alignment equipment specially designed for equipment specified in 7A.
Note: 7B001 does not control test, calibration or alignment equipment for Maintenance Level I or Maintenance Level II.

Technical Notes:

1. Maintenance Level I

The failure of an inertial navigation unit is detected on the aircraft by indications from the control and display unit (CDU) or by the status message from the corresponding sub-system. By following the manufacturer's manual, the cause of the failure may be localised at the level of the malfunctioning line replaceable unit (LRU). The operator then removes the LRU and replaces it with a spare.

2. *Maintenance Level II*
The defective LRU is sent to the maintenance workshop (the manufacturer's or that of the operator responsible for level II maintenance). At the maintenance workshop, the malfunctioning LRU is tested by various appropriate means to verify and localise the defective shop replaceable assembly (SRA) module responsible for the failure. This SRA is removed and replaced by an operative spare. The defective SRA (or possibly the complete LRU) is then shipped to the manufacturer.
N.B.: Maintenance Level II does not include the removal of controlled accelerometers or gyro sensors from the SRA.

7B002 Equipment, as follows, specially designed to characterize mirrors for ring "laser" gyros:
N.B.: SEE ALSO 7B102.

a. Scatterometers having a measurement accuracy of 10 ppm or less (better);
b. Profilometers having a measurement accuracy of 0.5 nm (5 angstrom) or less (better).

7B003 Equipment specially designed for the "production" of equipment specified in 7A., including:

a. Gyro tuning test stations;
b. Gyro dynamic balance stations;
c. Gyro run-in/motor test stations;

d. Gyro evacuation and fill stations;
e. Centrifuge fixtures for gyro bearings;
f. Accelerometer axis align stations.

7B102 Reflectometers specially designed to characterise mirrors, for "laser" gyros, having a measurement accuracy of 50 ppm or less (better).

7B103 Specially designed "production facilities" for equipment specified in 7A117.

7C Materials

None

7D Software

7D001 "Software" specially designed or modified for the "development" or "production" of equipment specified in 7A. or 7B.

7D002 "Source code" for the "use" of any inertial navigation equipment or Attitude and Heading Reference Systems (AHRS) including inertial equipment not controlled by 7A003 or 7A004.
Note: 7D002 does not control "source code" for the "use" of gimballed AHRS.

Technical Note
AHRS generally differ from inertial navigation systems (INS) in that an AHRS provides attitude and heading information and normally does not provide the acceleration, velocity and position information associated with an INS.

7D003 Other "software", as follows:

a. "Software" specially designed or modified to improve the operational performance or reduce the navigational error of systems to the levels specified in 7A003 or 7A004;

b. "Source code" for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level specified in 7A003 by continuously combining inertial data with any of the following navigation data:
1. Doppler radar velocity;
2. Global navigation satellite systems (i.e., GPS or GLONASS) reference data; or
3. Terrain data from data bases;

c. "Source code" for integrated avionics or mission systems which combine sensor data and employ "expert systems";

d. "Source code" for the "development" of any of the following:
1. Digital flight management systems for "total control of flight";
2. Integrated propulsion and flight control systems;
3. Fly-by-wire or fly-by-light control systems;
4. Fault-tolerant or self-reconfiguring "active flight control systems";
5. Airborne automatic direction finding equipment;
6. Air data systems based on surface static data; or
7. Raster-type head-up displays or three dimensional displays;

e. Computer-aided-design (CAD) "software" specially designed for the "development" of "active flight control systems", helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter "circulation controlled anti-torque or circulation-controlled direction control systems" whose "technology" is specified in 7E004.b., 7E004.c.1. or 7E004.c.2.

7D101 "Software" specially designed for the "use" of equipment specified in 7A001 to 7A006, 7A101 to 7A106, 7A115, 7B002, 7B003, 7B102 or 7B103.

7D102 Integration "software" for the equipment specified in 7A003 or 7A103.

7D103 "Software" specially designed for modelling or simulation of the "guidance sets" specified in 7A117 or for their design integration with the space launch vehicles specified in 9A004 or sounding rockets specified in 9A104."

Note: "Software" specified in 7D103 remains controlled when combined with specially designed hardware specified in 4A102.

7E Technology

7E001 "Technology" according to the General Technology Note for the "development" of equipment or "software" specified in 7A., 7B. or 7D.

7E002 "Technology" according to the General Technology Note for the "production" of equipment specified in 7A. or 7B.

7E003 "Technology" according to the General Technology Note for the repair, refurbishing or overhaul of equipment specified in 7A001. to 7A004.

Note: 7E003 does not control maintenance "technology" directly associated with calibration, removal or replacement of damaged or unserviceable LRUs and SRAs of a "civil aircraft" as described in Maintenance Level I or Maintenance Level II.

N.B.: See Technical Notes to 7B001.

7E004 Other "technology", as follows:

a. "Technology" for the "development" or "production" of:
   1. Airborne automatic direction finding equipment operating at frequencies exceeding 5 MHz;
   2. Air data systems based on surface static data only, i.e., which dispense with conventional air data probes;
   3. Raster-type head-up displays or three dimensional displays for "aircraft";
   4. Inertial navigation systems or gyro-astro compasses containing accelerometers or gyros specified in 7A001. or 7A002.;
   5. Electric actuators (i.e., electromechanical, electrohydrostatic and integrated actuator package) specially designed for "primary flight control";
   6. "Flight control optical sensor array" specially designed for implementing "active flight control systems";

b. "Development" "technology", as follows, for "active flight control systems" (including fly-by-wire or fly-by-light):
   1. Configuration design for interconnecting multiple microelectronic processing elements (on-board computers) to achieve "real time processing" for control law implementation;
   2. Control law compensation for sensor location or dynamic airframe loads, i.e., compensation for sensor vibration environment or for variation of sensor location from the centre of gravity;
   3. Electronic management of data redundancy or systems redundancy for fault detection, fault tolerance, fault isolation or reconfiguration;
      Note: 7E004.b.3. does not control" technology" for the design of physical redundancy.
   4. Flight controls which permit inflight reconfiguration of force and moment controls for real time autonomous air vehicle control;
   5. Integration of digital flight control, navigation and propulsion control data into a digital flight management system for "total control of flight";

Note: *7E004.b.5. does not control:*

1. "Development" "technology" for integration of digital flight control, navigation and propulsion control data into a digital flight management system for "flight path optimisation";

2. "Development" "technology" for "aircraft" flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

6. Full authority digital flight control or multisensor mission management systems employing "expert systems";

N.B.: *For "technology" for Full Authority Digital Engine Control ("FADEC"), see 9E003.a.9.*

c. "Technology" for the "development" of helicopter systems, as follows:

1. Multi-axis fly-by-wire or fly-by-light controllers which combine the functions of at least two of the following into one controlling element:
   a. Collective controls;
   b. Cyclic controls;
   c. Yaw controls;
2. "Circulation-controlled anti-torque or circulation-controlled directional control systems";
3. Rotor blades incorporating "variable geometry airfoils" for use in systems using individual blade control.

7E101 "Technology" according to the General Technology Note for the "use" of equipment specified in 7A001 to 7A006, 7A101 to 7A106, 7A115 to 7A117, 7B002, 7B003, 7B102, 7B103, 7D101 to 7D103.

7E102 "Technology" for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards, from external sources, as follows:

a. Design "technology" for shielding systems;

b. Design "technology" for the configuration of hardened electrical circuits and subsystems;

c. Design "technology" for the determination of hardening criteria of 7E102.a. and b.

7E104 "Technology" for the integration of the flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory.

CATEGORY 8 – MARINE

8A Systems, Equipment and Components

8A001 Submersible vehicles and surface vessels, as follows:

Note: For the control status of equipment for submersible vehicles, see:
Category 5, Part 2 "Information Security" for encrypted communication equipment;
Category 6 for sensors;
Categories 7 and 8 for navigation equipment;
Category 8A. for underwater equipment.

a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m;

b. Manned, untethered submersible vehicles, having any of the following:

1. Designed to 'operate autonomously' and having a lifting capacity of all the following:
   a. 10% or more of their weight in air; and

b. 15 kN or more;
2. Designed to operate at depths exceeding 1,000 m; or
3. Having all of the following:
   a. Designed to carry a crew of 4 or more;
   b. Designed to operate autonomously for 10 hours or more;
   c. Having a 'range' of 25 nautical miles or more; and
   d. Having a length of 21 m or less;

Technical Notes:

1. *For the purposes of 8A001.b., 'operate autonomously' means fully submerged, without snorkel, all systems working and cruising at minimum speed at which the submersible can safely control its depth dynamically by using its depth planes only, with no need for a support vessel or support base on the surface, sea-bed or shore, and containing a propulsion system for submerged or surface use.*
2. *For the purposes of 8A001.b., 'range' means half the maximum distance a submersible vehicle can cover.*

c. Unmanned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m, having any of the following:
   1. Designed for self-propelled manoeuvre using propulsion motors or thrusters specified in 8A002.a.2.; or
   2. Having a fibre optic data link;

d. Unmanned, untethered submersible vehicles, having any of the following:
   1. Designed for deciding a course relative to any geographical reference without real-time human assistance;
   2. Having an acoustic data or command link; or
   3. Having a fibre optic data or command link exceeding 1,000 m;

e. Ocean salvage systems with a lifting capacity exceeding 5 MN for salvaging objects from depths exceeding 250 m and having any of the following:

   1. Dynamic positioning systems capable of position keeping within 20 m of a given point provided by the navigation system; or
   2. Seafloor navigation and navigation integration systems for depths exceeding 1,000 m with positioning accuracies to within 10 m of a predetermined point;

f. Surface-effect vehicles (fully skirted variety) having all of the following characteristics:
   1. a maximum design speed, fully loaded, exceeding 30 knots in a significant wave height of 1.25 m (Sea State 3) or more;
   2. a cushion pressure exceeding 3,830 Pa; and
   3. a light-ship-to-full-load displacement ratio of less than 0.70;

g. Surface-effect vehicles (rigid sidewalls) with a maximum design speed, fully loaded, exceeding 40 knots in a significant wave height of 3.25 m (Sea State 5) or more;

h. Hydrofoil vessels with active systems for automatically controlling foil systems, with a maximum design speed, fully loaded, of 40 knots or more in a significant wave height of 3.25 m (Sea State 5) or more;

i. Small waterplane area vessels having any of the following:
   1. A full load displacement exceeding 500 tonnes with a maximum design speed, fully loaded, exceeding 35 knots in a significant wave height of 3.25 m (Sea State 5) or more; or
   2. A full load displacement exceeding 1,500 tonnes with a maximum design speed, fully loaded, exceeding 25 knots in a significant wave height of 4 m (Sea State 6) or more.

Technical Note:
A small waterplane area vessel is defined by the following formula: waterplane area at an operational design draught less than 2 x (displaced volume at the operational design draught)$^{2/3}$.

8A002 Systems and equipment, as follows:

Note: For underwater communications systems, see Category 5, Part 1 – Telecommunications.

a. Systems and equipment, specially designed or modified for submersible vehicles, designed to operate at depths exceeding 1,000 m, as follows:
   1. Pressure housings or pressure hulls with a maximum inside chamber diameter exceeding 1.5 m;
   2. Direct current propulsion motors or thrusters;
   3. Umbilical cables, and connectors therefor, using optical fibre and having synthetic strength members;

b. Systems specially designed or modified for the automated control of the motion of equipment for submersible vehicles specified in 8A001. using navigation data and having closed loop servo-controls:
   1. Enabling a vehicle to move within 10 m of a predetermined point in the water column;
   2. Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; or
   3. Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed;

c. Fibre optic hull penetrators or connectors;

d. Underwater vision systems, as follows:
   1. Television systems and television cameras, as follows:
      a. Television systems (comprising camera, monitoring and signal transmission equipment) having a limiting resolution when measured in air of more than 800 lines and specially designed or modified for remote operation with a submersible vehicle;
      b. Underwater television cameras having a limiting resolution when measured in air of more than 1,100 lines;
      c. Low light level television cameras specially designed or modified for underwater use containing all of the following:
         1. Image intensifier tubes specified in 6A002.a.2.a.; and
         2. More than 150,000 "active pixels" per solid state area array;

      Technical Note:
      Limiting resolution in television is a measure of horizontal resolution usually expressed in terms of the maximum number of lines per picture height discriminated on a test chart, using IEEE Standard 208/1960 or any equivalent standard.

   2. Systems, specially designed or modified for remote operation with an underwater vehicle, employing techniques to minimise the effects of back scatter, including range-gated illuminators or "laser" systems;

e. Photographic still cameras specially designed or modified for underwater use below 150 m having a film format of 35 mm or larger, and having any of the following:
   1. Annotation of the film with data provided by a source external to the camera;
   2. Automatic back focal distance correction; or
   3. Automatic compensation control specially designed to permit an underwater camera housing to be usable at depths exceeding 1,000 m;

f. Electronic imaging systems, specially designed or modified for underwater use, capable of storing digitally more than 50 exposed images;

g. Light systems, as follows, specially designed or modified for underwater use:
   1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;
   2. Argon arc light systems specially designed for use below 1,000 m;

h. "Robots" specially designed for underwater use, controlled by using a dedicated "stored programme controlled" computer, having any of the following:
   1. Systems that control the "robot" using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the "robot" and an external object; or
   2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium based alloys or "fibrous or filamentary" "composite" materials in their structural members;

i. Remotely controlled articulated manipulators specially designed or modified for use with submersible vehicles, having any of the following:
   1. Systems which control the manipulator using the information from sensors which measure the torque or force applied to an external object, or tactile sense between the manipulator and an external object; or
   2. Controlled by proportional master-slave techniques or by using a dedicated "stored programme controlled" computer, and having 5 degrees of freedom of movement or more;

      Note: Only functions having proportional control using positional feedback or by using a dedicated "stored programme controlled" computer are counted when determining the number of degrees of freedom of movement.

j. Air independent power systems, specially designed for underwater use, as follows:
   1. Brayton or Rankine cycle engine air independent power systems having any of the following:
      a. Chemical scrubber or absorber systems specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;
      b. Systems specially designed to use a monoatomic gas;
      c. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; or
      d. Systems specially designed:
         1. To pressurise the products of reaction or for fuel reformation;
         2. To store the products of the reaction; and
         3. To discharge the products of the reaction against a pressure of 100 kPa or more;
   2. Diesel cycle engine air independent systems, having all of the following:
      a. Chemical scrubber or absorber systems specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;
      b. Systems specially designed to use a monoatomic gas;
      c. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; and
      d. Specially designed exhaust systems that do not exhaust continuously the products of combustion;
   3. Fuel cell air independent power systems with an output exceeding 2 kW having any of the following:
      a. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; or
      b. Systems specially designed:
         1. To pressurise the products of reaction or for fuel reformation;
         2. To store the products of the reaction; and
         3. To discharge the products of the reaction against a pressure of 100 kPa or more;
   4. Stirling cycle engine air independent power systems, having all of the following:
      a. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; and
      b. Specially designed exhaust systems which discharge the products of combustion against a pressure of 100 kPa or more;

k. Skirts, seals and fingers, having any of the following:
   1. Designed for cushion pressures of 3,830 Pa or more, operating in a significant wave height of 1.25 m (Sea State 3) or more and specially designed for surface effect vehicles (fully skirted variety) specified in 8A001.f.; or
   2. Designed for cushion pressures of 6,224 Pa or more, operating in a significant wave height of 3.25 m (Sea State 5) or more and specially designed for surface effect vehicles (rigid sidewalls) specified in 8A001.g.;

l. Lift fans rated at more than 400 kW specially designed for surface effect vehicles specified in 8A001.f. or 8A001.g.;

m. Fully submerged subcavitating or supercavitating hydrofoils specially designed for vessels specified in 8A001.h.;

n. Active systems specially designed or modified to control automatically the sea-induced motion of vehicles or vessels specified in 8A001.f., 8A001.g., 8A001.h. or 8A001.i.;

o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:
   1. Water-screw propeller or power transmission systems, as follows, specially designed for surface effect vehicles (fully skirted or rigid sidewall variety), hydrofoils or small waterplane area vessels specified in 8A001.f., 8A001.g., 8A001.h. or 8A001.i.:
      a. Supercavitating, super-ventilated, partially-submerged or surface piercing propellers rated at more than 7.5 MW;
      b. Contrarotating propeller systems rated at more than 15 MW;
      c. Systems employing pre-swirl or post-swirl techniques for smoothing the flow into a propeller;
      d. Light-weight, high capacity (K factor exceeding 300) reduction gearing;
      e. Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 1 MW;
   2. Water-screw propeller, power generation systems or transmission systems designed for use on vessels, as follows:
      a. Controllable-pitch propellers and hub assemblies rated at more than 30 MW;
      b. Internally liquid-cooled electric propulsion engines with a power output exceeding 2.5 MW;
      c. "Superconductive" propulsion engines, or permanent magnet electric propulsion engines, with a power output exceeding 0.1 MW;
      d. Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 2 MW;
      e. Ventilated or base-ventilated propeller systems rated at more than 2.5 MW;
   3. Noise reduction systems designed for use on vessels of 1,000 tonnes displacement or more, as follows:
      a. Systems that attenuate underwater noise at frequencies below 500 Hz and consist of compound acoustic mounts for the acoustic isolation of diesel engines, diesel generator sets, gas turbines, gas turbine generator sets, propulsion motors or propulsion reduction gears, specially designed for sound or vibration isolation, having an intermediate mass exceeding 30% of the equipment to be mounted;
      b. Active noise reduction or cancellation systems, or magnetic bearings, specially designed for power transmission systems, and incorporating electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source;

p. Pumpjet propulsion systems having a power output exceeding 2.5 MW using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise;

q. Self-contained, closed or semi-closed circuit (rebreathing) diving and underwater swimming apparatus.

8B Test, Inspection and Production Equipment

8B001 Water tunnels, having a background noise of less than 100 dB (reference 1 μPa, 1 Hz) in the frequency range from 0 to 500 Hz, designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.

8C Materials

8C001 Syntactic foam designed for underwater use, having all of the following:
a. Designed for marine depths exceeding 1,000 m; and
b. A density less than 561 kg/m^3.

Technical Note:
Syntactic foam consists of hollow spheres of plastic or glass embedded in a resin matrix.

8D Software

8D001 "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials specified in 8A., 8B. or 8C.

8D002 Specific "software" specially designed or modified for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction.

8E Technology

8E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials specified in 8A., 8B. or 8C.

8E002 Other "technology", as follows:

a. "Technology" for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction;

b. "Technology" for the overhaul or refurbishing of equipment specified in 8A001., 8A002.b., 8A002.j., 8A002.o. or 8A002.p.

CATEGORY 9 – PROPULSION SYSTEMS, SPACE VEHICLES AND RELATED EQUIPMENT.

9A Systems, Equipment and Components

(For propulsion systems designed or rated against neutron or transient ionizing radiation, see the Military Goods Controls.).

9A001 Aero gas turbine engines incorporating any of the "technologies" specified in 9E003.a., as follows:
N.B.: SEE ALSO 9A101

a. Not certified for the specific "civil aircraft" for which they are intended;
b. Not certified for civil use by the aviation authorities in a "participating state";
c. Designed to cruise at speeds exceeding Mach 1.2 for more than thirty minutes.

9A002 Marine gas turbine engines with an ISO standard continuous power rating of 24,245 kW or more and a specific fuel consumption not exceeding 0.219 kg/kWh in the power range from 35 to 100%, and specially designed assemblies and components therefor.

Note: The term 'marine gas turbine engines' includes those industrial, or aero-derivative, gas turbine engines adapted for a ship's electric power generation or propulsion.

9A003 Specially designed assemblies and components, incorporating any of the "technologies" specified in 9E003.a., for the following gas turbine engine propulsion systems:

a. Specified in 9A001;
b. Whose design or production origins are either non-"participating states" or unknown to the manufacturer.

9A004 Space launch vehicles and "spacecraft".
N.B.: SEE ALSO 9A104.

Notes: 1. *9A004 does not control payloads.*
2. *For the control status of products contained in "spacecraft" payloads, see the appropriate Categories.*

9A105 Liquid propellant rocket engines, as follows:
N.B.: SEE ALSO 9A119.

(a) Liquid propellant rocket engines, usable in "missiles", other than those specified in 9A005, having a total impulse capacity of 1.1 MNs or greater;

(b) Liquid propellant rocket engines, usable in complete rocket systems or unmanned air vehicles, capable of a range of at least 300 km, other than those specified in 9A005 or 9A105.a., having a total impulse capacity of 0.841 MNs or greater.

9A006 Systems and components specially designed for liquid rocket propulsion systems, as follows:
N.B.: SEE ALSO 9A106 and 9A108.

a. Cryogenic refrigerators, flightweight dewars, cryogenic heat pipes or cryogenic systems specially designed for use in space vehicles and capable of restricting cryogenic fluid losses to less than 30% per year;
b. Cryogenic containers or closed-cycle refrigeration systems capable of providing temperatures of 100 K (-173°C) or less for "aircraft" capable of sustained flight at speeds exceeding Mach 3, launch vehicles or "spacecraft";
c. Slush hydrogen storage or transfer systems;
d. High pressure (exceeding 17.5 MPa) turbo pumps, pump components or their associated gas generator or expander cycle turbine drive systems;
e. High-pressure (exceeding 10.6 MPa) thrust chambers and nozzles therefor;
f. Propellant storage systems using the principle of capillary containment or positive expulsion (i.e., with flexible bladders);
g. Liquid propellant injectors, with individual orifices of 0.381 mm or smaller in diameter (an area of 1.14×10^{-3} cm^2 or smaller for non-circular orifices) specially designed for liquid rocket engines;
h. One-piece carbon-carbon thrust chambers or one-piece carbon-carbon exit cones with densities exceeding 1.4 g/cm^3 and tensile strengths exceeding 48 MPa.

9A007 Solid rocket propulsion systems with any of the following:
N.B.: SEE ALSO 9A119

a. Total impulse capacity exceeding 1.1 MNs;
b. Specific impulse of 2.4 kNs/kg or more when the nozzle flow is expanded to ambient sea level conditions for an adjusted chamber pressure of 7 MPa;
c. Stage mass fractions exceeding 88% and propellant solid loadings exceeding 86%;
d. Any of the components specified in 9A008 .; or
e. Insulation and propellant bonding systems using direct-bonded motor designs to provide a 'strong mechanical bond' or a barrier to chemical migration between the solid propellant and case insulation material.

Technical Note:
For the purposes of 9A007.e., a 'strong mechanical bond' means bond strength equal to or more than propellant strength.

9A008 Components, as follows, specially designed for solid rocket propulsion systems:
N.B.: SEE ALSO 9A108

a. Insulation and propellant bonding systems using liners to provide a 'strong mechanical bond' or a barrier to chemical migration between the solid propellant and case insulation material;
Technical Note:
For the purposes of 9A008.a., a 'strong mechanical bond' means bond strength equal to or more than propellant strength.

b. Filament-wound "composite" motor cases exceeding 0.61 m in diameter or having structural efficiency ratios (PV/W) exceeding 25 km.

Technical Note:
The structural efficiency ratio (PV/W) is the burst pressure (P) multiplied by the vessel volume (V) divided by the total pressure vessel weight (W).

c. Nozzles with thrust levels exceeding 45 kN or nozzle throat erosion rates of less than 0.075 mm/s;

d. Movable nozzle or secondary fluid injection thrust vector control systems capable of any of the following:
1. Omni-axial movement exceeding ± 5°;
2. Angular vector rotations of 20°/s or more; or
3. Angular vector accelerations of 40°/s^2 or more.

9A009 Hybrid rocket propulsion systems with:
N.B.: SEE ALSO 9A109 and 9A119

a. Total impulse capacity exceeding 1.1 MNs; or
b. Thrust levels exceeding 220 kN in vacuum exit conditions.

9A010 Specially designed components, systems and structures for launch vehicles, launch vehicle propulsion systems or "spacecraft", as follows:
N.B.: SEE ALSO 1A002 AND 9A110.

a. Components and structures each exceeding 10 kg, specially designed for launch vehicles manufactured using metal "matrix", "composite", organic "composite", ceramic "matrix" or intermetallic reinforced materials specified in 1C007 or 1C010;
Note: The weight cut-off is not relevant for nose cones.

b. Components and structures specially designed for launch vehicle propulsion systems specified in 9A005 to 9A009 manufactured using metal matrix, composite, organic composite, ceramic matrix or intermetallic reinforced materials specified in 1C007 or 1C010;
c. Structural components and isolation systems specially designed to control actively the dynamic response or distortion of "spacecraft" structures;
d. Pulsed liquid rocket engines with thrust-to-weight ratios equal to or more than 1 kN/kg and a response time (the time required to achieve 90% of total rated thrust from start-up) of less than 30 ms.

9A011 Ramjet, scramjet or combined cycle engines and specially designed components therefor.
N.B.: SEE ALSO 9A111 and 9A118.

9A101 Lightweight turbojet and turbofan engines (including turbocompound engines) usable in "missiles", other than those specified in 9A001, as follows:

a. Engines having both of the following characteristics:
   1. Maximum thrust value greater than 1000 N (achieved un-installed) excluding civil certified engines with a maximum thrust value greater than 8,890 N (achieved un-installed), and
   2. Specific fuel consumption of 0.13 kg/N/hr or less(at sea level static and standard conditions); or

b. Engines designed or modified for use in "missiles".

9A104 Sounding rockets, capable of a range of at least 300 km.
N.B.: SEE ALSO 9A004.

9A105 Liquid propellant rocket engines, as follows:
N.B.: SEE ALSO 9A119.

a. Liquid propellant rocket engines usable in "missiles", other than those specified in 9A005, having a total impulse capacity of 1.1 MNs or greater;

b. Liquid propellant rocket engines usable in 'missiles', other than those specified in 9A005 or 9A105.a., having a total impulse capacity of 0.841 MNs or greater.

9A106 Systems or components, other than those specified in 9A006, usable in "missiles", as follows, specially designed for liquid rocket propulsion systems:

a. Ablative liners for thrust or combustion chambers;

b. Rocket nozzles;

c. Thrust vector control sub-systems;

Technical Note:
Examples of methods of achieving thrust vector control specified in 9A106.c. are:
1. *Flexible nozzle;*
2. *Fluid or secondary gas injection;*
3. *Movable engine or nozzle;*
4. *Deflection of exhaust gas stream (jet vanes or probes); or*
5. *Thrust tabs.*

d. Liquid and slurry propellant (including oxidisers) control systems, and specially designed components therefor, designed or modified to operate in vibration environments of more than 10 g rms between 20 Hz and 2000 Hz.

Note: The only servo valves and pumps specified in 9A106.d, are the following:
   a. Servo valves designed for flow rates of 24 litres per minute or greater, at an absolute pressure of 7 MPa or greater, that have an actuator response time of less than 100 ms;
   b. Pumps, for liquid propellants, with shaft speeds equal to or greater than 8,000 rpm or with discharge pressures equal to or greater than 7 MPa.

9A107 Solid propellant rocket engines, usable in complete rocket systems or unmanned air vehicles, capable of a range of at least 300 km, other than those specified in 9A007, having total impulse capacity of 0.841 MNs or greater.
N.B.: SEE ALSO 9A119."

9A108 Components, other than those specified in 9A008, usable in "missiles", as follows, specially designed for solid rocket propulsion systems:

a. Rocket motor cases, "interior lining" and "insulation" therefor;
b. Rocket nozzles;
c. Thrust vector control sub-systems.

Technical Note:
Examples of methods of achieving thrust vector control specified in 9A108.c. are:
1. *Flexible nozzle;*
2. *Fluid or secondary gas injection;*
3. *Movable engine or nozzle;*
4. *Deflection of exhaust gas stream (jet vanes or probes); or*
5. *Thrust tabs.*

9A109 Hybrid rocket motors, usable in "missiles", other than those specified in 9A009, and specially designed components therefor.
N.B.: SEE ALSO 9A119.

9A110 Composite structures, laminates and manufactures thereof, other than those specified in 9A010, specially designed for use in the space launch vehicles specified in 9A004 or sounding rockets specified in 9A104 or the subsystems specified in 9A005, 9A007, 9A105.a., 9A106 to 9A108, 9A116 or 9A119, and resin impregnated fibre prepregs and metal coated fibre preforms therefor, made either with organic matrix or metal matrix utilising fibrous or filamentary reinforcements having a specific tensile strength greater than 7.62×10^4 m and a specific modulus greater than 3.18×10^6 m.
N.B.: SEE ALSO 1A002, 1C010 and 1C210.

Note: The only resin impregnated fibre prepregs specified in entry 9A110 are those using resins with a glass transition temperature (T_g), after cure, exceeding 418 K (145°C) as determined by ASTM D4065 or equivalent.

9A111 Pulse jet engines, usable in "missiles", and specially designed components therefor.
N.B.: SEE ALSO 9A011 and 9A118.

9A115 Launch support equipment, designed or modified for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104,", as follows:

a. Apparatus and devices for handling, control, activation or launching;

b. Vehicles for transport, handling, control, activation or launching.

9A116 Reentry vehicles, usable in "missiles", and equipment designed or modified therefor, as follows:

a. Reentry vehicles;

b. Heat shields and components therefor fabricated of ceramic or ablative materials;

c. Heat sinks and components therefor fabricated of light-weight, high heat capacity materials;

d. Electronic equipment specially designed for reentry vehicles.

9A117 Staging mechanisms, separation mechanisms, and interstages, usable in "missiles".

9A118 Devices to regulate combustion usable in engines, which are usable in "missiles", specified in 9A011 or 9A111.

9A119 Individual rocket stages, usable in complete rocket systems or unmanned air vehicles, capable of a range of at least 300 km, other than those specified in 9A005, 9A007, 9A009, 9A105, 9A107 and 9A109.

9B Test, Inspection and Production Equipment

9B001 Specially designed equipment, tooling and fixtures, as follows, for manufacturing or measuring gas turbine blades, vanes or tip shroud castings:

a. Directional solidification or single crystal casting equipment;
b. Ceramic cores or shells;
c. Ceramic core manufacturing equipment or tools;
d. Ceramic shell wax pattern preparation equipment.

9B002 On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for the "development" of gas turbine engines, assemblies or components incorporating "technologies" specified in 9E003 .a.

9B003 Equipment specially designed for the "production" or test of gas turbine brush seals designed to operate at tip speeds exceeding 335 m/s, and temperatures in excess of 773 K (500°C), and specially designed components or accessories therefor.

9B004 Tools, dies or fixtures for the solid state joining of "superalloy", titanium or intermetallic airfoil-to-disk combinations described in 9E003 .a.3. or 9E003 .a.6. for gas turbines.

9B005 On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for use with any of the following wind tunnels or devices:
N.B.: SEE ALSO 9B105.

a. Wind tunnels designed for speeds of Mach 1.2 or more,
except:
Those specially designed for educational purposes and having a test section size (measured laterally) of less than 250 mm;
Technical Note:
Test section size in 9B005.a.means the diameter of the circle, or the side of the square, or the longest side of the rectangle, at the largest test section location.
b. Devices for simulating flow-environments at speeds exceeding Mach 5, including hot-shot tunnels, plasma arc tunnels, shock tubes, shock tunnels, gas tunnels and light gas guns; or
c. Wind tunnels or devices, other than two-dimensional sections, capable of simulating Reynolds number flows exceeding 25 x 10^6.

9B006 Acoustic vibration test equipment capable of producing sound pressure levels of 160 dB or more (referenced to 20 μPa) with a rated output of 4 kW or more at a test cell temperature exceeding 1,273 K (1,000°C), and specially designed quartz heaters therefor.
N.B.: SEE ALSO 9B106.

9B007 Equipment specially designed for inspecting the integrity of rocket motors using non-destructive test (NDT) techniques other than planar X-ray or basic physical or chemical analysis.

9B008 Transducers specially designed for the direct measurement of the wall skin friction of the test flow with a stagnation temperature exceeding 833 K (560°C).

9B009 Tooling specially designed for producing turbine engine powder metallurgy rotor components capable of operating at stress levels of 60% of ultimate tensile strength (UTS) or more and metal temperatures of 873 K (600°C) or more.

9B105 Wind tunnels for speeds of Mach 0.9 or more, usable for "missiles" and their subsystems.
N.B.: SEE ALSO 9B005

9B106 Environmental chambers and anechoic chambers, as follows:

a. Environmental chambers capable of simulating the following flight conditions:
1. Vibration environments of 10 g rms or greater between 20 Hz and 2,000 Hz and imparting forces of 5 kN or greater; and
2. Altitudes of 15,000 m or greater; or
3. Temperature of at least 223 K (-50°C) to 398 K (+ 125°C)

b. Anechoic chambers capable of simulating the following flight conditions:
   1. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 20 microPa) or with a rated power output of 4 kW or greater; and
   2. Altitudes of 15,000 m or greater; or
   3. Temperature of at least 223 K (-50°C) to 398 K (+ 125°C)

9B115 Specially designed "production equipment" for the systems, sub-systems and components specified in 9A005 to 9A009, 9A011, 9A101, 9A105 to 9A109, 9A111, 9A116 to 9A119.

9B116 Specially designed "production facilities" for the space launch vehicles specified in 9A004, or systems, sub-systems, and components specified in 9A005 to 9A009, 9A011, 9A101, 9A104 to 9A109, 9A111 or 9A116 to 9A119."

9B117 Test benches and test stands for solid or liquid propellant rockets or rocket motors, having either of the following characteristics:

a. The capacity to handle more than 90 kN of thrust; or
b. Capable of simultaneously measuring the three axial thrust components.

9C Materials

None

9D Software

9D001 "Software" specially designed or modified for the "development" of equipment or "technology" specified in 9A. , 9B. or 9E003 .

9D002 "Software" specially designed or modified for the "production" of equipment specified in 9A. or 9B.

9D003 "Software" specially designed or modified for the "use" of full authority digital electronic engine controls (FADEC) for propulsion systems specified in 9A. or equipment specified in 9B., as follows:

a. "Software" in digital electronic controls for propulsion systems, aerospace test facilities or air breathing aero-engine test facilities;
b. Fault-tolerant "software" used in "FADEC" systems for propulsion systems and associated test facilities.

9D004 Other "software", as follows:

a. 2D or 3D viscous "software" validated with wind tunnel or flight test data required for detailed engine flow modelling;
b. "Software" for testing aero gas turbine engines, assemblies or components, specially designed to collect, reduce and analyse data in real time, and capable of feedback control, including the dynamic adjustment of test articles or test conditions, as the test is in progress;
c. "Software" specially designed to control directional solidification or single crystal casting;
d. "Software" in "source code", "object code" or machine code required for the "use" of active compensating systems for rotor blade tip clearance control.

Note: 9D004 .d. does not control "software" embedded in uncontrolled equipment or required for maintenance activities associated with the calibration or repair or updates to the active compensating clearance control system.

9D101 "Software" specially designed for the "use" of goods specified in 9B105, 9B106, 9B116 or 9B117.

9D103 "Software" specially designed for modelling, simulation or design integration of the space launch vehicles specified in 9A004 or sounding rockets specified in 9A104, or the sub-systems specified in 9A005, 9A007, 9A105.a., 9A106, 9A108, 9A116 or 9A119.

Note: "Software" specified in 9D103 remains controlled when combined with specially designed hardware specified in 4A102.

9E Technology

Note: "Development" or "production" "technology" specified in 9E001 to 9E003. for gas turbine engines remains controlled when used as "use" "technology" for repair, rebuild and overhaul. Excluded from control are: technical data, drawings or documentation for maintenance activities directly associated with calibration, removal or replacement of damaged or unserviceable line replaceable units, including replacement of whole engines or engine modules.

9E001 "Technology" according to the General Technology Note for the "development" of equipment or "software" specified in 9A001.c., 9A004. to 9A011., 9B. or 9D.

9E002 "Technology" according to the General Technology Note for the "production" of equipment specified in 9A001.c., 9A004. to 9A011. or 9B.

Note: For "technology" for the repair of controlled structures, laminates or materials, see 1E002.f.

9E003 Other "technology", as follows:

a. "Technology" "required" for the "development" or "production" of any of the following gas turbine engine components or systems:
   1. Gas turbine blades, vanes or tip shrouds made from directionally solidified (DS) or single crystal (SC) alloys having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000°C) at a stress of 200 MPa, based on the average property values;
   2. Multiple domed combustors operating at average burner outlet temperatures exceeding 1,813 K (1,540°C) or combustors incorporating thermally decoupled combustion liners, non-metallic liners or non-metallic shells;
   3. Components manufactured from organic "composite" materials designed to operate above 588 K (315°C), or from metal "matrix" "composite", ceramic "matrix", intermetallic or intermetallic reinforced materials controlled by 1A002 or 1C007;
   4. Uncooled turbine blades, vanes, tip-shrouds or other components designed to operate at gas path temperatures of 1,323 K (1,050°C) or more;
   5. Cooled turbine blades, vanes or tip-shrouds, other than those described in 9E003.a.1., exposed to gas path temperatures of 1,643 K (1,370°C) or more;
   6. Airfoil-to-disk blade combinations using solid state joining;
   7. Gas turbine engine components using "diffusion bonding" "technology" controlled by 2E003.b.;
   8. Damage tolerant gas turbine engine rotating components using powder metallurgy materials controlled by 1C002.b.;
   9. "FADEC" for gas turbine and combined cycle engines and their related diagnostic components, sensors and specially designed components;
   10. Adjustable flow path geometry and associated control systems for:
      a. Gas generator turbines;
      b. Fan or power turbines;
      c. Propelling nozzles;

      Notes: 1. Adjustable flow path geometry and associated control systems in 9E003.a.10. do not include inlet guide vanes, variable pitch fans, variable stators or bleed valves for compressors.

      2. 9E003.a.10 does not control "development" or "production" "technology" for adjustable flow path geometry for reverse thrust.
   11. Rotor blade tip clearance control systems employing active compensating casing "technology" limited to a design and development data base; or
   12. Wide chord hollow fan blades without part-span support;

b. "Technology" "required" for the "development" or "production" of any of the following:
   1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system; or
   2. "Composite" propeller blades or propfans capable of absorbing more than 2,000 kW at flight speeds exceeding Mach 0.55;

c. "Technology" "required" for the "development" or "production" of gas turbine engine components using "laser", water jet, ECM or EDM hole drilling processes to produce holes having any of the following sets of characteristics:
   1. All of the following:
      a. Depths more than four times their diameter;
      b. Diameters less than 0.76 mm; and
      c. Incidence angles equal to or less than 25°; or
   2. All of the following:
      a. Depths more than five times their diameter;
      b. Diameters less than 0.4 mm; and
      c. Incidence angles of more than 25°;

      Technical Note:
      For the purposes of 9E003.c., incidence angle is measured from a plane tangential to the airfoil surface at the point where the hole axis enters the airfoil surface.

d. "Technology" "required" for any of the following:
   1. The "development" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems; or
   2. The "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;

e. 1. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:
      a. A box volume of 1.2 m^3 or less;
      b. An overall power output of more than 750 kW based on 80/1269/EEC, ISO 2534 or national equivalents; and
      c. A power density of more than 700 kW/m^3 of box volume;

      Technical Note:
      Box volume: the product of three perpendicular dimensions measured in the following way:
      Length: The length of the crankshaft from front flange to flywheel face;
      Width: The widest of the following:
         a. The outside dimension from valve cover to valve cover;
         b. The dimensions of the outside edges of the cylinder heads; or
         c. The diameter of the flywheel housing;
      Height: The largest of the following:
         a. The dimension of the crankshaft centre-line to the top plane of the valve cover (or cylinder head) plus twice the stroke; or
         b. The diameter of the flywheel housing.

   2. "Technology" "required" for the "production" of specially designed components, as follows, for high output diesel engines:
      a. "Technology" "required" for the "production" of engine systems having all of the following components employing ceramics materials controlled by 1C007:
         1. Cylinder liners;
         2. Pistons;
         3. Cylinder heads; and
         4. One or more other components (including exhaust ports, turbochargers, valve guides, valve assemblies or insulated fuel injectors);
      b. "Technology" "required" for the "production" of turbocharger systems, with single-stage compressors having all of the following:
         1. Operating at pressure ratios of 4:1 or higher;
         2. A mass flow in the range from 30 to 130 kg per minute; and
         3. Variable flow area capability within the compressor or turbine sections;

c. "Technology" "required" for the "production" of fuel injection systems with a specially designed multifuel (e.g., diesel or jet fuel) capability covering a viscosity range from diesel fuel (2.5 cSt at 310.8 K (37.8°C)) down to gasoline fuel (0.5 cSt at 310.8 K (37.8°C)), having both of the following:
   1. Injection amount in excess of 230 mm^3 per injection per cylinder; and
   2. Specially designed electronic control features for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;

3. "Technology" "required" for the "development" or "production" of high output diesel engines for solid, gas phase or liquid film (or combinations thereof) cylinder wall lubrication, permitting operation to temperatures exceeding 723 K (450°C), measured on the cylinder wall at the top limit of travel of the top ring of the piston.
Technical Note:
High output diesel engines: diesel engines with a specified brake mean effective pressure of 1.8 MPa or more at a speed of 2,300 r.p.m., provided the rated speed is 2,300 r.p.m. or more.

9E101 "Technology" according to the General Technology Note for the "development" or "production" of goods specified in 9A101, 9A104 to 9A111 or 9A115 to 9A119.

9E102 "Technology" according to the General Technology Note for the "use" of: space launch vehicles specified in 9A004, or goods specified in 9A005 to 9A011, 9A101, 9A104 to 9A111, 9A115 to 9A119, 9B105, 9B106, 9B115, 9B116, 9B117, 9D101 or 9D103.

ANNEX II - COMMUNITY GENERAL EXPORT AUTHORIZATION

1. A general authorization is granted for the export of dual-use items as specified in Schedule A hereto to any destination in any country specified in Schedule B hereto.

(a) Schedule A

Dual-use items specified in any entry in Annex I of the present Regulation except

- all entries in category O (nuclear items)
- all entries in category 5, part 2 (Information security)
- all entries with a '1' in the third position of the reference number (items controlled for reasons of missile proliferation)
- all entries of goods specified in Annex IV of the present Regulation

(b) Schedule B

Australia, Canada, Czech Republic, Hungary, Japan, New Zealand, Norway, Poland, Switzerland, United States of America

2. The registration and/or reporting requirement attached to the use of this Authorization are the respective requirement defined by Member States for the use of national General Authorizations.

3. The list of destinations specified in Schedule B shall be kept under constant review.

ANNEX III - MODEL FORM

EUROPEAN COMMUNITY

EXPORT OF DUAL-USE GOODS (Reg. (EC) No

1 Exporter No

2 Identification number

3 Expiry date

4 Contact point details

5 Consignee

6 Address of the issuing authority

7 Agent/Representative (if different to exporter) No

8 Country of origin (if applicable) Code

9 Country of consignment (if applicable) Code

10 End user (if different to consignee)

11 Member State of current or future location of the goods Code

12 Member State of intended entry into the customs export procedure Code

13 Country of destination Code

14 Description of the goods

15 Commodity code

16 Control list no

17 Currency and value

18 Quantity of the goods

14 Description of the goods

15 Commodity code

16 Control list no

17 Currency and Value

18 Quantity of the goods

19 End use

20 Contract date

21 Customs exp. proc.

22 C.S.

23 Additional information

Available for peripheral information at discretion of Member States

26 For completion by issuing authority

Signature

Stamp

Function

Place

Date

Note: In part 1 of column 28, write the quantity still available and in part 2 of column 28, write the quantity deducted on this occasion.			
27 Net quantity/value (Net mass/other unit with indication of unit)		30 Customs document (Type and number) or extract (Nr) and date of deduction	31 Member state, name and signature, stamp of deduction authority
28 In numbers	29 In words for quantity/value deducted		
1			
2			
1			
2			
1			
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2			

ANNEX IV

PART A

(a) List of goods subject to licensing requirement (Article 23.1)

ITEMS INCLUDED IN THE NSG – TRIGGER LIST INFCIRC 254/PART 1 (change of text)

0B001 Plant for the separation of isotopes of "natural uranium" and "depleted uranium", "special fissile materials" and "other fissile materials";

0B002 Auxiliary equipment for enrichment plants;

0B004 Heavy water, deuterium or deuterium compound production equipment and components;

0B006 Plant for the reprocessing of irradiated "nuclear reactor" fuel elements;

0C002 Only the following fissile materials:

(a) separated plutonium;

(b) "uranium enriched in the isotopes 235 or 233" to more than 20%;

0D001 As it relates to 0B001, 0B002, 0B004, 0B006 and OC002.

0E001 As it relates to 0B001, 0B002, 0B004, 0B006 and 0C002

PART B

(b) List of goods subject to notification procedure (Article 22.1)

General Note

1. The notification procedure does not apply to items listed in Category 5, part 2 (Information Security) when these items are transferred for personal use and are accompanying the user.
2. The necessity to maintain the notification procedure for items listed in Category 5, part 2, shall be periodically reviewed.

3A002.g Atomic frequency standards;

4A001b. Electronic computer and related equipment, as follows, and "electronic assemblies", and specially designed components therefor, having characteristics or performing functions exceeding the limits in Category 5 Part 2 ("Information Security");
except:
"digital computers" having characteristics or performing functions described by 4 in Category 5 Part 2 of this Annex when they are for personal use and accompanying their user.

4D003c. "Software" having characteristics or performing functions exceeding the limits in Category 5 Part 2 ("Information Security");
except:
"software" having characteristics or performing functions described at:
(a) 1. of Category 5 Part 2 of this Annex and without end-to-end encryption or decryption capability; or
(b) 4. of Category 5 Part 2 of this Annex when they are for personal use and accompanying their user.

Category 5 All goods specified in Part 2 – ("Information Security"), other than:

1. Portable or mobile radiotelephones designed to recognized national, regional or international civil standards, e.g., portable or mobile radiotelephones for use with commercial civil cellular radiocommunication systems;

2. Commercial civil cellular radiocommunication base stations having all of the following:

   (a) limited to supporting radiotelephones which are not capable of employing cryptographic techniques on message traffic between handsets except over direct links between radiotelephones and base stations (known as the Air Interface); and
   (b) not capable of employing cryptographic techniques on message traffic except over the air interface;

3. Equipment specified in 5B002 for equipment described in 2 above;

4. Those not capable of on-line voice encryption or decryption and designed to be used in conjunction with "digital computers" (including those described by Category 4) for personal use when accompanying their user;

5. "Software" when incorporated as part of the goods whose characteristics or performing functions are described in:

   (a) 1. to 3. above; or
   (b) 4. above and is for personal use when accompanying the user;

6. "Technology" for the "use" of goods described in 1 to 5 above."

6A001 Acoustics;

6D003.a. "Software" for the real time processing of acoustic data.

STEALTH TECHNOLOGY

1C001 Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers;

1D103 "Software" specially designed for analysis of reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures;

6B008 Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor;

6B108 Systems specially designed for radar cross section measurement usable for "missiles" and their subsystems;

MTCR TECHNOLOGY

9A005 Liquid rocket propulsion systems;

9A007.a Solid rocket propulsion systems with a total impulse capacity exceeding 1.1 MNS;

9A008.d Movable nozzle or secondary fluid injection thrust vector control systems, specially designed for solid rocket propulsion systems;

9A009.a Hybrid rocket propulsion systems with total impulse capacity exceeding 1.1 MNS;

9A108.c Thrust vector control sub-systems, specially designed for solid rocket propulsion systems;

9A119 Individual rocket stages;

9B115 Specially designed "production equipment" for the systems, sub-systems and components specified in 9A005, 9A007.a, 9A008.d, 9A108.c and 9A119;

9B116	Specially designed "production facilities" for the systems, sub-systems and components specified in 9A005, 9A007.a, 9A008.d, 9A108.c and 9.A119;
9D001	"Software" required for the "development" of equipment or "technology" specified in 9A005, 9A007.a, 9A008.d, 9A108.c, 9A119, 9B115 and 9B116;
9D101	"Software" specially designed for the "use" of goods specified in 9B116;
9D103	"Software" specially designed for modelling, simulation or design integration of the systems specified in 9A007.a, 9A108.c or 9A119;
9E001	"Technology" for the "development" of equipment specified in 9A005, 9A007.a, 9A008.d., 9B115, 9B116;
9E002	"Technology" for the "production" of equipment specified in 9A005, 9A007.a, 9A008.d., 9B115 and 9B116;
9E101	"Technology" for the "development" or "production" of equipment specified in 9A108.c. or 9A119.

Financial Statement

External trade relations - Proposal for a Council Regulation regarding export of dual use goods

1. TITLE

Proposal for Council Regulation N° ....setting up a Community regime for the control of exports of dual-use goods and technology and repealing Regulation (EC) N°3381/94

2. BUDGETARY HEADINGS:

A-7030

3. LEGAL BASIS

- Article 113 of the Treaty of Rome
- Proposal for Council Regulation No ....setting up a Community regime for the control of exports of dual-use goods and technology and repealing Regulation (EC) No 3381/94

4. DESCRIPTION OF OPERATION :

The purpose of the Regulation is to establish an efficient export control system at Community level concerning dual-use goods.

Period covered: indefinite

5. CLASSIFICATION OF EXPENDITURE/REVENUE

Not applicable

6. TYPE OF EXPENDITURE/REVENUE

Not applicable

7. FINANCIAL IMPACT ON APPROPRIATIONS FOR OPERATIONS

Not applicable

8. WHAT ANTI-FRAUD MEASURES ARE PLANNED IN THE PROPOSAL FOR THE OPERATION ?

Not applicable

9. ELEMENTS OF COST-EFFECTIVENESS ANALYSIS

Not applicable

10. ADMINISTRATIVE EXPENSES

Actual mobilisation of the necessary administrative resources will depend on the Commission's annual decision on the allocation of resources, taking into account the number of staff and additional amounts authorised by the budgetary authority. There is no request for additional staff.

10.1

Effect on the number of posts

Type of post		Staff to be assigned to managing the operation		Source		Duration
		Permanent posts DG I	Temporary posts	Existing resources in the DG	Additional resources	
Officials	A	1	None	1	None	permanent
	B					
	C					
Other resources		None				
Total		1		1		

10.2 Overall financial impact of human ressources

	Amounts	Method of calculation
Officials (see*) 1A	108.000*ECU	1 x 108.000 ECU
Temporary staff	none	
Other resources (indicate budget heading)	none	
Total	108.000*ECU	

*By using existing ressources necessary to manage the operation (calculation based on titles A-1, A-2, A-4, A-5 and A-7)

10.3 Increase in other administrative expenditure as a result of the operation

ECU

Budget heading	Amounts	Method of calculation
A-7030 (Meetings)	39.000 ECU	4 meetings (1 day each) a year Average cost for one national expert per Member State and per meeting : 650 ECU 4X15x650 ECU
Total	39.000 ECU	

The credits will be found in the existing envelope of DG I.

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