

COMMISSION OF THE EUROPEAN COMMUNITIES

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M E M O R A N D U M

on the implementation of an iron and steel research programme,
with a view to obtaining financial aid under
Article 55(2)(c) of the ECSC Treaty

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the ESCS Treaty

I - INTRODUCTION

This memorandum consists of 11 projects that will form the first part of the ECSC programme of research and development on iron and steel for 1983 for which aid under Article 55, 2(c) of the ECSC Treaty is requested. After detailed examination of these proposals by the services of the Commission in collaboration with the Iron and Steel Technical Research Committee, they have been selected as first priority for the inclusion in the programme.

In the evaluation of the proposals, priority has been given to those that correspond most closely to the criteria outlined on the medium term orientation for steel research (1981-1985)(*) and which have the following overall objectives :

- to improve industrial competitiveness by reducing production costs and improving the product and
- to promote steel as an engineering and structural material through studies of the service properties and utilisation of steel.

The technical scope of this first part of the programme for 1983 is confined to the areas of ironmaking in the blast furnace, measurements and analysis and constructional steels.

In the research on blast furnaces, further support is proposed on coal injection techniques aimed at eliminating the need for fuel-oil injection and lowering the coke rate, thereby reducing operating costs. In the field of measurements and analysis, the main themes deal with the hot surface inspection and repair of cast and semi-finished products and the development of more advanced chemical analytical techniques needed for monitoring and controlling various stages of iron and steel production. Finally, the projects in the field of constructional steels are aimed at the achievement of superior mechanical properties of rolled products by optimising alloy composition and thermo-mechanical history and the improvement in the service performance of steel components for automobile applications.

The financial aid for the 11 research proposals outlined below amounts to a total of 2.920.800 ECU. To this is added 79.200 ECU for ancillary costs and dissemination of information, giving a total financial commitment of 3.000.000 ECU.

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(*) Official Journal C99, Vol. 24, 2 May 1981

II. THE RESEARCH PROJECTS

II.1. ORE REDUCTION

(Blast Furnace)

Both of the projects described below pursue the aim of replacing part of the metallurgical coke with coal breeze, which is injected via the tuyères. This is a priority problem since for economical reasons most blast furnaces have abandoned oil injection in favour of all-coke operation.

P 1377 : Metallurgical aspects of powdered coal injection in blast furnaces

This project is intended to determine the ratio in which coke can be replaced by coal and to investigate the gasification and combustion behaviour of different types of coal. The following measurements will be carried out on the blast furnace :

- measurement of transport parameters
- measurement of heat loss at the tuyères
- observations using an endoscope
- measurement of combustion parameters
- sampling from the tuyère zone to determine degree of combustion
- testing different pipe designs to determine optimum blast/coal ratio.

There are also plans for laboratory testing of the different types of coal.

Applicant : IRSID - St Germain-en-Laye
Budget : 795.000 ECU
Poss. duration : 3 years

P 1428 : Blast furnace coal injection

The project has two objectives :

- a) injection of coal breeze (pneumatic)
- b) injection of coal/water slurry

The following are to be studied :

- The performance of different types of pneumatic injection equipment.
- The effect on a blast furnace of injecting large quantities (100 kg/t crude iron).
- The maximum possible coal content of coal/water slurry for optimum mixture pumpability and stability.
- The effect of slurry on blast furnace performance.
- The combustibility of coal breeze and slurry.

The physical parameters are to be described in a model.

The preliminary research for determining combustion and lance parameters (for coal breeze and slurry) and the testing of the metering devices are to be carried out on a combustion furnace and followed by tests on the blast furnace.

Applicant : B.S.C. - London
Budget : 445.000 ECU
Poss.duration : 2 years

II.2. MECHANICAL WORKING

P 1370 : Computer control of a universal beam mill

The project objective is to improve output in beam rolling by means of computer control.

The mathematical model developed by IRSID under an earlier ECSC contract (7210-EA/3/304) is to be adapted for controlling a universal mill train, with

- calculation of optimum pass sequence;
- automatic control of mill stands;
- dynamic correction on every pass. When a given tolerance is exceeded the correction is to be made automatically for the next pass.

Applicant : ARBED - Luxembourg
Budget : 336.000 ECU
Poss.duration : 4 years

II.3. MEASUREMENTS AND ANALYSIS

In the manufacture of iron and steel products there is a reorganisation taking place which is aimed at improving processes and at rationalisation as well as at the widespread introduction of continuous casting processes and meeting the urgent necessity for a reduction in energy consumption per unit of metal manufactured. If the quality concept, which is becoming more and more of a competitive weapon in the world steel market, is added, it is easy to appreciate the importance which can be attached to new methods of analysis and examination for meeting the ever-changing and ever more demanding requirements and acceptability criteria in the field. It must also be emphasized that there is an increasing tendency towards, on the one hand, computer-assisted equipment and/or monitoring and analysis facilities, and on the other hand towards bringing industrial robotics into the control of new plant. The projects listed below have been devised with that in mind and to meet the demand.

P 1281 : Zeeman effect on background correction during atomic absorption spectrometric analysis

Metallurgical laboratories are ill-equipped to face the impressive increase in the number of requests for analysis of trace elements. Flame atomic absorption spectrophotometry is well known and all that is required is to add an atomizer for the method to be applicable to trace analysis. The aim of the research is to study the applicability of Zeeman-effect atomic absorption spectrophotometry to the analysis of ferrous materials. This research will be closely linked

with research projects 7210-GA/407 and 7210-GD/401 which are currently under way.

Applicant : Creusot-Loire - Firminy
Budget : 135,500 ECU
Poss. duration : 2 years

P 1314 : System for inspection and reconditioning iron and steel products

The project has two main aims : to develop and construct an automatic system for inspecting the surface condition of iron and steel products at high temperature and reconditioning in accordance with the information transmitted by the inspection unit. The work will consist in linking a visualization unit selection of which will be part of the research (TV camera, ultrasound device, photodiode networks, Foucault current) to a robot having sufficient degrees of freedom to be able to inspect any surface of the test piece from different angles. Similarly, the reconditioning unit, which may be a deseaming torch for example, will be mounted on the same support and articulated so as to be free to move in different directions.

Applicant : CRM - Liège
Budget : 498.000 ECU
Poss. duration : 3 years

P 1316 : Analysis of elements in very small concentrations by coupled furnace and plasma torch spectrometry

The purpose of the project is to examine the simultaneous determination of trace elements in various ferrous materials. This is the logical application of the plasma torch from previous work subsidized by the ECSC. Simultaneous determination of trace elements (beryllium, bismuth, arsenic, antimony, tellurium, boron, etc.) in the various iron and steel products is on the increase. CRM proposes to connect up a graphite-lined furnace at high temperature (2000° to 3000°) to volatilize the test piece and to introduce the vapour (atomization) into the plasma torch of an I.C.P. (inductive coupling plasma) spectrometer. The initial phase of the project will be devoted to establishing the experimental conditions best suited for the analysis, and then a start will be made on direct analysis of solid materials.

Applicant : CRM - Liège
Budget : 207.500 ECU
Poss. duration : 3 years

P 1337 : On-Line thickness profile measurement of hot wide strip

Development and construction of a differential thickness gauge for the profile and flatness of hot-rolled wide strip. The principle applied to that of attenuation of ionizing radiation. The radioisotopes which it is intended to use in this work are Cs¹³⁷ and Am²⁴¹. The principle to be used will be the simultaneous measurement of about 5 traces using point detectors in each edge zone,

an emitter placed on the opposite side of the strip irradiating the entire edge zone. This project should enable the European industry to avoid having recourse to Japanese equipment (Toshiba X-ray gauge). The work is to be carried out in collaboration with the BSC at Port Talbot, which has considerable experience in industrial gammametry. This research is confined to measurement of the thickness profile of the strip as it emerges from the rolls.

Applicant : Hoesch - Dortmund
Budget : 751.000 ECU
Poss. duration: 3 years

P 1391 : Optical inspection of the surface of hot continuously cast semis

The objectives of this project are energy saving coupled with improved product quality. Inspection of the surface of hot semi-finished products is therefore one of the essential conditions for hot charging or direct rolling. In previous research projects (agreements 7210-GA/304 and 7210-GB/301), IRSID devised two methods for the inspection of hot iron and steel products :

- Foucault current (fine defects and inclusions)
- Optical sensor (TV camera) (extensive surface defects).

As part of the latter study IRSID intends to continue the work undertaken during the previous projects, making use of the results obtained there but directing its efforts towards the detection of surface defects of the longitudinal crack type in continuous casting products after descaling.

Setting up a series of detectors on an industrial installation. Development of data processing to permit fully-automatic detection.

- Real time processing of visual information using a special numerical analyser in situ.
- Testing of detection algorithms using an on-site minicomputer.

Applicant : IRSID - St Germain-en-Laye
Budget : 527.000 ECU
Poss. duration : 3 years

P 1408 : Integrated system of chemical analysis to monitor the continuous casting of Al-killed steel

In the production of low-carbon Al-killed steels, to obtain continuous-cast slabs of a high quality it is essential to have information on oxygen activity and on the content of soluble and insoluble aluminium at each stage of the process. To achieve this the information on the evolution of both the steel and

the slag must be relayed promptly to the manufacturing control centres, the information must be reliable and the algorithms used for processing it must be tailored to give sufficiently accurate predictions and reduce as far as possible the input data required. This, generally speaking, is the aim of the project, which is designed to be split up into three activity sections.

Series of data gathering campaigns (in two steelworks : OBM and LD).

- a) Correlation between compositions at each stage in the process.
- b) Establishment of data acquisition points or sampling points and frequency of data collection or number of samples taken in routine conditions.
- c) Working out techniques for measurement, sampling, preparation of test pieces and how best to use them for analysis purposes.

Applicant : CSM - Roma
Budget : 307.500 ECU
Poss. duration : 3 years

II.4. SERVICE PROPERTIES AND PERFORMANCE

(Constructional Steels)

Research projects on the fatigue behaviour of steel components are of vital importance both on safety grounds (welded motor vehicle structures, for example) and for reasons of economy at the fabricating stage (energy savings, optimization of heat treatment and alloying elements). The proposed projects reflect these considerations.

P 1397 : Present prospects for the development of constructional steels and their treatment

Alongside the development of thermomechanical treatments for low-carbon low-alloy steels, the engineering industry will obviously always have a need for higher carbon steels, generally low-alloy, having excellent mechanical properties either throughout the cross section or on the product surface. The growing costs of conventional full heat treatment for engineering parts will increase the pressure on steelmakers to supply pre-treated half-hard steel bars already having the mechanical properties and structures required for service. Apart from conventional quenching and tempering carried out on bars before delivery, accelerated cooling structures could be of interest if the treatment could be carried out in line and tempering omitted or reduced. A degree of expertise in continuous controlled cooling has now been acquired. By combining this with in-line induction heating, it is possible to develop both properly controlled complete fast thermal cycles that will enable better use to be made of the ends of rolling stocks and also economic compositions. The purpose of the research is to investigate the possibilities of adapting the compositions of hard or half-hard steels and the treatments available by combining different treatments in the rolling line:

- Grain refining during rolling with controlled cooling before final working.
- By means of rolling stopped at about 750-700°C, modification of the conditions of pearlite germination so as to obtain without difficulty fine non-laminar pearlite, which is more ductile than coarse pearlite.
- Use of controlled cooling (flat jet or spray banks) of product at rolling heat to control secondary structures (including possibilities of precipitation hardening) and their gradients in the bar section.
- Use of brief induction tempering in the rolling line to attenuate the effects of structural gradients obtained during continuous quenching.

Applicant : IRSID - St Germain-en-Laye
Budget : 376.500 ECU
Poss. duration : 3 years

P 1416 : Use of steel in the motor industry with the necessary characteristics for finite life design criteria

This programme forms the second stage of the research undertaken in 1982 with the financial assistance of the ECSC for the purpose of promoting the use of steel for structural components. The primary object of the project as a whole is to provide a reliable basis for the design of lightweight mechanical components and for the choice of suitable steels through efficient and significant characterization of the steels themselves so that the fatigue life of mechanical components made with them can be predicted. The first stage covers the characterization of a number of steels, some of which will be studied more extensively in a subsequent second stage so as to determine the influence of factors such as chemical composition, type of fabricating process, etc. The parameters obtained during the characterization studies are used as direct inputs to the computer programmes for determining the projected fatigue life of mechanical components.

The input data required for these programmes are the load and strain time histories of the components investigated, the right stress concentration factor for the critical areas and the parameters characterizing the cyclic behaviour of the material.

It is planned to use last-generation computer programmes for the research and to make a critical evaluation of some of the general assumptions which can possibly be improved in the light of a better knowledge of the elastoplastic behaviour of the steels.

Applicant : CSM - Roma
Budget : 489.000 ECU
Poss. duration: 1 1/2 years

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Project No	Title of Research	Research proposed			Financial Aid	
		by	Probable duration (years)	BUDGET ECU (30.9.1982)	%	AMOUNT ECU (30.9.1982)
1416	Use of steel in the motor industry with the necessary characteristics for finite life design criteria	CSM	1 1/2	489.000	60	293.400
	SUB-TOTAL			4.868.000		2.920.800
	ANCILLARY COSTS AND DISSEMINATION OF INFORMATION					79.200
	TOTAL					3.000.000

Communication from the Commission of the European Communities to companies in the ECSC

(Article 48 of the ECSC Treaty)

In the letter to the chairman of the Consultative Committee of the ECSC, the Commission asked the Committee to undertake the consultation laid down in Article 55 (2) (c) of the Treaty concerning the desirability of allocating the following sums from the levies laid down in Article 50 of the Treaty for financial aid aimed at facilitating the following technical research projects.

Under Article 48 of the Treaty, associations of companies in the ECSC are entitled to submit to the Commission the observations made by their members concerning the undermentioned subjects of consultation.

Any observations should be received by the Commission not later than ~~10 March 1982~~ ^{January 1983}

(in ECU)

1377 1	Metallurgical aspects of powdered coal injection in the blast furnace	477.000
1428 2	Blast furnace coal injection	267.000
1370 3	Computer control of a universal beam mill	201.600
1287 4	Zeeman effect on background correction during atomic and absorption spectrometry analysis	81.300
1415 5	System for inspection and reconditioning of steel products	298.800
1276 6	Analysis of elements in very small concentrations by coupled furnace and plasma torch spectrometry	124.500
1287 7	On-line thickness profile measurement on hot wide strip	450.600
1291 8	Optical inspection of the surface of hot continuously cast semis	316.200
1408 9	Integrated system of chemical analysis to monitor the continuous casting of aluminium-killed steel	184.500
1397 10	Present prospects for the development of constructional steels and their treatment	225.900
1416 11	Use of steel in the motor industry with the necessary characteristics for finite life design criteria	293.400