SPACE APPLICATIONS INSTITUTE

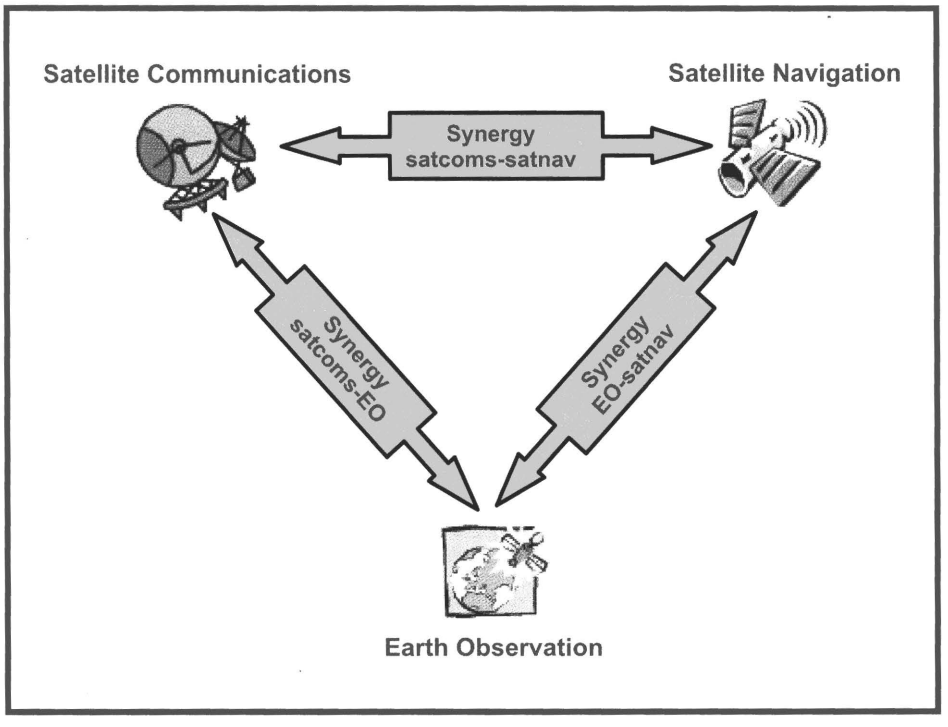
ASTRON

Applications on the Synergy of
satellite Telecommunications,
eaRth Observation and Navigation

PROCEEDINGS

ASTRON INFORMATION DAY

19 January 1999



CEE: XV / 8

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Space Applications Institute

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Preface

ASTRON (Applications on the Synergy of satellite Telecommunications, eaRth Observation and Navigation) is one of the eleven projects of the Space Applications Institute (SAI) for the 5th Framework Programme (1999-2002). ASTRON investigates the synergy of the three space technologies with the aim to identify, develop and demonstrate sustainable space applications. ASTRON is under the responsibility of the SSSA (Strategy and Systems for Space Applications) Unit of SAI. On the 19th of January 1999, SAI organised an Information Day in Ispra, Italy. The objective of the day was to give information about the results of the ASTRON Pathfinder Phase (1996-1998) and to present the initial plans for the next 4 years. The day was an open event. In the morning, information about ASTRON was flowing from SAI to the attendants (what was done, what is planned). In the afternoon, information was flowing from other services that undertake projects / activities relevant to ASTRON. Services in this respect were either EC services (DG III, VII, XII, XIII, JRC) or external to the EC (space agencies, data providers, space segment operators, etc). This volume includes the presentations of speakers and the list of participants.

AGENDA, 19 January 1999
ASTRON Information Day

Session 1: ASTRON (background, status and plans; chair: P. Churchill, EC

- Welcome - P. Churchill, SAI
- ASTRON - Introduction and Background - M. Ketselidis, SAI
- A market perspective: benefits for Europe from integrating space technologies - S. Howes, ESYS
- Case Study 1: Distribution of meteo data over satellite - D. Bestwick, AVANTI

Session 1 (contd.)

- Case Study 2: Distribution of EO data from the Vegetation archive - S. Vizzari, MSI
- Synergy of EO and Navigation - V. Ashkenazi, NS Ltd
- ASTRON: Current status and plans - M. Ketselidis, SAI

Session 2: EC Round Table (EC projects / activities relevant toAstron); chair: P. van Nes, EC

- DG III - Industry - E. Cremer
- DG VII - Transport - C. Edmonds
- DG XII - Science, Research and Development - T. Businaro
- DG XIII - Telecommunications, Information Market and Exploitation of Research - B. Barani, W. Boch, M. Monteiro
- JRC - Joint Research Transport (P. Van Nes, J. Aschbacher)

Session 3: Non-EC projects / activities relevant to ASTRON; chair: P. Churchill, EC

EO Data Providers

- EUMETSAT - W. Dillen
- Spot Image - L.F. Guerre
- Space Imaging Europe - N. Spiropoulos

AGENDA, 19 January 1999
ASTRON Information Day

Satcom Operators
- EUTELSAT - M. Nikolaidis
- SES / ASTRA - P. Glover

Space Agencies
- ESA - E. Rammos
- CNES - G. Blondeau
- DLR - A. Jungstand
- BNSC - R. Robinson

SESSION 1
ASTRON: background, status and plans

ASTRON: INTRODUCTION AND BACKGROUND

M. KETSELIDIS, JRC, JOINT RESEARCH CENTRE

ASTRON - Introduction and Background

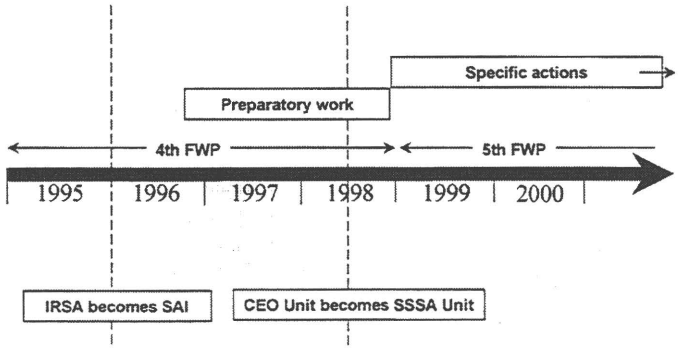
(mid 1996 - mid 1998)

Applications on the Synergy of satellite Telecommunications, eaRth Observation and Navigation

Objectives:

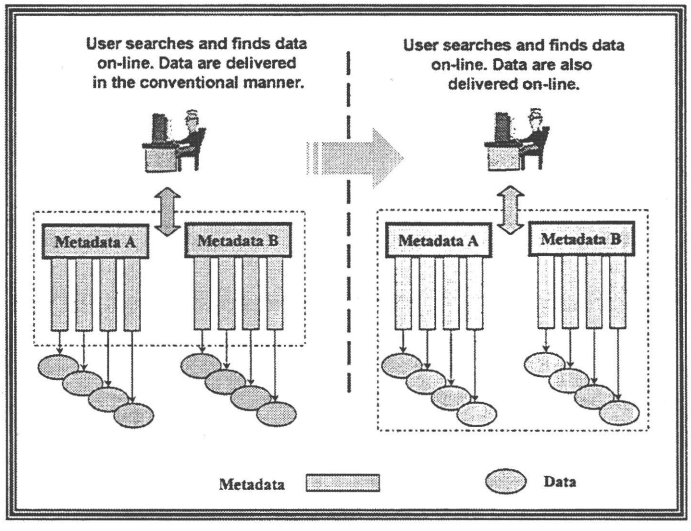
- **To investigate the synergy between satcoms, EO and satnav in order to develop innovative and sustainable applications.**
- **To provide direct support to the EC services responding to their requirements, in the areas of our technical competence**

ASTRON timeline and SAI evolution



EO requirements for on-line access

from metadata to data



CEO Programme

Synergy of space applications: Examples

- **EO and satcoms**

  - ➪ Information Broadcast: Distribution of the same data to 1000 users may be cheaper using satcoms than with telephone lines: One transmission, instead of a thousand.
    - ❑ Meteorological data
  - ➪ Areas of poor infrastructure: In developing countries satcoms may represent the only efficient way for information transfer.
    - ❑ Certain Users of *Vegetation* data
    - ❑ EO receiving stations in Usbekistan, Mongolia, Antarctica.
  - ➪ Monitoring networks: Collection of monitoring data
    - ❑ A FPIV project regularly transmits sea state and positioning data from sea buoys to a central site, over satellite. These data would normally be retrieved manually.

- **EO and navigation**
  - ➪ Improved products
    - ❑ Two FP IV projects use the GPS signal delay to improve atmospheric water vapour measurements for operational meteorology.

Synergy in other EC FPV preparatory work

The 5FP and Space Technology Applications (SEC(1998)1055, June 98) :
...The three areas of space technology applications in communications, navigation and EO together constitute the different facets of a challenge. Integration of several of these applications under a common satellite infrastructure can pave the way towards systems that offer global information services, and development of generic critical technologies for such systems will benefit several applications at the same time...

input for FPV

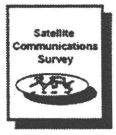
Report on R&D, DG XIII (ACTS) Satellite Working Group, Jan 98 (BNSC, CNES, DASA, ALCATEL, ALENIA, ESA, IMARSAT, EUTELSAT, THOMSON, FT, BT, EUROSPACE, TELESPAZIO, SAAB): 11 technological fields are proposed as themes for EC support in the 5FP: Components, RF elements, ..., *Links to EO and navigation.*

ASTRON - Background work (1)

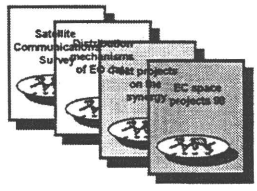
1996: Workshop *'Effective synergy of EO and satcoms'*

Ispra, Dec.1996

1997: 1 Report, *'Satcoms survey 1997'*

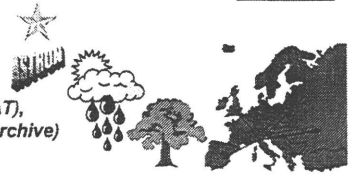


3 re-prints todate

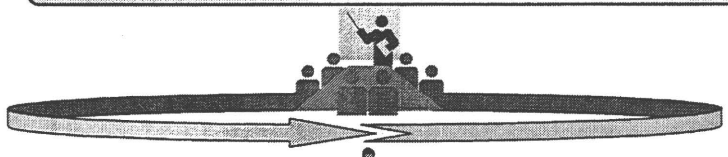


1998: 4 Reports,
'Satcoms survey 1998',
'Distribution mechanisms of EO data providers' (2 parts),
'Past projects on the synergy of EO and satcoms',
'EC Space Compendium 98' (in support of the EC SCG)

1998: 3 industrial studies,
'Development of the ASTRON concept',
'Distribution of meteo data over satellite' (with EUMETSAT),
'Distribution of Vegetation data' (with VITO, the Belgian archive)



Workshop, 12-13 December 1996, JRC Ispra
Effective Synergy of Satellite Communications with Earth Observation Applications



European Space Communications Systems

- Aerospatiale
- Alcatel
- Alenia
- Dornier / DASA
- Eutelsat
- Inmarsat
- Matra Marconi Space
- Nuova Telespazio

EC and ESA experience, current initiatives and plans

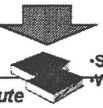
- DG III (Industry)
- DG XII (Research)
- DG XIII (Telecommunications)
- ESA (ESTEC & ESRIN)

attending

- DGI (External Relations)

SAI Earth Observation Applications

- Advanced Techiques Unit
- Agricultural Information Systems Unit
- Centre for Earth Observation Unit
- Environmental Mapping and Modeling Unit
- Marine Environment Unit
- Monitoring Tropical Vegetation Unit



- Satellite Communications Survey '97
- Workshop Proceedings

Space Applications Institute
Unit: Strategy and Systems for Space Applications

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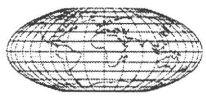
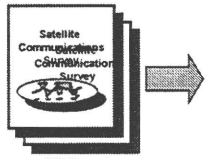
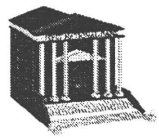
Communication - 1997



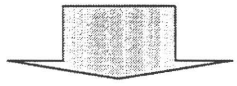




Requests from various countries (EU, US, China, Israel, Lithuania, Bulgaria, Algeria..)

- Ministries (US Defense,...),
- Banks (ABN, Chase Manhattan,...),
- EC General Directorates (I, III, IV, VII, XI, XII, XIII, XVI,...)

More than 1000 copies today (three re-prints)



New activity initiated!

Applications on the Synergy of satellite Telecommunications, eaRth Observation & Navigation

Space Applications Institute
Unit: Strategy and Systems for Space Applications

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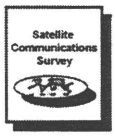

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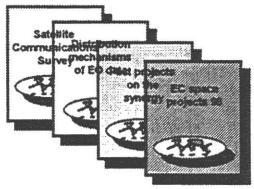

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'Development of the ASTRON concept',
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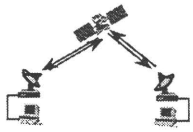
'Distribution of Vegetation data' (with VITO, the Belgian archive)

ASTRON - Background work (2)

- **1996**
  - ⇨ Demonstration project: Transmission of EO data, (ATM over satellite) with EUTELSAT, building on a DG XIII-ACTS project



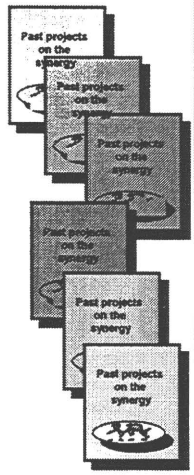
- **1997**
  - ⇨ Collaboration agreements EUMETSAT, CCRS (Canada)

- **1998**
  - ⇨ Issue of Call for Ideas in the EC Official Journal
  - ⇨ Consultation meetings
    - ❑ national level (Space Agencies - UK, D, F,..)
    - ❑ European level (EUMETSAT, ESA)
    - ❑ EC level (Collaboration meetings, Ispra & Brussels, XIII/A, III/F, XIII/C)

  - ⇨ Participation in GNSS-2 Forum
  - ⇨ 5th EEOS Workshop on 'On-line Data Access', Edinburgh, UK
- **1999**
  - ⇨ Satellite link in Indonesia in support of DGIB (Data transfer in the frame of SARI project)

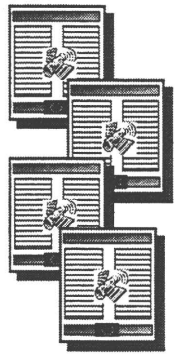
Results of Pathfinder Phase : Reports

- *'Satellite Communications Survey - Systems & Applications, release 2', (EUR 18146EN)*
- *'Overview of Current and Planned Spaceborne Earth Observation Systems; the Report - Missions, Instruments, Orbits, Products, Indicative Costs', (EUR 18673 EN)*
- *'Overview of Current and Planned Spaceborne Earth Observation Systems; the Handbook - Scenarios of Integrated Space Applications (Satcoms and EO)',(EUR 18672 EN), available in March 1999*
- *'Inventory of projects, with a European dimension, where Satellite Communication are used for Earth Observation applications', (EUR 18675 EN)*
- *Space Compendium '98 (all space projects that the EC funded in the 4FP and TEN TELECOM), available in April 1999 (in support of the EC's Space Coordination Group)*
- *'Satellite Navigation Survey - Systems & Applications, Report, available in April 1999*



Results of Pathfinder Phase Info Sheets

- *'Synergy of Earth Observation and Satellite Communications – A potential market perspective'*
- *'Synergy of Earth Observation and Satellite Communications – Feasibility Study 1: Distribution of meteorological data over satellite'*
- *'Synergy of Earth Observation and Satellite Communications – Feasibility Study 2: Distribution of data from the Vegetation archive', available in February 1999*
- *'Synergy of Earth Observation and Satellite Navigation – A potential market perspective', available in April 1999*



A MARKET PERSPECTIVE FOR ASTRON: DERIVING GREATER BENEFITS FOR EUROPE FROM INTEGRATION OF SATELLITE SERVICES

S. HOWES, ESYS LIMITED

A market perspective for ASTRON: Deriving greater benefits for Europe from integration of satellite services

Sally Howes

JRC, 19 January 1999

Final presentation of a concept study performed for SAI by ESYS and Spot Image

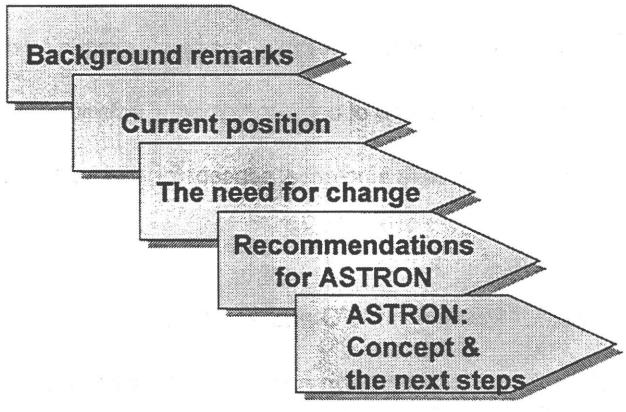
ESYS Limited
1 Stoke Road, Guildford GU1 4HW
01483 304545
showes@esys.co.uk

ESYS:
J Styles
A Davies

Spot Image:
L-F Guerre

ESYS

Presentation guide



ESYS

Background remarks

Why debate ASTRON?

- An initiative dedicated to "SYNERGY" of space technologies has gained support
- ***The proposition***:
  - Synergy can deliver improved benefits to customers of space based services thus increasing the market
  - European suppliers need a dedicated programme to assist in building new business partnerships both to respond to and also to stimulate demand

- ***Some of the constraints***:
  - Research funding of space programmes to date has made it difficult to exploit synergy at European or national levels
  - The "pull" should be from "downstream" industry although these organisations are not strong enough to lead the change required
  - Pricing models today and lack of commercial service development are barriers

ESYS

The aims of the ESYS & Spot Image investigation

- To research the needs for "synergy", examining relevant initiatives
- To form a view of ongoing "synergy" activities
- To formulate a potential concept for ASTRON as an EC initiative

Consider synergy of EO and satcoms only

An informal consultation process with 34 representatives from industry, EC, ESA and National space agencies

ESYS

Different aspects of synergy

	Type of synergy	EC	ESA	Eumet-sat	National	Industry/ Market
Mission	space segment implementation		✓		✓	✓
	shared space platforms			✓		✓
	comms signals for EO		✓			
	comms platforms of opportunity		✓		✓	
Ground infrastructure	local data collection			✓	✓	✓
	EO ground segments		✓	✓	✓	✓
	product delivery	✓	✓	✓	✓	✓
Services for the market	digital information services					✓

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The mystery of synergy

- Why focus on it? Who will benefit?
  - EO suppliers may stand to gain more
  - EO markets are not attractive business opportunities for satcoms operators
- Look for the bigger picture: not synergy but **integration**
  - satcoms with terrestrial
  - satellite EO data with other information
  - interconnection of comms and information into emerging digital interactive services
- Opportunity to exploit satellite technologies not in their own right but integrate them easily within broader information services. This needs:
  - reorientation of R&TD
  - new business partnerships (information service operators)
  - a different sales approach for satellite services providers

Impacts the current satellite "value adding" sector

ESYS

Markets & drivers for digital information services

Government:

- European monetary union
- re-engineering Government administrations
- open access to government data (individual rights - global public interests)
- pressure to manage natural resources, growth of urban populations, pressures for intelligent transportation systems, managing disasters
- global environmental change
- defence and security aspects

Corporate:

- networking changing work practice
- progressive emergence of a single market
- shared information in the virtual enterprise
- new business paradigms
- re-engineering the boundary between industry and government
- business intelligence
- accelerated pace of change

Consumer:

- electronic commerce
- integration of digital technologies in the home (computing, TV, radio and audio, cameras, camcorders)
- new interaction technologies
- access to public services
- education on demand
- lifelong training services

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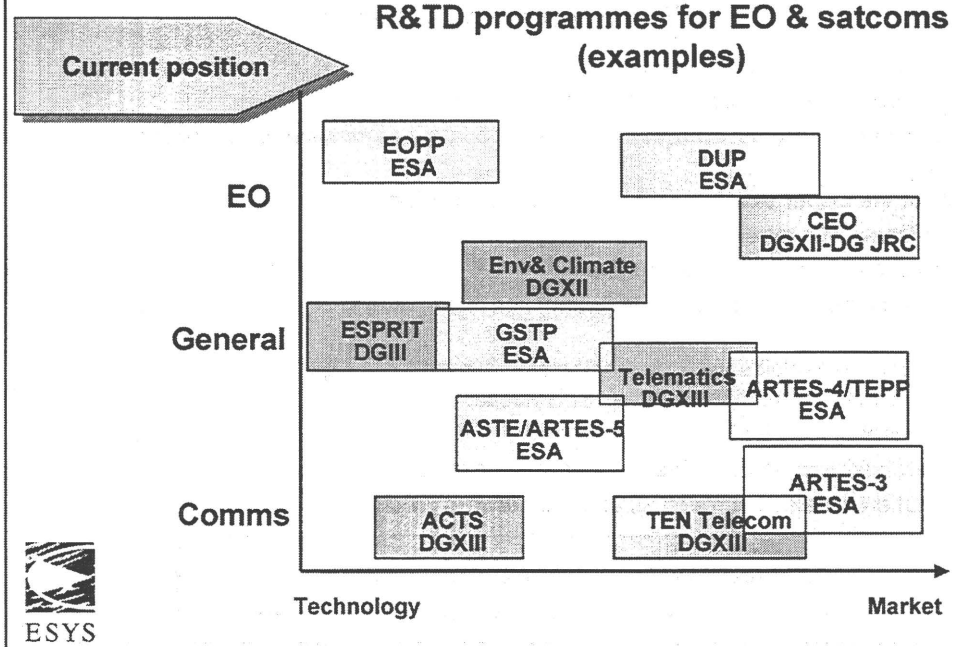
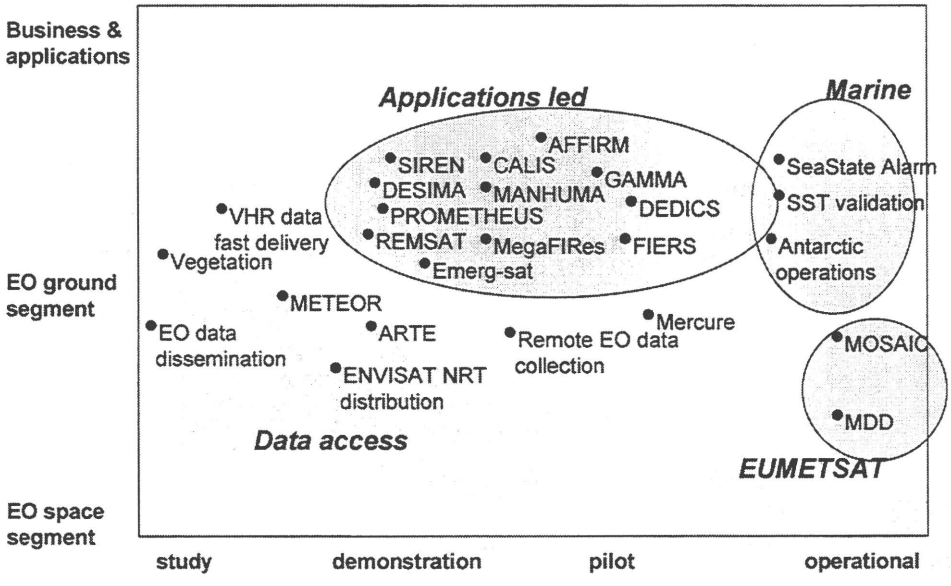
R&TD programmes for EO & satcoms (examples)



ESYS

Today's projects integrating EO with satcoms



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The need for change

Business as normal is not an attractive proposition

EO aspects:

- The volume of global business in selling EO products and services today is not sufficient to sustain further investment in future European satellite systems
- There is a mismatch between investment and the areas of greatest risk to business development
- No major growth markets have emerged 1994 - 1997

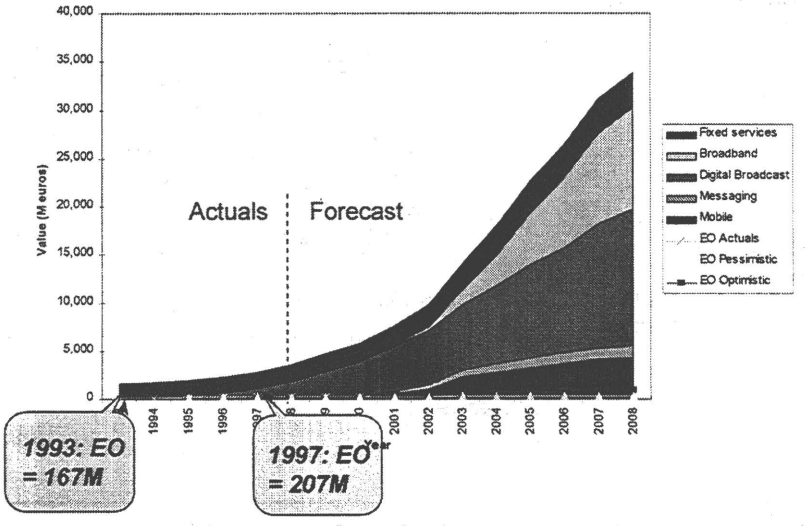
Satcom aspects:

- Satcom works best for broadcast applications
- Satcom operations still have a modest share of overall comms market (2-5%)
- Increasing realisation of importance of new market applications to grow demand & need for integration with terrestrial services

Common needs:
- break out from an expensive niche industry
- break into mainstream business

ESYS

Revenues for European suppliers of satellite services



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The lure of interactive digital services

- The interactive service industry is a major growth sector for European companies - and has been assisted in Framework IV
- Involves, telecoms operators, internet providers, broadcasters, publishing, media, IT
- Total value of the business in Europe in 1996 was 419 B euro
- Driven by reduced bandwidth costs (bandwidth on demand) and falling equipment costs on communications and network side
- Recognised that "***content***" is the most important asset
  - a targeted bundle of information, comms & transaction service
  - estimated at 50% of service revenue
- An industry in transition - convergence processes

ESYS

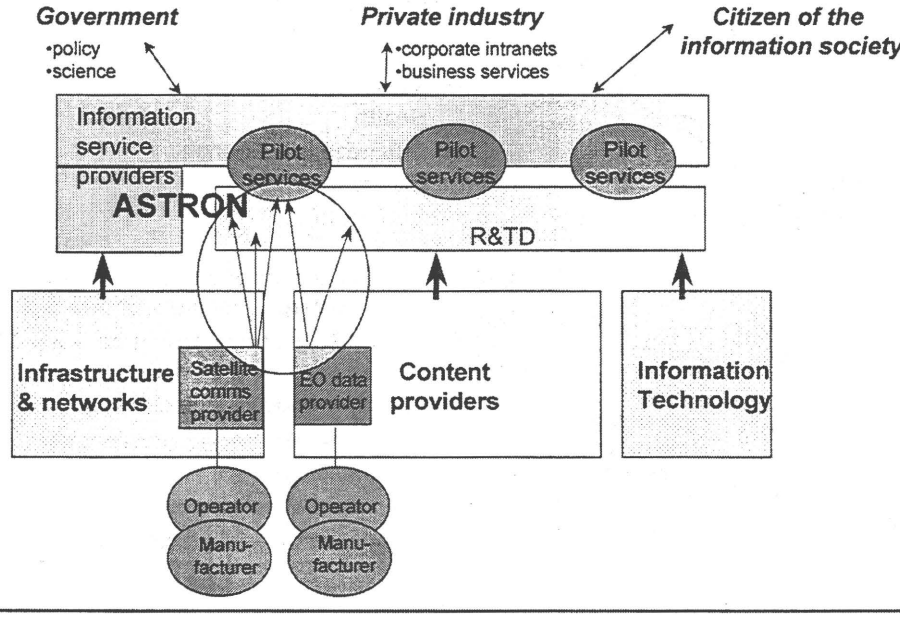
Recommendations for ASTRON

The missing link for success

- The desirability to serve European government administrations, European business and the citizen with improved digital information services is widely recognised
- Framework V is responding to this need through the Information Society Technology Programme
- Potential for satellite services to contribute is high in the medium to long term
- In the short term there are some engineering, organisational and business constraints associated with existing satellite services developments and organisation of the industry
- The EC is in a good position to assist through a dedicated initiative in ***satellite service integration*** - taking the longer term & market oriented view
- Many business opportunities are pan-European and global

ESYS

Where does ASTRON fits in?



ESYS

ASTRON: The concept & the next steps

Creating a focus for ASTRON

To improve benefits from the use of space technologies and services in Europe by assisting in their integration within emerging digital information services

Especially where services may not be cost effective today

Through a range of science, technology, regulatory support actions

(1) Identify markets and target services

(2) Offer incentives for incorporating space based technologies & services

(3) Maximise opportunities for commercial development

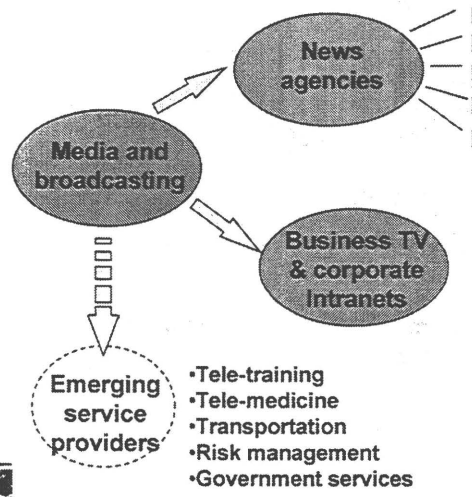
The interface with providers (private & government)

(4) Provide feedback to satellite mission operators & for new missions

Scope can be varied according to budget

ESYS

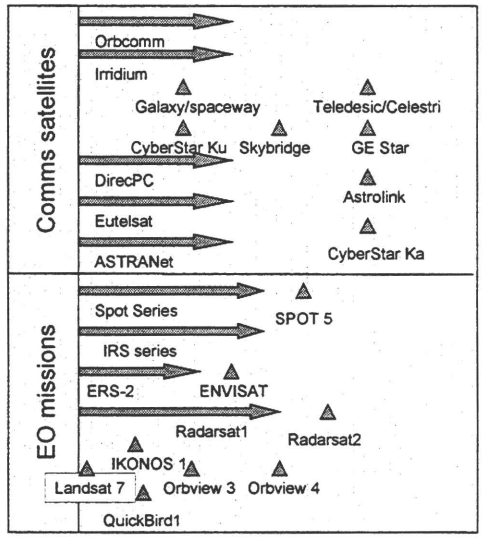
The way in



- Look beyond traditional players at emerging markets for new digital service
- Seek commonalities between JRC and other FPV activities:
  - Serving the citizen
  - Enhancing sustainability
  - Underpinning European competitiveness
- Look for entry points for satellite services

ESYS

The timing is good: new missions and services in the ASTRON lifetime



ESYS

Concluding remarks

- There is a role for ASTRON as an EC initiative:
  - ***INTEGRATION*** not synergy
  - ***DIGITAL INFORMATION SERVICES*** not space or ground segment infrastructure
- There are some good opportunities to benefit more from space technology in Europe and consequently to help increase the market for suppliers
- The critical need is to enter the mainstream information service market and less dependent on an **"satellite-view of the world"**
- Judgement on the "winning" digital information services to back will be key:
  - start by building on what has emerged: ***decision support services for disaster management (liaising with EC, ESA & National programmes)***
  - identify new themes (within Framework V and beyond):
    - environmental information services for the citizen
    - environmental treaty verification for Central & Eastern Europe

ESYS

FEASIBILITY STUDY INTO THE DISTRIBUTION OF METEOROLOGICAL DATA BY SATELLITE

D. BESTWICK, AVANTI COMMUNICATIONS

"Feasibility Study into the Distribution of Meteorological Data by Satellite"

ASTRON Information Day

Ispra, 19th January, 1999

Avanti Communications Ltd
1 Catherine Street
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Objectives and Methodology

- Meteorological data has a number of important characteristics:
  - requirement for timely dissemination;
  - large user community;
  - large data sets.
- EUMETSAT already disseminates data via satellite communications, but:
  - MTP communications payload designed in the 1970's;
  - MSG communications payload designed in the early 1990's and due to operate until 2010.
- Can commercial satellite communications systems provide an efficient and effective complementary means for distributing meteorological data ?
- If so, what is the best way of demonstrating this capability within a European context ?

User Requirements Analysis (WP 100)

- A wide range of potential met users were contacted.
- Seven potential demonstration services were identified:

1) Meteorological Archive and Retrieval Facility (MARF) Data Distribution
   - EUMETSAT archive of MOP and MTP data;
   - Plans for evolution to Unified MARF incorporating MSG and EPS data;
   - Current access via Internet - limited product delivery capability via FTP;
   - Satellite Internet services may overcome terrestrial bottlenecks.

2) Meteorological Self-Briefing Terminal (MIST)
   - UK Met Office weather information service for small businesses;
   - PC connection to Met Office Host Computer via PSTN or X.25;
   - Extracts from met databases used to generate user products;
   - Limited availability of satellite and rain radar data due to bandwidth;
   - Hourly broadcast of met database would overcome bandwidth restrictions.

User Requirements Analysis (2)

3) Public Met Services for Developing Countries
   - both WEFAX and MDD missions support users in Africa to some extent;
   - SDUS or MDD User Stations required;
   - data is transmitted in analogue format.

4) Indian Ocean Experiment (INDOEX)
   - an experiment to investigate aerosol and pollutant distribution in Indian Ocean;
   - Meteosat-5 moved to 63° East to support INDOEX;
   - modification to PDUS receiver required to acquire data between 135°E to 4°W;
   - two PDUS receivers required to obtain data from Primary Mission and INDOEX.

5) Foreign Satellite Data Disseminated via Meteosat
   - Meteosat dissemination schedules include broadcast of data from foreign satellites;
   - data is transferred by complex routes to Lannion for up-link;
   - a generic approach to data transfer could be desirable.

User Requirements Analysis (3)

6) Mesoscale Alpine Project (MAP)
   - an investigation of precipitation processes over the Alps;
   - uses Meteosat-6 (located at 10° W) to provide rapid scans (every 5 mins) of the Alps;
   - Meteosat-6 data collected over 6 to 18 hour periods of "interesting weather";
   - Up to 2.7 GB of satellite data collected over an 18 hour period and transferred to MAP Data Centre for onward dissemination to participants;
   - Meteosat-7 HRI data required at MAP operations centres for experiment planning.

7) Data Distribution for National Meteorological Offices
   - National Met Offices operate series of "Out Stations", e.g. UK, Germany;
   - Distribution of Meteosat data to these stations is desirable;
   - UK currently utilises military communications channels;
   - Deutscher Wetterdienst is examining a number of communications schemes.

Existing and Future Satellite Services (WP 200)

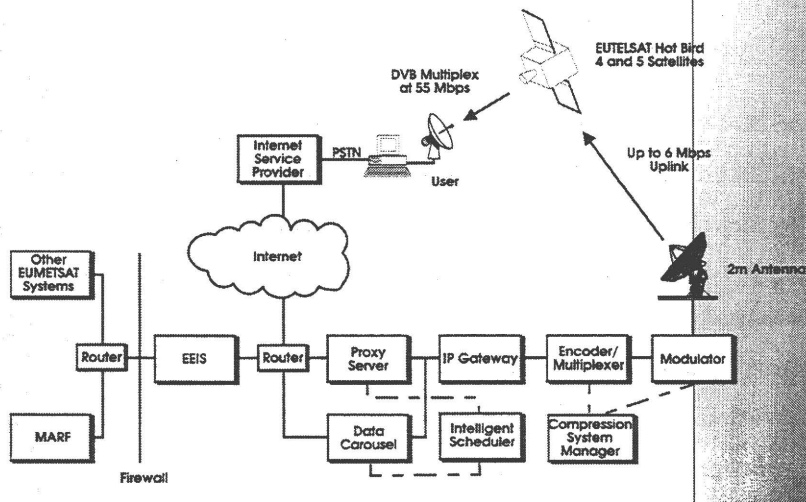
A short list of 7 satellite communications services was investigated:

- ASTRANET - multicast file delivery and streaming data;
- EUTELSAT Multimedi@ Platform - as above but suitable for bespoke services;
- Convergence1 - high speed Internet service using the EMP;
- Skyplex - enables multiple small up-link stations to broadcast on a single DVB multiplex;
- EuroSkyWay - Alenia-led GEO system for multimedia applications;
- WorldSpace - digital audio broadcast system covering developing nations;
- SkyBridge - very high bandwidth Internet service.

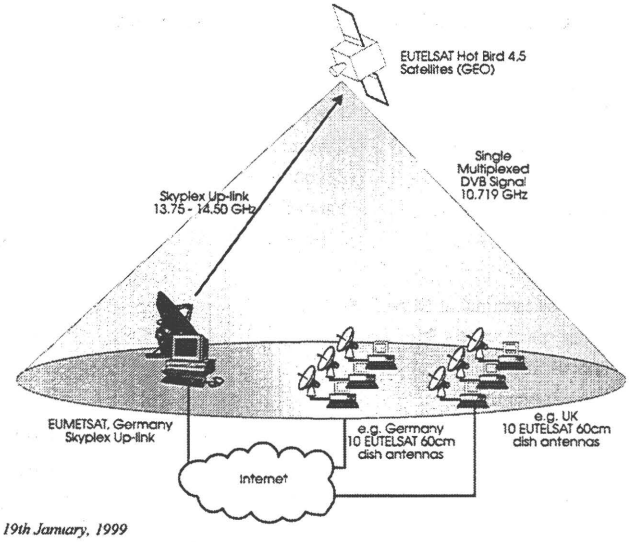
Selection of Demonstration Cases

- Demonstration case studies were selected following the Intermediate Review;
- Emphasis placed on projects of direct relevance to EUMETSAT's activities:
  - Satellite Internet access to the MARF;
  - Distribution of near-real-time data in support of meteorological research projects (e.g. MAP);
  - The evolution of these demonstrations into a operational services.
- Skyplex is well suited to the first two of these demonstrations:
  - the Skyplex terminal is small and inexpensive;
  - common hardware and software can be used for both demonstrations;
  - the demonstrations can be run concurrently;
  - the terminal can be located at EUMETSAT avoiding terrestrial Internet congestion.
- The third project looked at how the Skyplex demonstrations might evolve:
  - build on the DVB infrastructure and experience;
  - "scale up" the Skyplex demonstrations to a full DVB up-link.

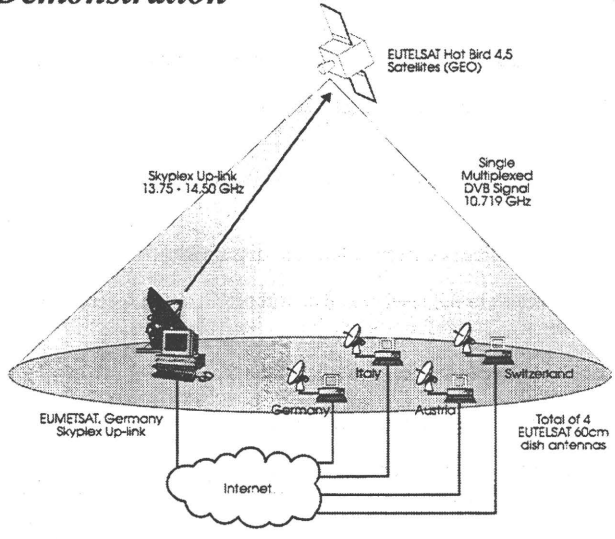
Demonstration System Configuration



Meteorological Archive and Retrieval Facility Data Access Demonstration



Near-Real-Time Data Dissemination Demonstration



Demonstration Plans

- Demonstration of MARF Access and NRT Data Dissemination requires a 15 month project:
  - Requirements Refinement 1 month;
  - Architectural Design 1 month
  - Detailed Design and Implementation 5 months
  - Integration and Test 2 months
  - Demonstration Operations 5 months
  - Review and Recommendations 1 months
- Main requirements:
  - Installation of a Skyplex terminal at EUMETSAT;
  - Rental of transponder space on Hot Bird 4 or 5;
  - Interface of Skyplex to EEIS;
  - Recruitment of user community.
- Budget
  - Less than 1.5 MEuro;
  - Reductions possible in the context of a Framework V project.

Conclusions - Why use SatComs ?

- Commercial Satellites have a role to play in meteorological data distribution;
  - Multicast capability to users across Europe (and beyond) is well suited to NRT dissemination requirements;
  - Satellite Internet infrastructure is already in place - it offers a current solution to terrestrial Internet congestion;
- Complements, rather than replaces current Meteosat dissemination scheme;
  - Provides much wider access to full resolution data without requiring specialised receiving equipment;
  - Gives great flexibility to enable the needs of specialised applications to be met.
- Provides a sound solution for high data rate access to the MARF;
  - more expensive than terrestrial Internet but overcomes local and backbone bottlenecks to ensure higher data rates to the end user.

Cost Comparisons

- Like-for-like cost comparisons are very difficult;
  - "Free" use of Meteosat communications payload v full commercial rates;
  - True capital cost of Meteosat comms payload difficult to establish;
  - Meteosat operations costs difficult to apportion.
- Case-by-case analysis required for applications which cannot be serviced by current Meteosat distribution scheme;
  - e.g. MARF Data Access - Satellite is economical v terrestrial when end to end system costs are considered.
- Commercial communications equipment costs are low:
  - Up-link utilises DVB standards currently being adopted by broadcasters world-wide;
  - User terminals are based on DVB receivers used in digital TV;
  - Both benefit from economies of scale due to extensive satellite and terrestrial usage.

Recommendations

- A demonstration is feasible in the near term which will complement existing EUMETSAT services;
- A demonstration is required to verify "best value for money" and identify practical difficulties;
- There is a clear evolutionary path from demonstration to operational service;
- The combination of EO and satcoms will benefit:
  - met data providers gain an efficient route to market and greater utilisation of their data;
  - satcoms operators get a new, committed user with ever more demanding requirements;
  - met users get improved data access, exploiting the capabilities of new satcom services
- Framework V offers an ideal opportunity to undertake a realistic and effective demonstration of met data distribution via commercial comms satellites.

FEASIBILITY STUDY: WORLD-WIDE DISTRIBUTION OF VEGETATION DATA

S. VIZZARI, MATRA SYSTEMES & INFORMATION

CEO
Centre for Earth Observation

FEASIBILITY STUDY: WORLD-WIDE DISTRIBUTION OF VEGETATION DATA

ASTRON RGC 11/98-B

Ispra - 19 January 1999

Sergio VIZZARI
Matra Systèmes & Information
svizzari@matra-ms2i.fr

Slide 1

19/01/99

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Introduction

- **This ASTRON study aims to address satcom dissemination - possibly on global scale - of VEGETATION data**
- **VEGETATION services (more info at http ://www.vgt.vito.be) are designed to provide enhanced low-resolution imagery:**
  - ✓ **long-term scientific studies at regional and global scales (e.g. to develop dynamic models of the biosphere interacting with climate models)**
  - ✓ **monitoring natural ressources**

"Global" deeply involves developing countries, with different financing abilities (e.g. vs. US or Europe), where *cost is an issue and satcom advantage may be less evident.*

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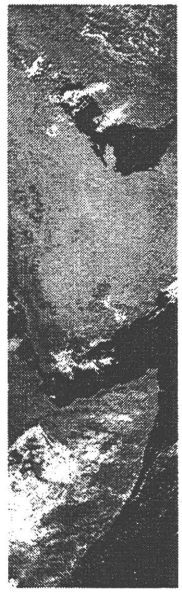

VEGETATION Products

Three basic products:

- **VGT-P Segment Projected**
- **VGT-S Daily Synthesis**
- **VGT-S Decade Synthesis**

At 1km/res.:

- **VGT-P is 12byte/pel**
- **VGT-S is 16byte/pel**

Compression can gain a factor 2 - 4

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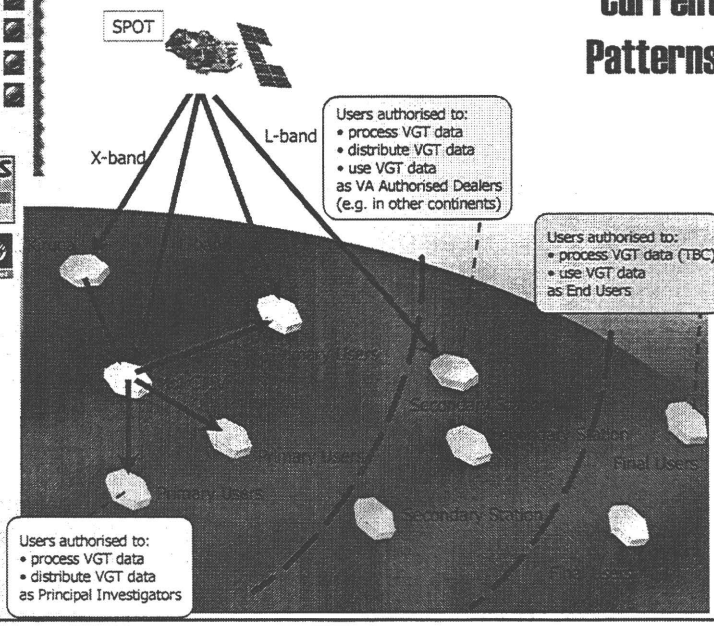
Current Patterns



Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions

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Slide 5

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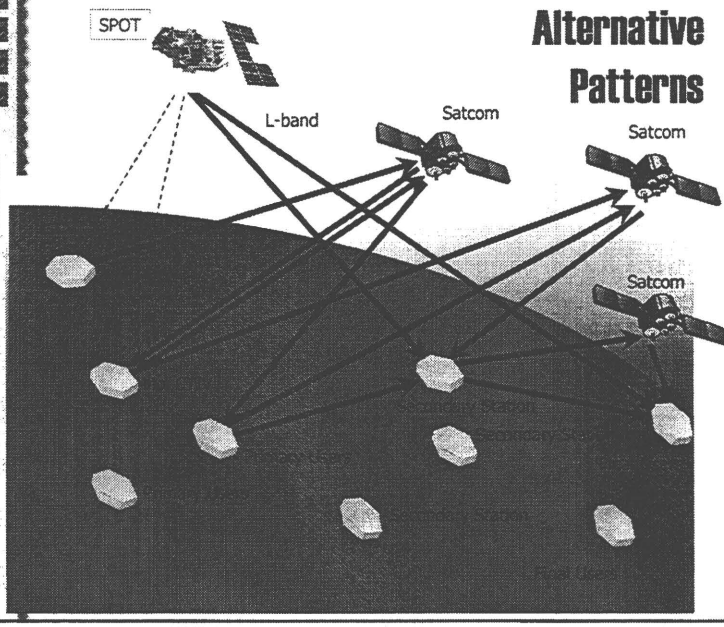
Sample Alternative Patterns



Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions

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Slide 6

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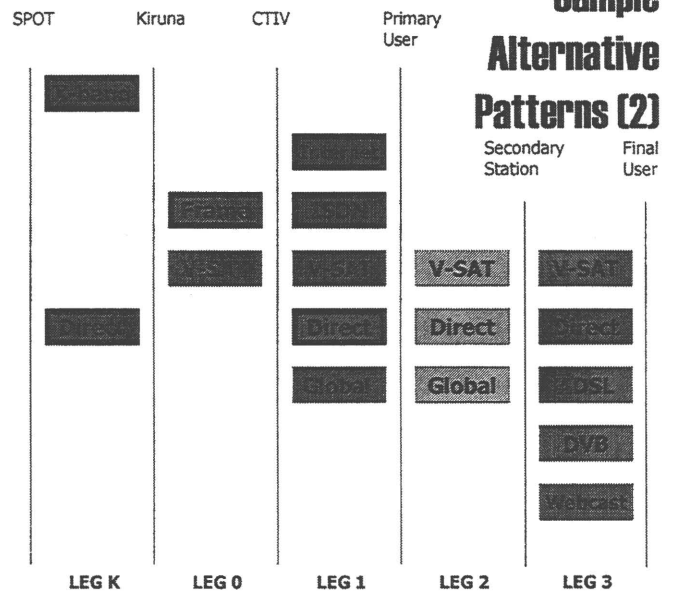
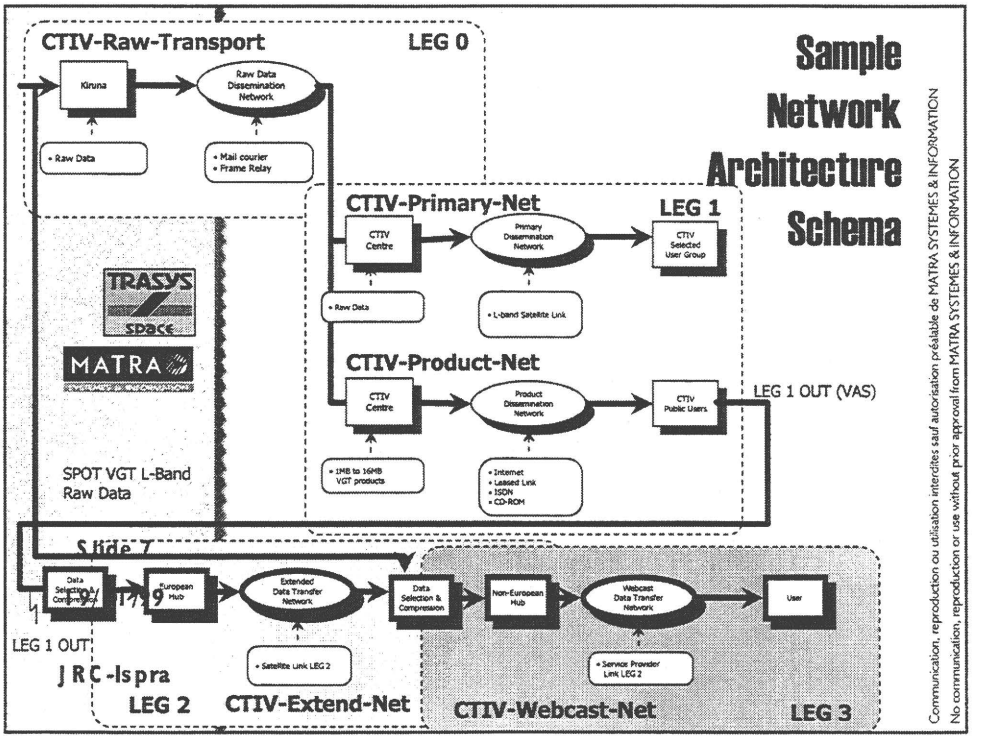
Sample Alternative Patterns (2)



Note: «Direct» = L-band
«Global» = Global Telecom Operator


CTIV-Raw-Transport
LEG 0
Kiruna
Raw Data Dissemination Network
• Raw Data
• Mail courier
• Frame Relay
CTIV-Primary-Net
LEG 1
CTIV Centre
Primary Dissemination Network
CTIV Selected User Group
• Raw Data
• L-band Satellite Link
CTIV-Product-Net
CTIV Centre
Product Dissemination Network
CTIV Public Users
LEG 1 OUT (VAS)
• 1MB to 16MB VGT products
• Internet
• Leased Link
• ISDN
• CD-ROM
TRASYS space
MATRA
SPOT VGT L-Band Raw Data
Slide 7
Data Selection & Compression
European Hub
Extended Data Transfer Network
Data Selection & Compression
Non-European Hub
Webcast Data Transfer Network
User
LEG 1 OUT
• Satellite Link LEG 2
• Service Provider Link LEG 2
JRC-Ispra
LEG 2
CTIV-Extend-Net
CTIV-Webcast-Net
LEG 3
Sample Network Architecture Schema
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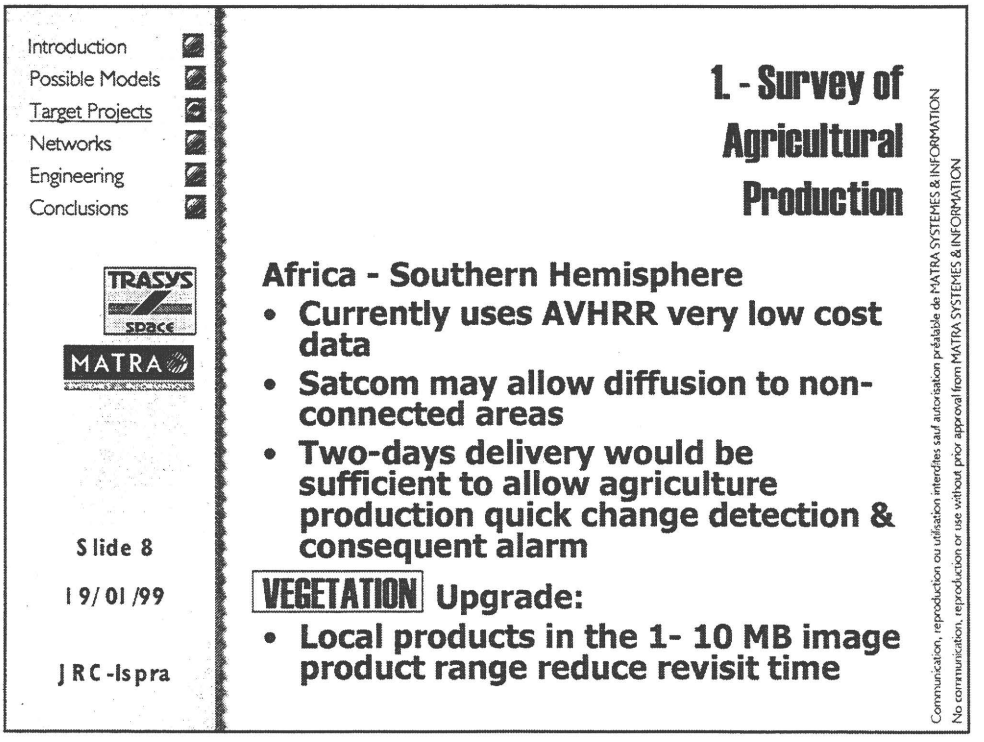
Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions
TRASYS space
MATRA
Slide 8
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1. - Survey of Agricultural Production
Africa - Southern Hemisphere
• Currently uses AVHRR very low cost data
• Satcom may allow diffusion to non-connected areas
• Two-days delivery would be sufficient to allow agriculture production quick change detection & consequent alarm
VEGETATION Upgrade:
• Local products in the 1- 10 MB image product range reduce revisit time
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2. - Locust Monitoring

Africa - Northern Hemisphere to Asia

- **Regional Centre in Rome (FAO)**
- **Exchange of e-mail messages for information update with National Stations**
- **Image maps used at National level**
- **Fast delivery in case of emergency**

VEGETATION Upgrade:

- **Direct L-band acquisition could be foreseen, but also:**
- **1- 10 MB image product**
- **fast delivery «short» messages <48kB**

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Slide 10

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3. - Fire Early Warning & Statistics

Asia & Central/South America

- **Current use of AVHRR NDVI**
- **Fast delivery may allow to enlarge current statistical service to "early risk detection & warning"**

VEGETATION Upgrade:

- **1- 10 MB image product (VGT-P)**
- **Statistical products needed should be customised by a VAR**
- **faster delivery, «short» text messages (<48kB)**

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Common Guidelines

- Cost of transmission vs. cost of product itself is an important evaluation factor
- Direct reception via L-band stations and data exploitation licence distribution is a viable option in certain cases
- «Progressive» information transmission methods, i.e. fast «urgent» message followed by slow context map information
- Necessity of select and compress valid information, i.e. use of a (dynamic) value-adding chain

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Slide 12

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1 - IRIDIUM

- Terminal cost of 1700-2500 Euros
- 60 Euro Monthly Rate + 100 Euro *una tantum* Installation Rate
- 5.23 Euro/min (Europe to Asia) at 1200 bps = 20 Euros/3.75 min for a 32kB message
- NOMAD initiative for humanitarian project TBC
- Slower alternative is ORBCOMM (limitation at 16kB/message)
  - ✔ Terminal cost of 1300-1700 Euros
  - ✔ Monthly rate of 40 Euros
  - ✔ .005 Euro/byte=163 Euro for a 32kB msg

Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions

TRASYS space
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Slide 13

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2. - SatelLife

- **Extremely Low-cost Global System**
  - ✔ LEO satellites (2 for the time being)
  - ✔ simple PC-based ground stations
  - ✔ Radio- and telephone- based computer networks
- **Seamless and reliable with little or no telecom infrastructure**
- **Good coverage in Africa and Asia**
- **Simple Store-and-forward, User-transparent Message Routing & Delivery**
- **Interfaced with the Internet**
- **Synergies with existing projects?**

Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions

TRASYS space
MATRA

Slide 14

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3. - MSAT

- **V-SAT, L-Band Voice and Data (Mobile) Services in Africa**
- **Relatively little terminal (3kEuro) should be sufficient (to be assessed with direct SPOT L-band reception link, if required)**
- **50 Euros/Mbyte for a transmission time of about an hour (e.g. Inmarsat: same terminal cost, 0.5 Euro/min cheaper rate)**
- **Hubs in RSA, Zimbabwe, Zambia, Mozambique and other African countries**
- **For FAO in Rome, Fucino hub available**

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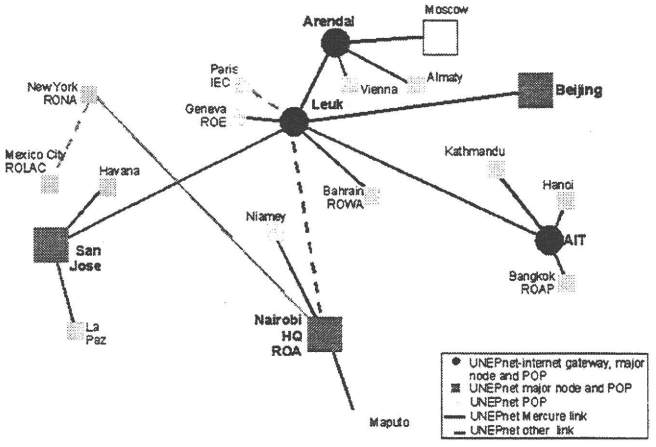
4. - UNEP Mercure

UNEPnet Nodes Under installation in 1997



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Slide 16

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A Sample Project

"Progressive information transmission for emergency & fast survey cases"

3 users (e.g. in Africa) able to receive:

- **quick messaging via IRIDIUM (and/or SatelLife)**
- **image information via VSAT L-band terminals**
  - ✓ **UNEP/MSAT VSAT network or equivalent**
  - ✓ **via direct reception of SPOT data (TBC)**
- **estimated cost for a 6 months *demo*: 250-300kEuro**
  - ✓ **20k-25k (Euro) IRIDIUM**
  - ✓ **80k-100k VSAT services (hub TBD)**
  - ✓ **150k-180k 6-months engineering phase and other (e.g. VAR) service costs**

Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions

TRASYS space
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Slide 17

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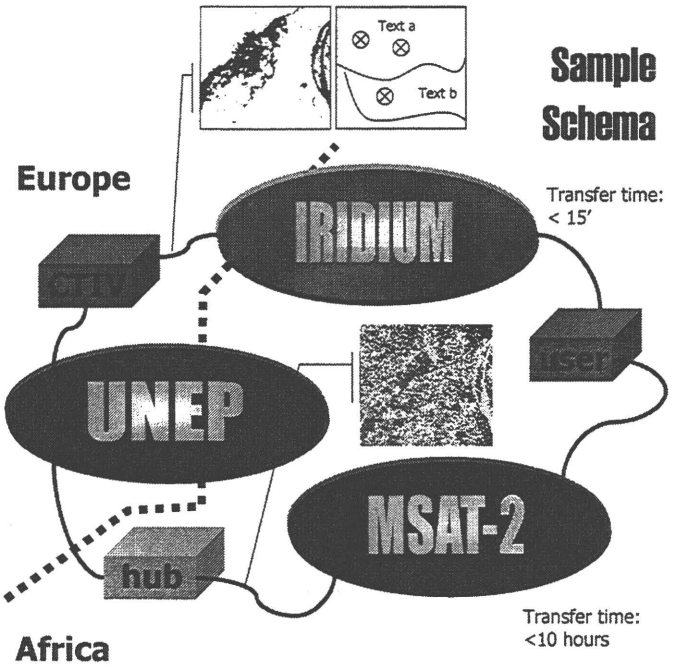
Sample Schema



Introduction
Possible Models
Target Projects
Networks
Engineering
Conclusions

TRASYS space
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Slide 18

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Current Conclusions

- **Clear interest of SATCOM for developing countries, where other telecommunications infrastructures are not available for certain target communities**
- **Necessity to «team» and/or «piggyback»**
  - ✓ **other information dissemination networks (e.g. media)**
  - ✓ **other similar applicative contexts**
- **Enhance Network Performances via Information Selection & Compression Techniques (e.g. distribution of short messages or «vector» maps)**

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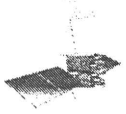
SYNERGY BETWEEN EARTH OBSERVATION AND SATELLITE NAVIGATION

V. ASHKENAZI, UNIVERSITY OF NOTTINGHAM



ASTRON Information Day
Ispra, 19 January 1999

1

Synergy between Earth Observation and Satellite Navigation

Vidal Ashkenazi
CEO, Nottingham Scientific Limited
University of Nottingham

NSL

Contents

2

- Brief Summary of Earth Observation
- Brief Introduction to Satellite Navigation
- Potential Synergy of EO and GNSS
- Recent Developments in GNSS

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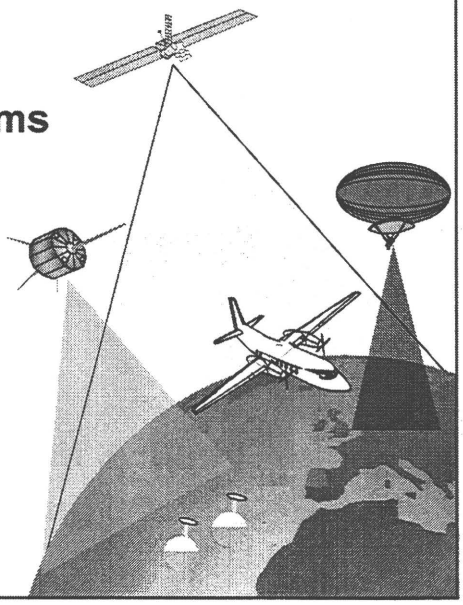
Earth Observation

- Observation Platforms
  - Space borne
  - Airborne
  - Ground-based



3

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Earth Observation

- Targets of Observation
  - The Continents
  - The Seas and Oceans
  - The Atmosphere
  - The Geology
  - The Geophysics

4

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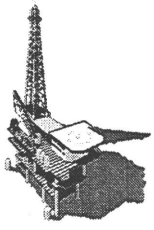
Earth Observation

- Aims of Observation

  - Scientific
    (eg Natural Environment)
  - Engineering
    (eg Built Environment)



  - Wealth Creation
    (eg Exploration)

5

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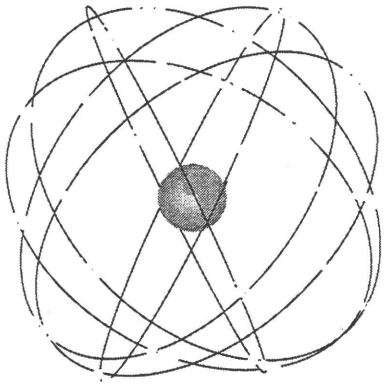
GPS Satellite Constellation



- 24 Satellites
- 20 000 km above Earth
- 12 hr Orbits

- 6 Orbital Planes
- 55° Inclination
- 5 hrs above Horizon

Minimum 4 Satellites in View

6

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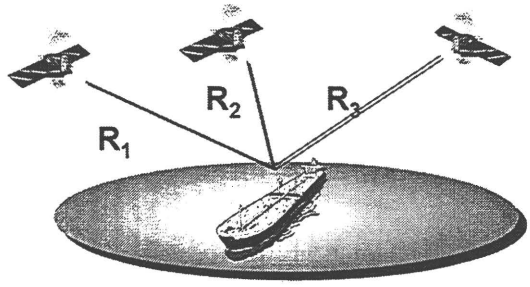
GPS Navigation Concept



7

Given : X, Y, Z Coordinates of Satellites

Measure: Minimum 4 Ranges R_1, R_2, ...

To Find: X, Y, Z Coords & Δt Clock Error

Accuracy : 50 to 100 metres

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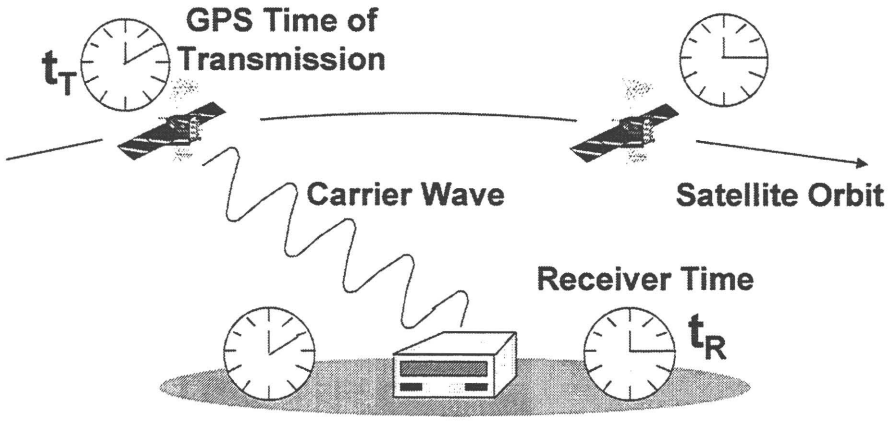
Pseudorange Principle



8

(Pseudo-) Range = t_R - t_T

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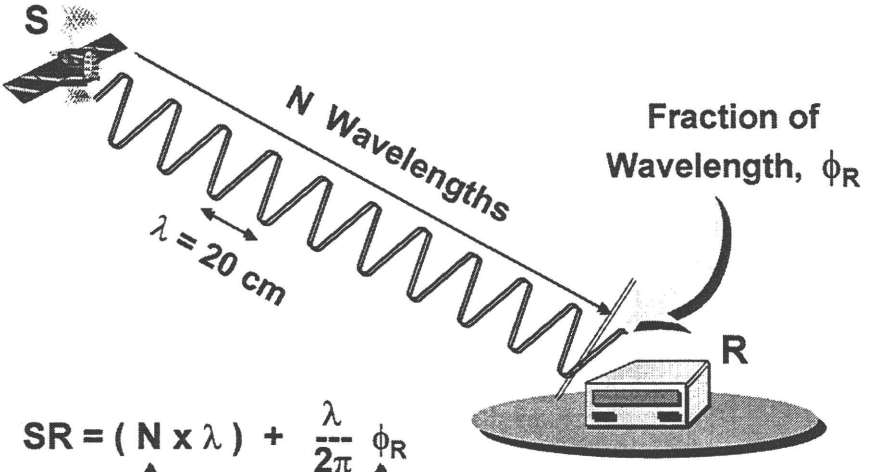
Carrier Phase Principle



$$SR = (N \times \lambda) + \frac{\lambda}{2\pi} \phi_R$$

Integer Ambiguity

Phase Reading

11

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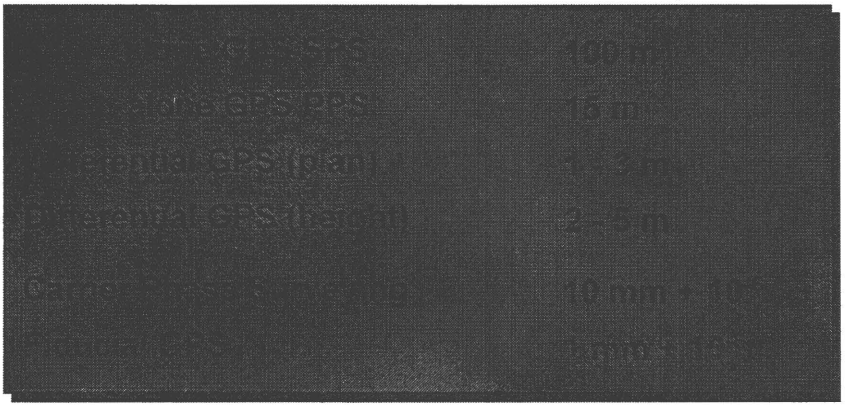
Standard GPS Accuracies



12

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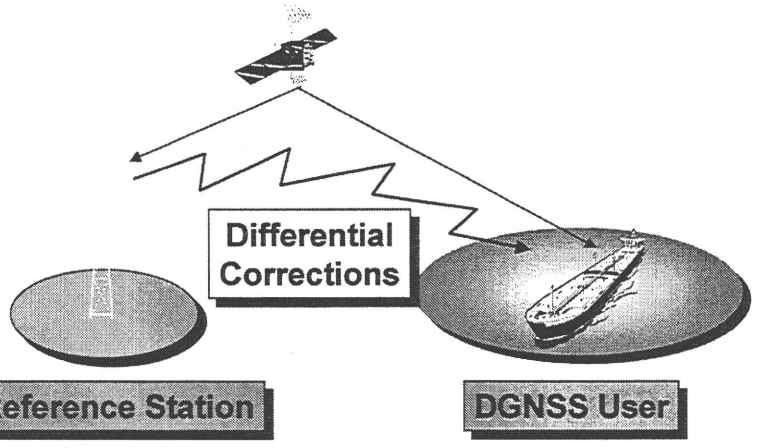
Differential GPS (DGPS)

9



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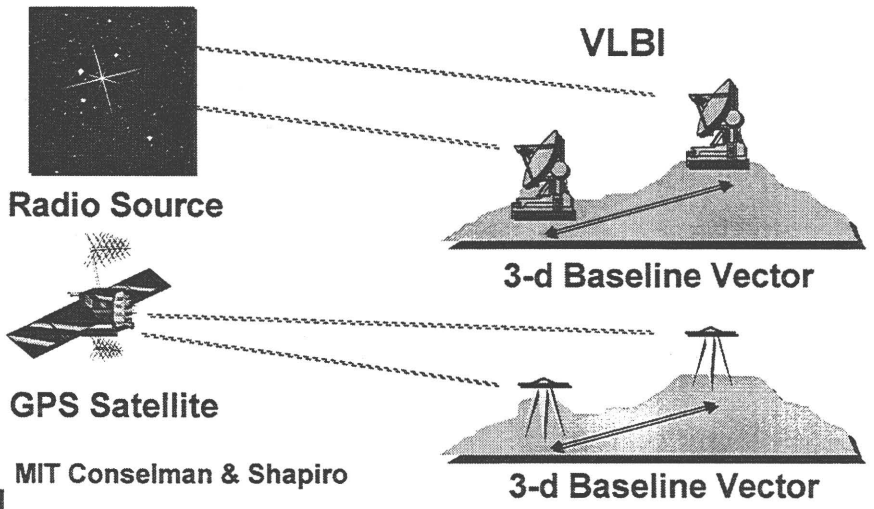
Accuracy : 1 - 2 metres

Carrier Phase Interferometry

10



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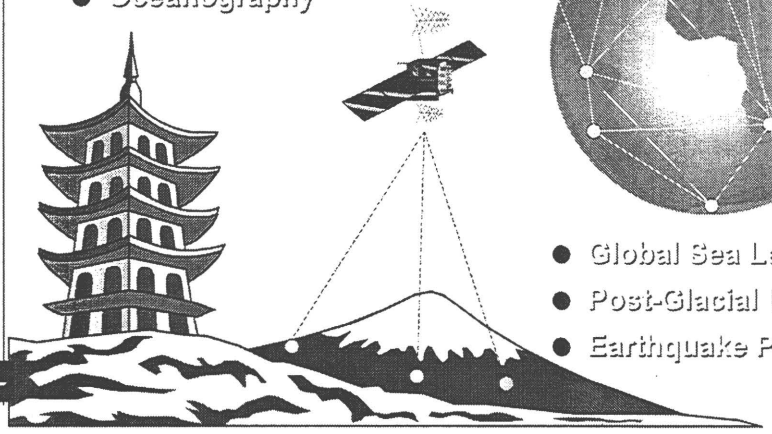
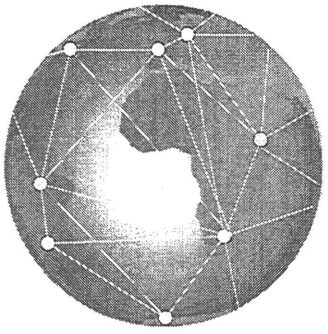
Accuracy : millimetres

Monitoring the Natural Environment

- Geodesy
- Geophysics
- Oceanography





- Global Sea Level Rise
- Post-Glacial Uplift
- Earthquake Prediction

13

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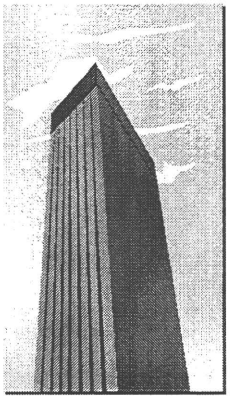
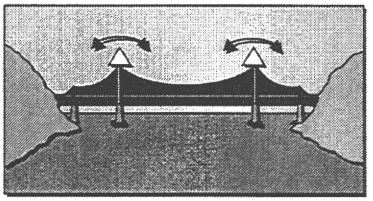
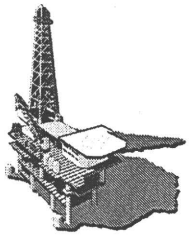
Monitoring the Built Environment



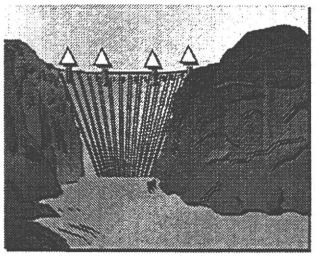
Buildings



Bridges



Rigs & Platforms



Dams

14

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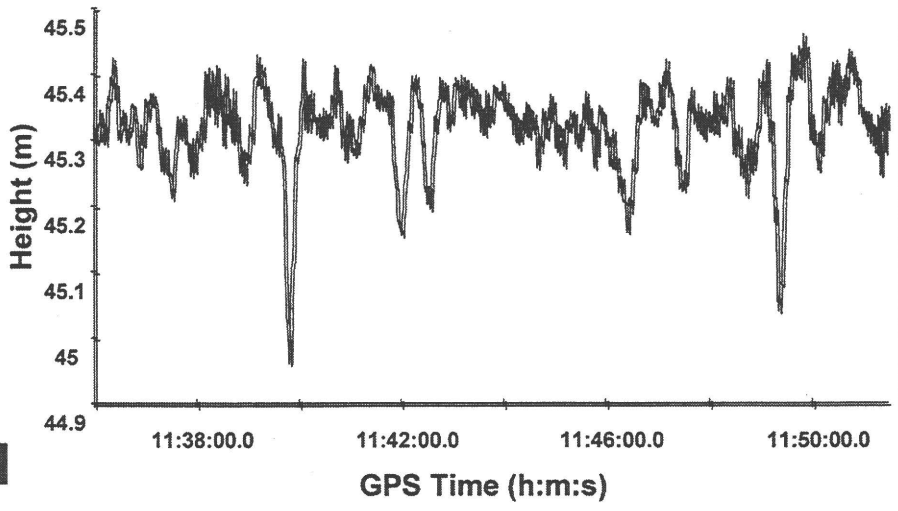
Vertical Deformation of the Bridge

15



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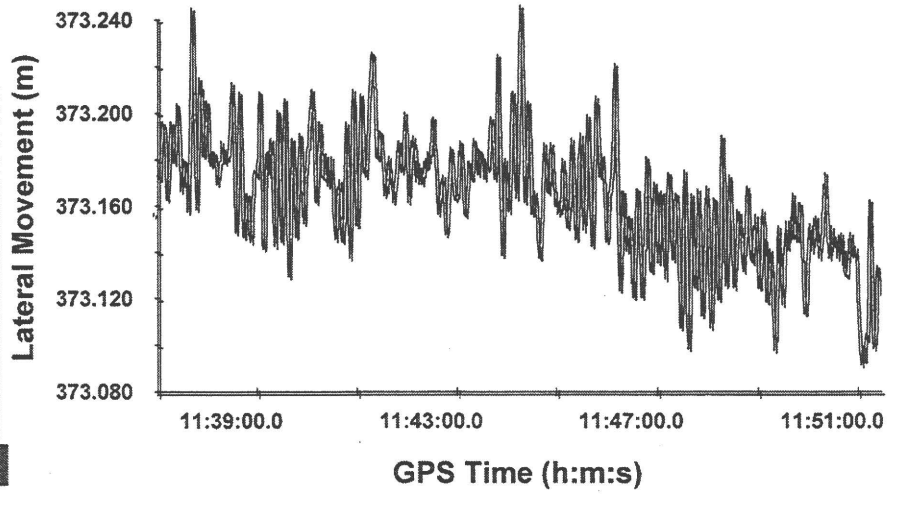
Lateral Deformation of the Bridge

16



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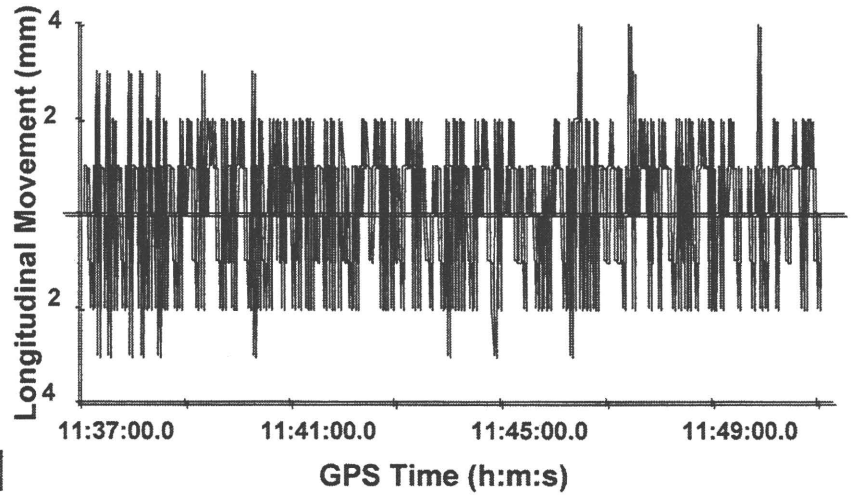
Longitudinal Deformation

17



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Synergy between EO and GNSS

Potential Application Areas

18

1) High Precision EO Platform Positioning
2) Calibrating Other EO Sensors (eg Altimeter)
3) Meteorology & Climatology
4) Surveying, Mapping & GIS
5) Navigation in Hazardous Environments
6) Agriculture (Precision Farming)
7) Traffic Monitoring & Management ??

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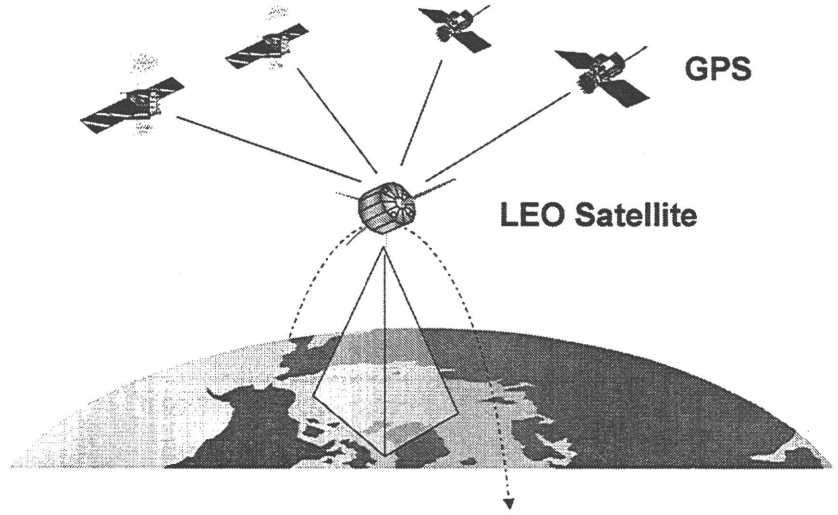
1) High Precision EO Platform Positioning

Objective : 1 m Radial Accuracy in Real-Time



19

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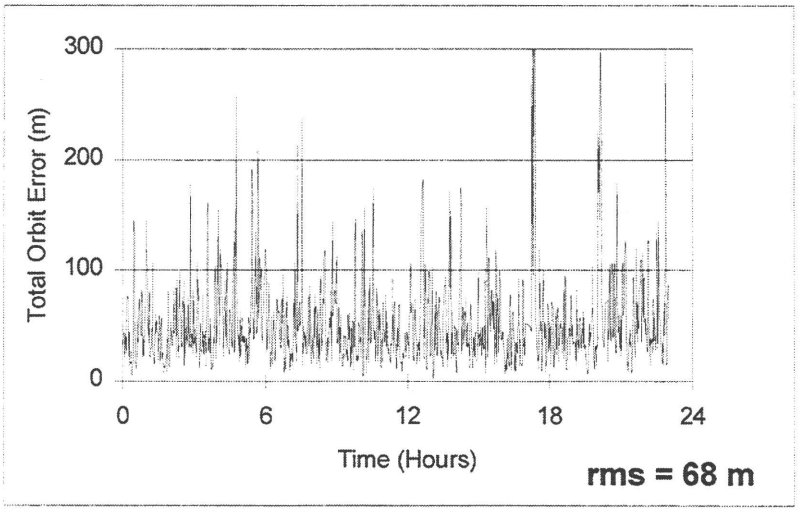
1) High Precision EO Platform Positioning

GPS Stand-alone Positioning



rms = 68 m

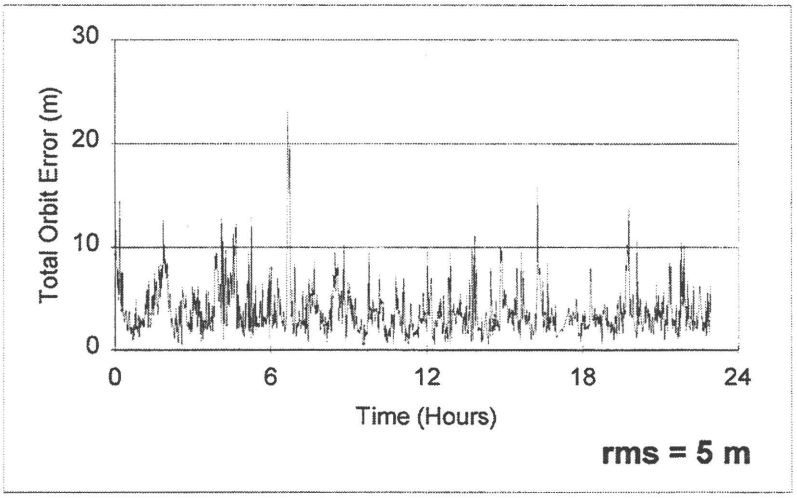
20

NSL

1) High Precision EO Platform Positioning

Global Differential GPS Positioning

21

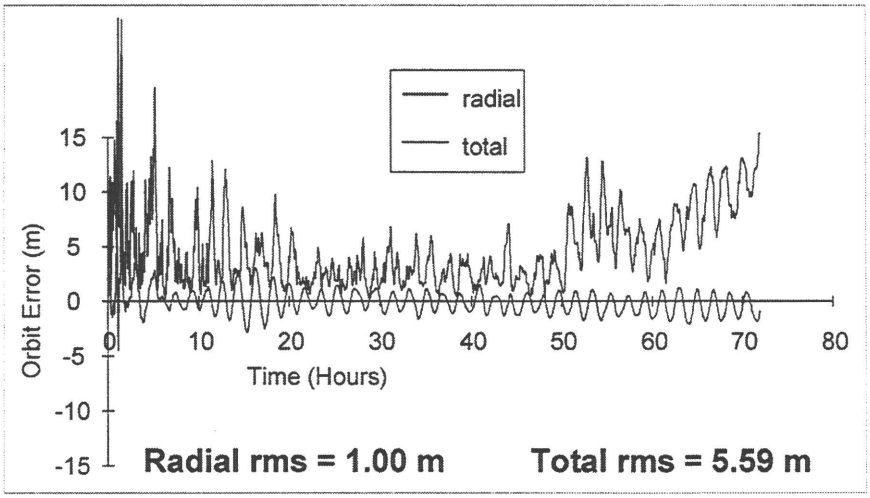


rms = 5 m

1) High Precision EO Platform Positioning

Reduced-Dynamic Approach

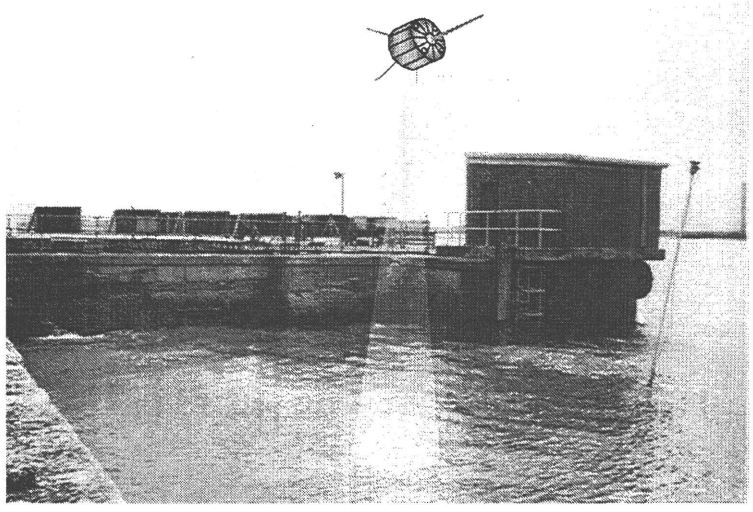
22



Radial rms = 1.00 m **Total rms = 5.59 m**

2) Calibration of Other EO Sensors

GPS Buoy & Altimeter



23

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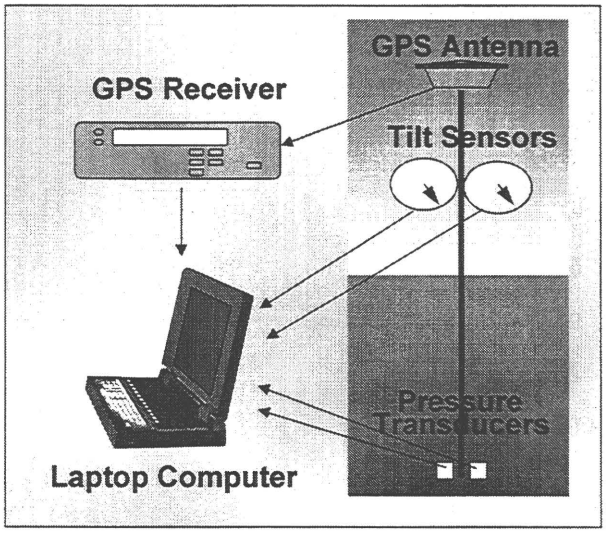
2) Calibration of Other EO Sensors

GPS Buoy



24

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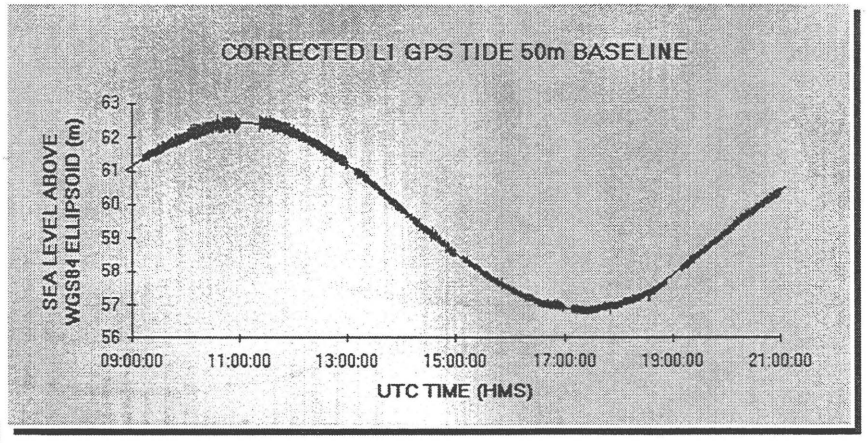
Instantaneous GPS Sea Level

GPS Sea Level against Tide Gauge Sea Level



25

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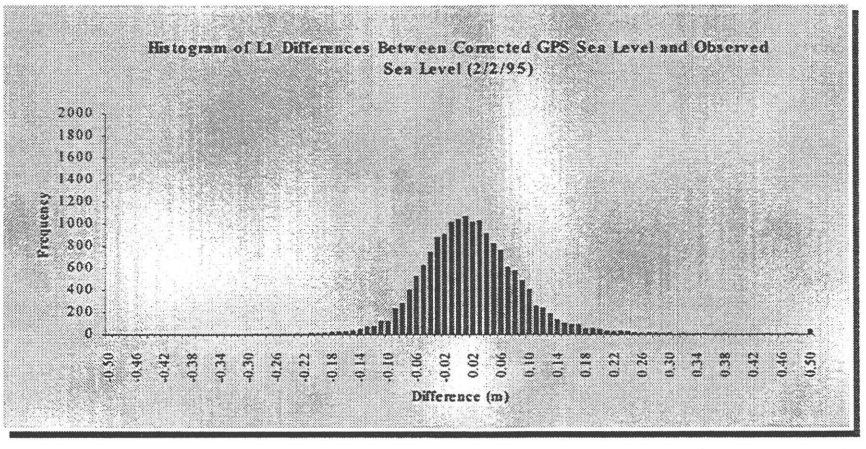
Histogram of Differences

Between GPS and Sea Level



26

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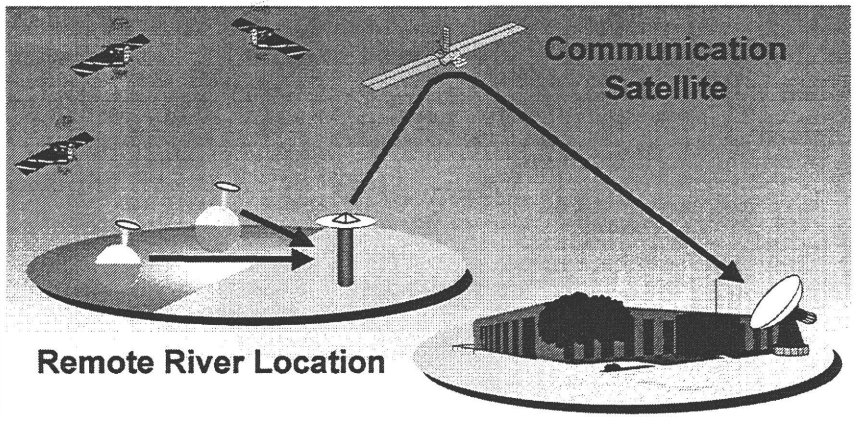
New Application

Real-time River Height Monitoring



27

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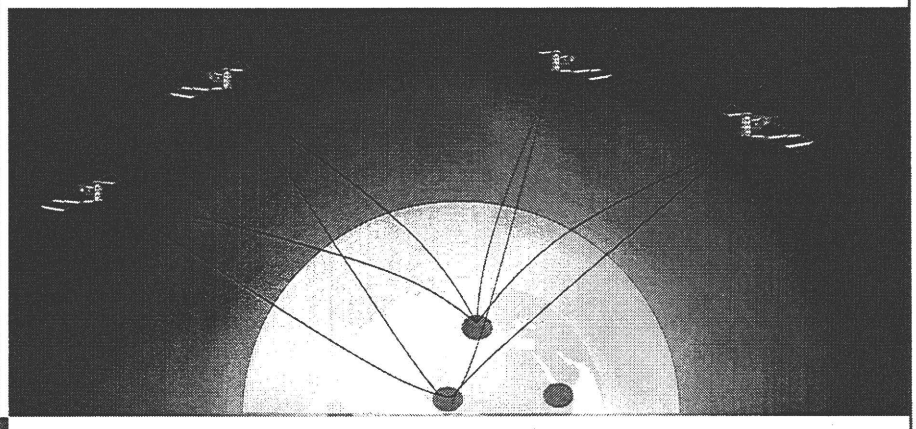
3) Meteorology & Climatology

GPS Water Vapour Estimation



28

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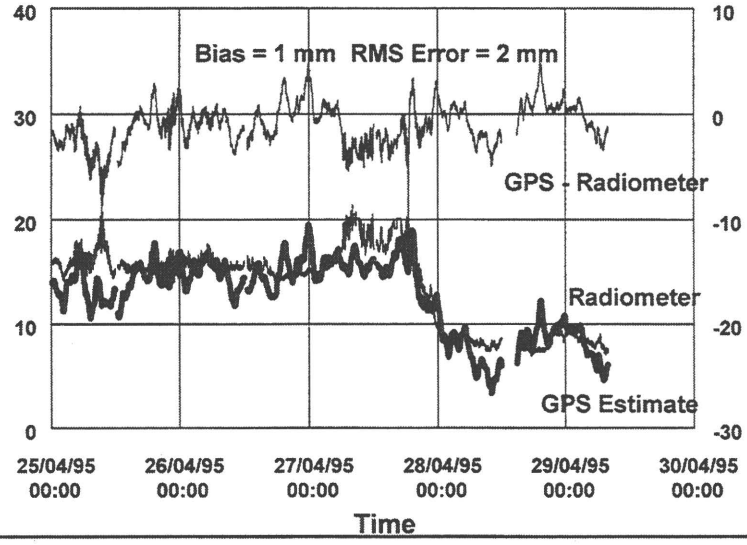
Short-term Forecasts & Long-term Climate Change

3) Meteorology & Climatology

GPS Water Vapour Estimation

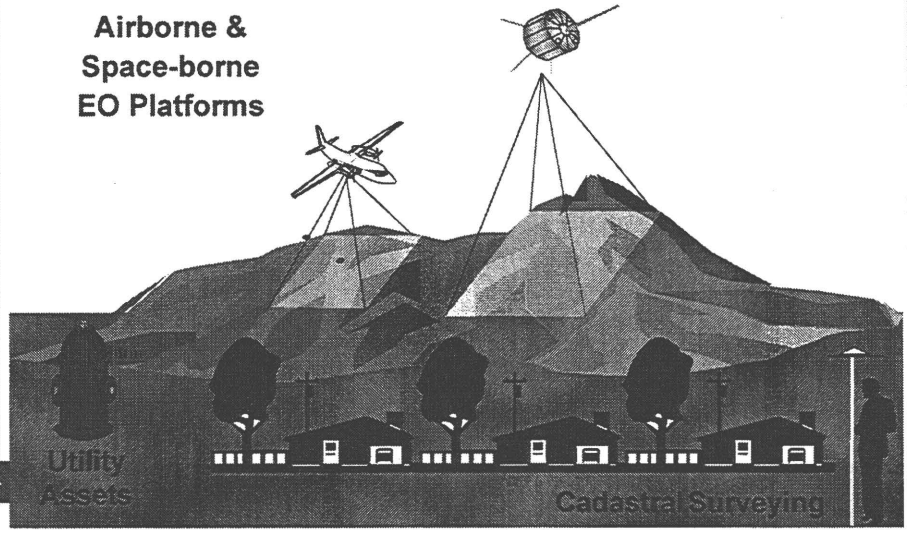


29

NSL

4) Surveying, Mapping & GIS

Airborne &
Space-borne
EO Platforms



30

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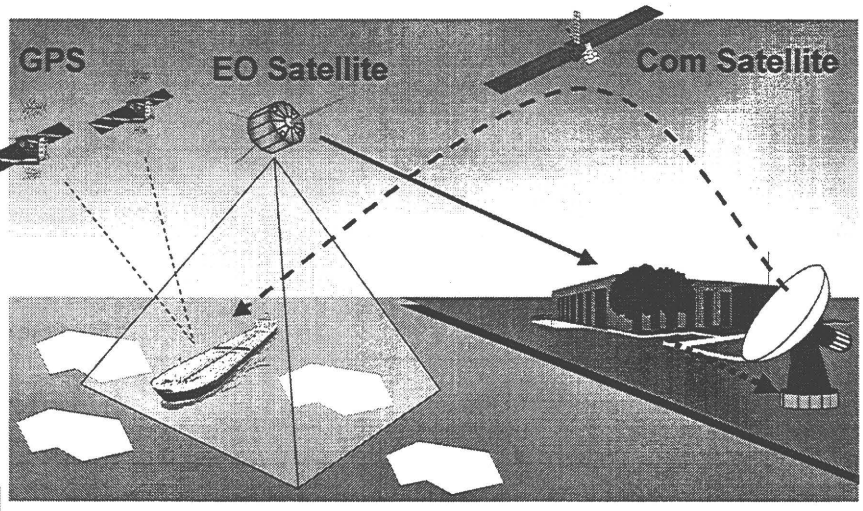
5) Navigation in Hazardous Environments



31

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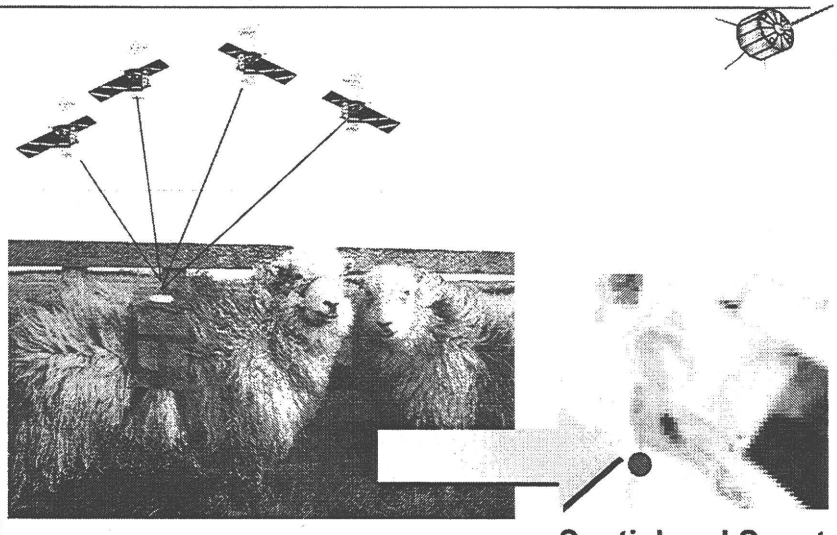
Habitat Monitoring & Conservation (?)



32

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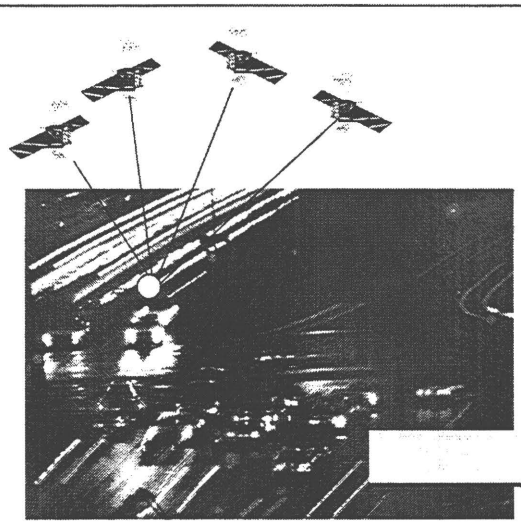
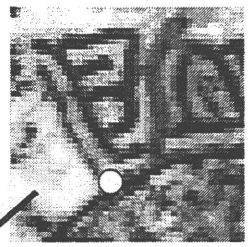
Precise Location Information

Spatial and Spectral Detail

7. Traffic Monitoring & Management (?)

33





Precise Location Information

Spatial and Spectral Detail

However ...

34

- EO can give map-like detail
- But NOT individual cars or wildlife
- Needs much Improved Resolution
- AND Frequency of Observation
- LEO SATS & Airborne have Resolution
- GEO & IGSO have Frequency
- Unfortunately, neither has both

Recent Developments in GNSS

- 01/98 : EC proposes GNSS Strategy
- 03/98 : Council of Ministers
  - Endorses Strategy
  - Instructs EC to evaluate options and make detailed recommendations by Q1 1999
- 07/98 : GNSS High Level Group
  - establishes GNSS Forum
- 03/99 : EU Council expected to decide on Implementation of GNSS-2

EU GNSS Strategy

- Three Broad Political Options considered
  - Joint Development by all Major Players
  - EU Development with some Partners
  - Independent Development by EU
- GNSS-2 Forum assessed Options
- ESA issued 3 corresponding Tenders
  - Contracts negotiated
  - Early input to Forum through WG2

GNSS-2 Forum

Four Working Groups

1. **Institutional and Legal Questions**
2. **Technical Development and Finance**
3. **Security and Defence Issues**
4. **Users and Service Requirements**

37

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Timetable

- **GNSS-2 Forum established : 07/98**
- **Interim Report ready : 11/98**
- **Recommendations to HLG : 12/98**
- **EC Recommendations to EU Council – Early 1999**
- **EU Council Decision : Q1/99 or Q2/99**

38

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Likely Outcome

(Personal Opinion)

- There will be a GNSS-2
  - led by Europe
- Basic System from 'Public' Funds
  - EC, ESA, EU Governments
- Total Cost between 1.5 and 2.5 BECU
- Basic Performance like GPS IIF
- User-driven Augmentations
  - paid for by Users

39

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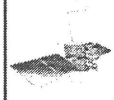
Conclusions : EO and SatNav



- EO can be successfully combined with
- Satellite Navigation (GPS→ GNSS)
- For a Variety of Applications
- Especially in Combination with Comms
- Need for Research on Applications
- And on more Generic Problems
- Such as Higher Resolution and Frequency
- How about ...

40

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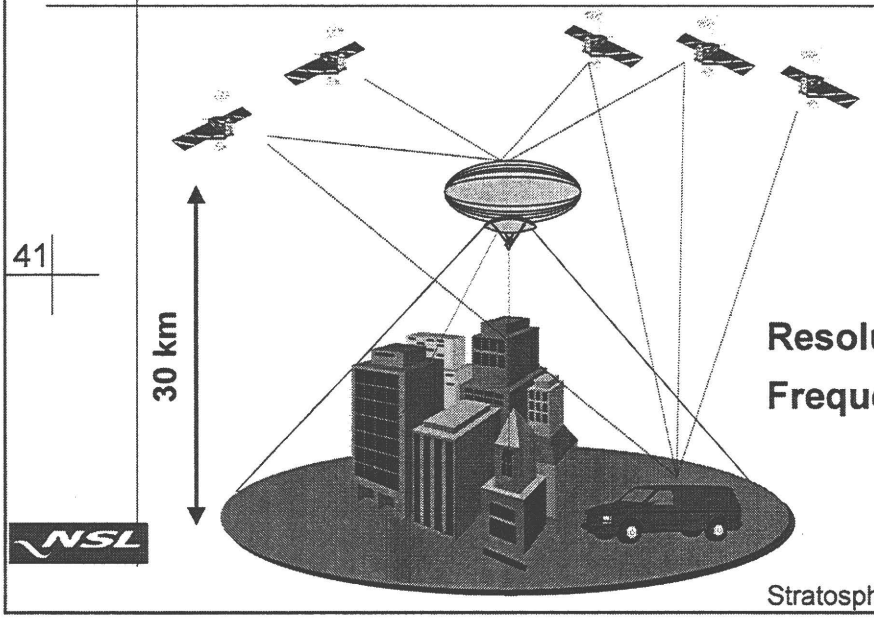
Multi-Functional Platforms

Satellite Communication, Observation & Navigation



Resolution ✓

Frequency ✓

Stratospheric Platform

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ASTRON: CURRENT STATUS AND PLANS

M. KETSELIDIS, JRC, JOINT RESEARCH CENTRE

ASTRON - Current Status and Plans

(mid 1998 - ...)

Applications on the Synergy of satellite Telecommunications, eaRth Observation and Navigation

Objectives:

- **To investigate the synergy between satcoms, EO and satnav in order to develop innovative and sustainable applications.**
- **To provide direct support to the EC services responding to their requirements, in the areas of our technical competence**

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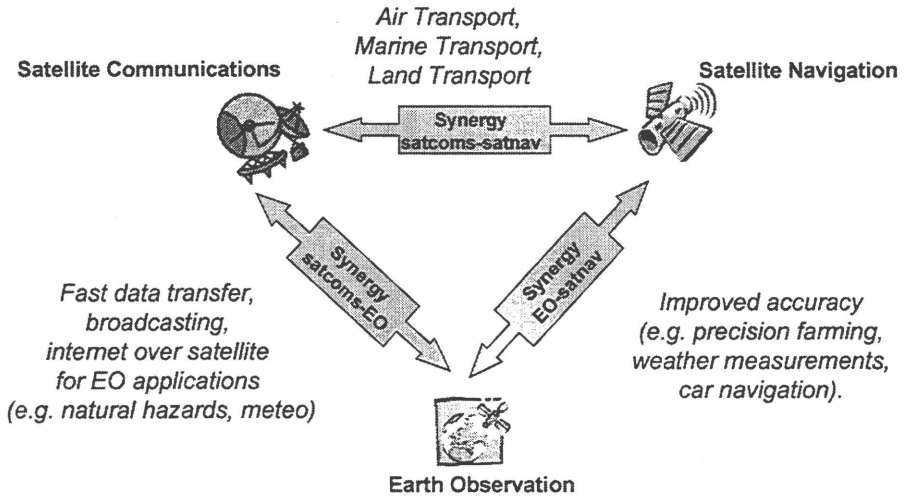
European Commission

Rationale



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Creating added value

through the synergy of space applications

- **Global market prospects for the years 1996-2005:**

⇨ Satellite Communications	over 500 billion ECU
⇨ Satellite Navigation	over 70 billion ECU
⇨ Earth Observation	over 26 billion ECU

Source: EC report COM/96/617

- **FPIV distribution of funds for space-related projects**

Specific Programme/JRC	Communications	Navigation	Observation
ACTS	50 MECU		
ESPRIT	15 MECU		5 MECU
Telematics	5 MECU	15 MECU	5 MECU
Transport		5 MECU	
Environment and Climate			125 MECU
Marine Science &Technology			10 MECU
Joint Research Centre			135 MECU
Total	70 MECU	20 MECU	280 MECU

Source: EC report, SEC(1998)1055

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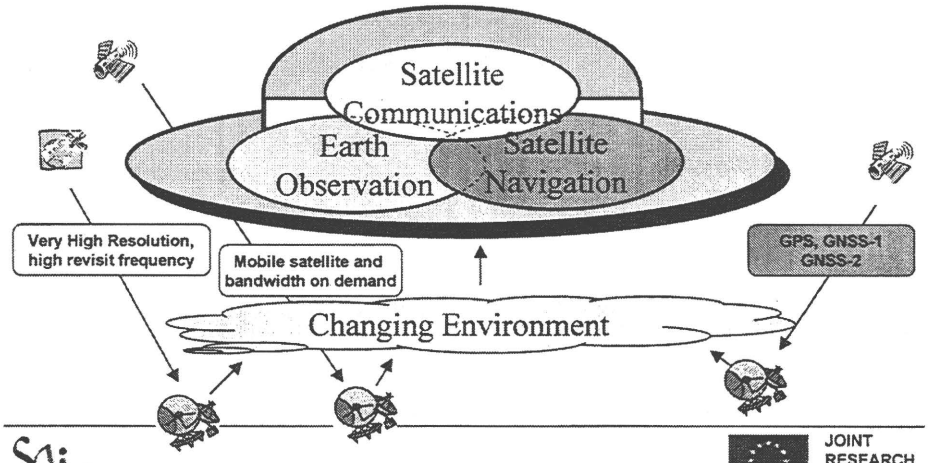
Integrated Space Applications:

Le Chapeau

Convergence of Information from Satellites
Timely, accurate, reliable



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European Context

DG XIII
IST (Information Society Technologies) Programme Action Lines
- *KA I: Systems and Services for the citizen*
- *KA IV: Essential Technologies and Infrastructures*
- *CPA.1 Integrated applications platforms*

TEN-TELECOM Priority areas for Satellite Communications
- *I. Emergency services Management at Pan-European level*
- *II. Remote sensing services to produce synthetic and continuously update picture of the state of Environment*
- *III. Tools and services at low cost to access Environment data*

EC

CNES (F): METEOR
- ⇨ *exploitation of satcoms for EO applications in Euro-Med countries*

BNSC (UK): 'Ka-band Feasibility Study' (1998)
- ⇨ *EO identified as promising business application for future satcom systems*

National

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Support notes and meetings

XIII - R. Verrue, Director General;
M. Richonnier, Director;
Y. Capouet, Unit Head; M. Monteiro, XIII/A;
W. Boch, P. Flament, J. Basso, S. Bird, N. Pantalos, XIII/C.

III - G. Metakides, Director;
D. Talbot, J.Jaaskelainen, U. Boes, III/F;
M. Coomans, III/A.

VII - M. Ruete, Director;
C. Edmonds, D. Ludwig, N. Wariksko, VII/A;
C. Bernabei, U. Fischer, VII/E.

SG / UCLAF - P.B. Knudsen, Director;
G. Hitzler, F. Beullens,Unit Heads.

SCG - P. van Nes, Unit Head

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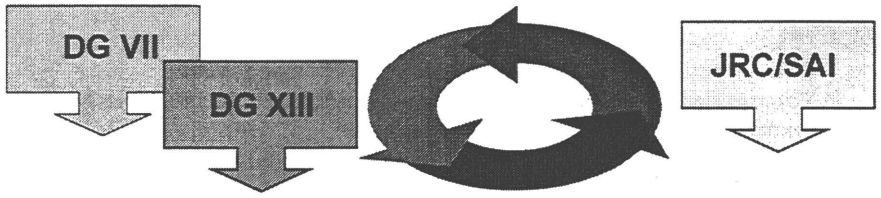
Technical collaboration with XIII, VII in the 5FP

Not a new thing: SAI collaborated with XII for the CEO programme in the 4FP



Specific mechanisms, measures, areas to be discussed / decided in early 1999

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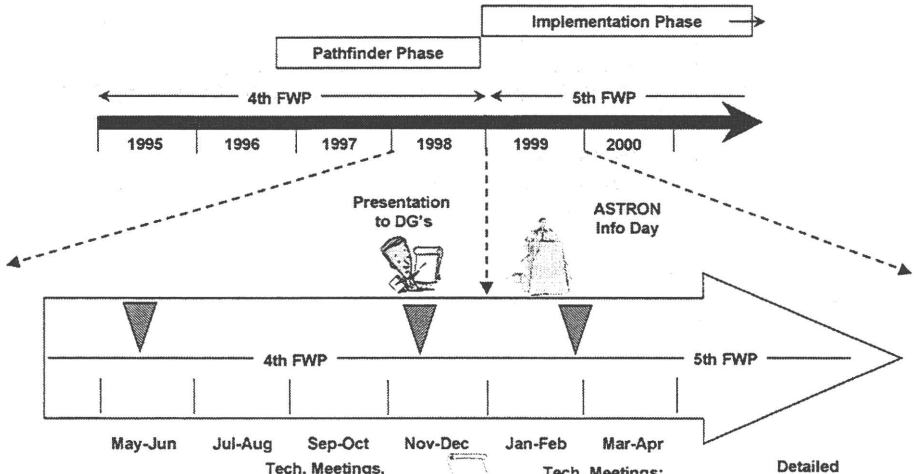
ASTRON Timeline



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Work Breakdown

- ✓ Application Watch
- ✓ Technology Watch
- ✓ Market & Users Watch
- ✓ Demonstration
- ✓ Communication
- ✓ Support to DG's

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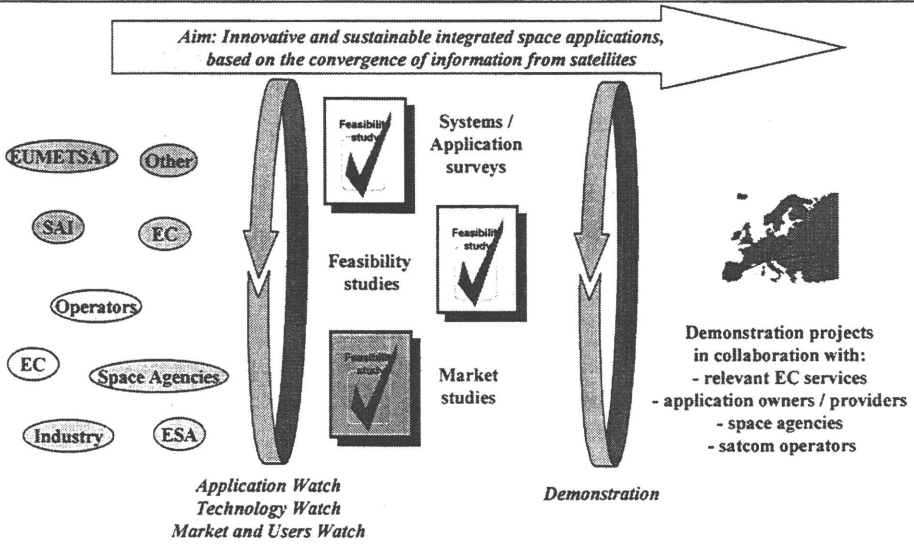
A potential role for ASTRON in the 5FP



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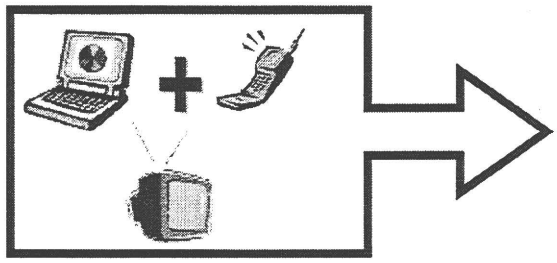
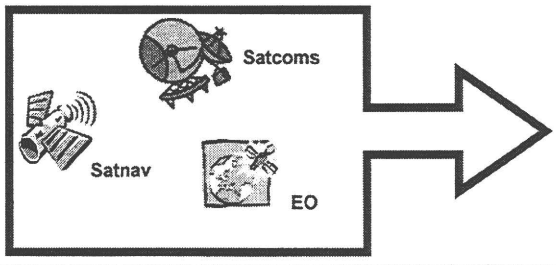
Exploring the *Convergence* of satellite applications and services



Desktop box



Spatial Information
(timely, accurate, reliable)

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The Mobile Millennium...

- A view to future services (year 2007) with around 40 new techniques that will then become available
  - ⇨ Terrestrial Communications (GSM/UMTS), no satcoms
  - ⇨ Navigation through triangulation, not GPS
  - ⇨ Mapping Information, but not EO
- Why interested in terrestrial systems?
  - ⇨ Satcoms (the most successful satellite application) only represents 2% - 5% of the global market

    Source: Future Satellite Services, Concepts and Technologies, ESA study, 1998
  - ⇨ Telecoms is already the most important private EO data market
  - ⇨ Synergy of EO and GNSS can provide an information source for terrestrial systems
  - ⇨ Synergy of satcoms, EO and satnav can provide a complement
- ASTRON targets public interest services, not consumer
- Thanks to CELLNET (GSM Operator, UK)

Email: mike.short@cellnet.co.uk

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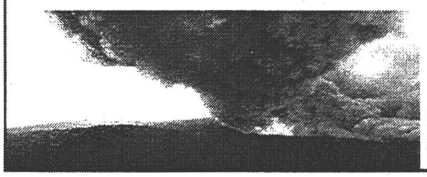
SCENARIO 1

Forest fire monitoring (e.g. in the Mediterranean)

- Aim: Supply real time EO derived information of fire locations and burnt areas
- End-users receiving information from a central site are
  - ➡ On-site fire fighting units
  - ➡ On-site troops
  - ➡ On-site coordinating civil protection authorities
- Communication needs include the immediate transfer of EO derived information of the fire location and extension; data volume to be transferred remains relatively small (i.e. coordinates, small vector maps, alphanumeric weather data) with many updates required



NATURAL HAZARDS & DISASTERS

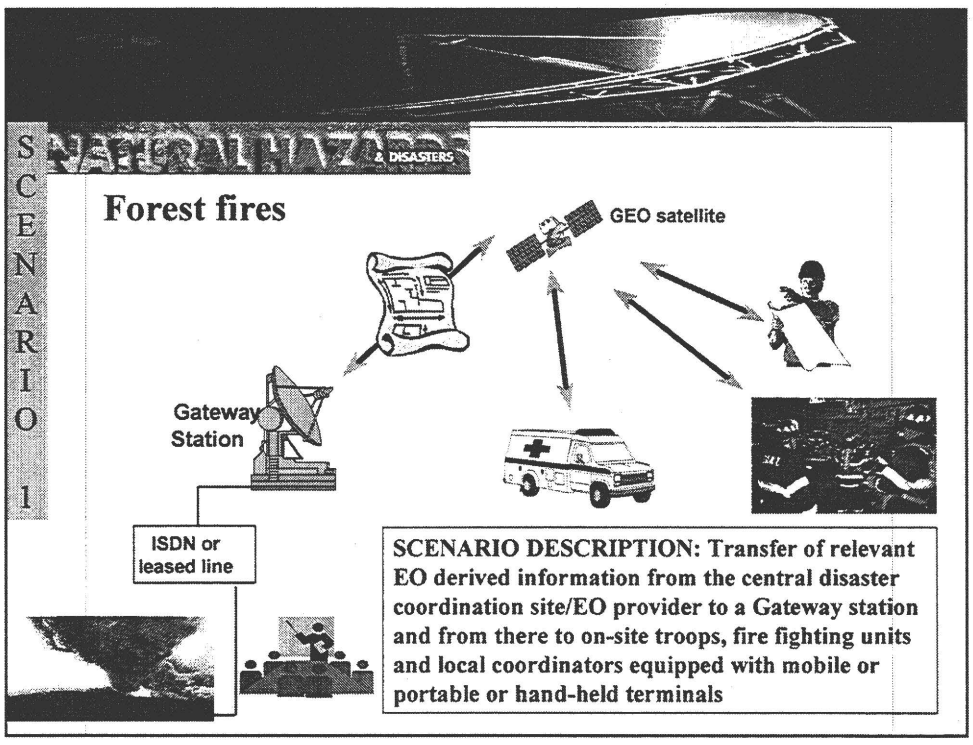
SCENARIO 1

ASSESSMENT

	Critical	Not critical
Timespan to receive information	✓	
Extra cost to end user		✓

ROLE OF SATCOMS

- ➡ Transfer of large data volumes between the central site and the coordinating civil protection authorities on-site via mobile satcom terminals (e.g. INMARSAT), in case the area of interest is not covered by terrestrial mobile communication systems or they have been destroyed ;data transfer rates up to 64 Kbps
  (see illustration on following page)
- ➡ Mobile communications between the central site (existing and future hand-held S-PCS systems) and on-site rescue teams; data transfer rates in the range of 2,4 Kbps


SCENARIO 1
NATURAL HAZARDS & DISASTERS
Forest fires
GEO satellite
Gateway Station
ISDN or leased line
SCENARIO DESCRIPTION: Transfer of relevant EO derived information from the central disaster coordination site/EO provider to a Gateway station and from there to on-site troops, fire fighting units and local coordinators equipped with mobile or portable or hand-held terminals

SESSION 2
EC Round Table: EC projects / activities relevant to ASTRON

ACTIVITIES RELEVANT TO ASTRON

C. EDMONDS, EUROPEAN COMMISSION, DG VII - TRANSPORT

DG VII Activities Relevant to ASTRON: Introduction

European Commission - Directorate General for Transport

- Context of DG VII's involvement
- Legal/Political framework
- Main activities

DG VII's Role

European Commission - Directorate General for Transport

3 main areas of the EC Common Transport Policy:

- improving quality, through integrated & competitive transport based on advanced technologies which also meet environmental and safety objectives
- promote single market, to improve efficiency, choice and user-friendly transport
- external dimension: improving transport links with third countries and fostering access of EU operators to other transport markets

DG VII Legal/Political Framework: I

European Commission - Directorate General for Transport

DG VII activity focused on development of a Global Navigation Satellite System (GNSS)

Jan 1998 Communication: "Towards a Trans-European Positioning and Navigation Network". Two tracks:

Continue with implementation of GNSS-1: European augmentation service, EGNOS

Commission to define strategy for future civilian system: GNSS-2. Joint system, or independent European System

DG VII Legal/Political Framework: II

European Commission - Directorate General for Transport

Follow up legislation being prepared. Following GNSS-2 Forum, expect that Commission will propose:

- Independent civil-controlled European constellation of 24 MEO satellites
- Controlled Access Service, and interface with military system
- Possible limited communication payload, to support navigation and combined applications
- Creation of an independent GNSS organisation
- International cooperation: signal interoperable with GPS. Investigating best form of cooperation with Russia.

DGVII Activities: Budgets

European Commission - Directorate General for Transport

To date, activities focused on development of EGNOS. Expect increasing focus on GNSS-2.

Activities covered by

- Trans-European Transport Networks (TEN-T). Mainly infrastructure (including validation etc)
- Research Programme (FP4 & FP5). FP5 will include several GNSS-2 Tasks
- General transport budget for studies

DG VII Activities: TEN-T

European Commission - Directorate General for Transport

- Support for EGNOS development through ESA ARTES-9 Programme
- EGNOS Pre-operational implementation project, with air traffic services in Italy, Spain and UK
- Smaller projects, e.g. use of satellite navigation in inland waterways

DG VII Activities: TENS

European Commission - Directorate General for Transport

For 1999 the following are planned:

- Further support to ESA ARTES-9 programme
- Supporting activities to multi-modal EGNOS certification
- Small studies, e.g. use of GPS/GNSS for tracking rail traffic

DG VII Activities: FP5

European Commission - Directorate General for Transport

First Call for proposals on 1st March 1999. Will cover 5 tasks:

- Review of GNSS-2 target applications requirements
- Review of GNSS-2 non-target applications requirements
- GNSS-2 related activities monitoring & reporting
- Support to GNSS-2 standardisation process
- GNSS-2 education & awareness programme

DG VII Activities: FP5

European Commission - Directorate General for Transport

Second call for proposals end 1999. Will cover 3 tasks:

- Support to GNSS-2 Detailed definition
- Joint research action towards world-wide GNSS2 infrastructure
- Support to in-orbit flight experiment

DG VII Activities: FP5

European Commission - Directorate General for Transport

Third call for proposals end-2000. Will cover 3 tasks:

- Implementation of ad-hoc institutional context
- Implementation of ad-hoc economic context
- Refinement of GNSS-2 validation methodology and support to GNSS-2 validation

Main activities to date: Transport budget

European Commission - Directorate General for Transport

Main activities to date:

- GNSS Cost benefit analysis
- IMERP Project
- Extension of Trans-European Navigation network
- EGNOS validation and portable test-bed

DGVII Activities: General Transport

European Commission - Directorate General for Transport

Studies planned under 1999 budget:

- GNSS Market Analysis
- Integration of COSPA/SARSAT with GNSS
- Support to European Radio Navigation Plan

DG VII: Conclusions

European Commission - Directorate General for Transport

- To date, have focused on EGNOS development, both through TEN-T support to ESA programme and supporting activities

- Expect shift in future to GNSS-2 activities. Synergy with other non-transport applications increasingly important to maximise benefits from GNSS-2.

SPACE-RELATED PROJECTS IN THE RTD PROGRAMMES OF DG XII

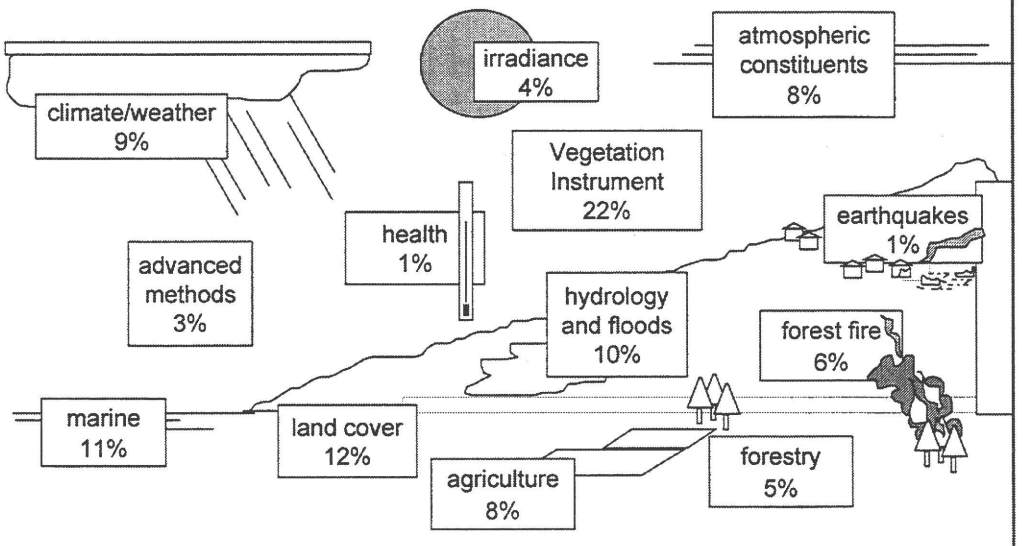
T. BUSINARO, EUROPEAN COMMISSION, DG XII , SCIENCE RESEARCH AND DEVELOPMENT

Space-related projects in the RTD programmes of DGXII

Framework 4: the first shared-cost action line for EO

- Part of the Environment & Climate RTD Programme
- To expand the uses and users of Earth observation, particularly those linked to the implementation of EU policies.
- exactly 100 projects funded (from feasibility, methodological research through to CEO pilot projects)
- Community contribution of 108 million euro
  - contribution of partners another 100 million euro
- Significant effort to stimulate the EO sector

Total contribution: 108 million ECU



EO must always be combined with other data and other technologies

- Some projects use, or could use, other *space* technologies
- details can be found in the report
- for example.....

TABLE B.I
LIST OF PROJECTS

	Proj. Name	Project Description	Project coordinator
1.	CALIS	**Calamities Informations System** Monitoring and assessment of Agricultural Damage caused by drought, flood, storm and frost F, ES, GR	Dominique Medal, Matra Systemes & Information (F), medal@matra-ms2i.fr
2.	IMSI	**Integrated use of new microwave satellite data for improved sea ice observations** Sea ice monitoring in the north sea NO,FI,RU,DK	Stein Sandven, NERSC (NO), Stein.Sandven@nrsc.no
3.	SIREN	**EO based flood risk information management service,** **F, I, D, ES**	Scot Conseil (F), Philippe Puyou-Lascassies E-mail : philippe.puyou@scot.cnes.fr
4.	MAGIC	**Meteorological Applications of GPS Integrated Column Water vapor Measurements in the Western Mediterranean F, ES, I, DK**	ACRI (F), Jennifer Haase, Jh@acri.fr
5.	ENVIREF	**Environmental Monitoring of refugee camps using high resolution satellite images** Increasing the efficiency of humanitarian relief operations and protecting the environment. N, S, CH, ES	NERSC (NO), Einar Bjorgo, Einar.Bjorgo@NRSC.no
6.	ICAMS	**Integrated Coastal Analysis and Monitoring System** Integrated system for routine monitoring of water quality	Earth Observation Sciences Ltd (UK), Dr. Graham Bland grahamb@eos.co.uk

❹ CALIS

XII/D

Calamities Information System

CALIS's objective is to monitor vegetation condition and to evaluate the impact of climate hazard on the environment and agriculture production. To reach this objective, CALIS combines meteorological and EO data with low scale information, and provides ready-to-use information. which helps the end-users to evaluate damages and take appropriate decisions.

The users of such an application would be insurance companies, Government and Ministries, Agricultural banks, Chambers of agriculture and farmers, Technical and Research Institutions.

This type of application produces value-added products that can be available in data servers for retrieval by the end-users. Communication needs range from bulk daily data transfers between regional and the central site to modest data interactions between users and the regional sites.

❺ IMSI

XII/D

Integrated Use of new Microwave Satellite data for Improved sea Ice observations

The goal of IMSI is to explore and test methods for use of new satellite EO data (spaceborne SAR data) in sea ice monitoring and improve the utilization of these observations in a wider user community. Sea ice monitoring is of national importance in countries with sea areas covered with ice, where sea ice has an impact on sea transportation. The project geographical areas of interest are the Baltic region (20.000 ships per winter), Greenland (200 - 500 ships per year) and the Northern Sea Route (500 ships per year).

The users of such an application would be National Ice Services, Marine Authorities, research institutes, oil and gas companies, shipping companies and ships.

The processed ice information (images and/or graphical products) will be generated and located at the ice centres of a specific country. Each ice centre can distribute ice information to several hundred customers every day using the appropriate communications medium.

Communication needs include regular transfer of several megabytes of data -typically images and/or graphical products, 1) from satellite receiving stations to ice centres, and 2) from ice centres to the customers.

❻ SIREN

XII/D

An EO Based Flood Risk Information Management Service

The overall objective of the SIREN project is to specify an EO-based flood risk information service in order to bridge the gap between "customers" and "EO data" for flood management (prevention, crisis and post-crisis).

The proposed service is organized in two main functions :

1. The "customer service", interface between the customer and the EO data provider, which allows the customers to submit queries and to receive the relevant information products.
2. The transformation of EO data into high level thematic products required by the customers.

The potential users of such an application would be governmental, public and research organizations concerned with flood management activities.

❼MAGIC

XII/D

Meteorological Applications of GPS Integrated Column Water Vapor Measurements in the Western Mediterranean

Limitations in atmospheric observation accuracy, as well as temporal and spatial coverage, often lead to problems in climate modeling and numerical weather prediction. MAGIC's objective is to examine the need for improved water vapor estimates and evaluate the ability of GPS ground based networks to address this need.

The proposed network consists of remote sites equipped with GPS receiving equipment and communications capability to send data, data collection centers and processing centers. MAGIC is a regional system (country level). The network covers the western Mediterranean with 6 sites in France, 9 sites in Spain, and 13 sites in Italy. The potential users of such an application would be public authorities, organizations and research institutes concerned with meteorological activities.

Communication needs include i) broadcasting and transfer of high data volumes between data collection and processing centers, ii) broadcasting low data volume to end-users. 3Mbytes per remote site are downloaded once per day, with possible increase to 90 Mbytes per site per day.

❽ENVIREF

XII/D

Environmental monitoring of refugee camps using high-resolution satellite images

This project aims to demonstrate the pre-operational use of EO data for more efficient and cost-effective planning and management of refugee camps. The overall objective of the study is to develop and evaluate new products from high-resolution EO satellite images for application and exploitation in humanitarian relief operations in customers' working environment. Envisaged products are high quality space maps, roads, surrounding water resources, forests etc.

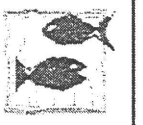
The potential users of such an application would be relief organisations (such as the U.N.) and agencies involved in humanitarian relief operations.

The communications infrastructure required to support these operations should provide mobility and portability, especially in remote areas.

❾ICAMS

XII/D

Integrated Coastal Analysis and Monitoring System



The objective of the ICAMS project is to provide an integrated engineering and scientific system for routine monitoring of water quality (temperature, turbidity, chlorophyll concentration, and primary production) from satellite data sources and coincident standard surface measurements (in situ measurements from sensors mounted on buoys). The two types of data will be processed to produce maps of coastal water quality.

The potential users of such an application would be the local industry (e.g. mariculture) as well as authorities with relevant activities.

The transfer of surface measurement data from the buoys to the processing center needs a wireless communications infrastructure adapted to the specific needs in each country.

INTRACOM S.A.

SAI

Fifth Framework Programme (1999-2002)

- Emphasis on problem-solving, concentration, flexibility
- Agreement by Council on 23 December 1998
  - Specific programme on Environment, Energy and Sustainable Development (programme 4)
  - 1.083 bn euro for 'Environment' part

Many opportunities for EO in FP5:

- Work programmes are currently before the programme committees:
- EO can contribute to several key actions:
  - agriculture/fisheries/forestry/rural areas (prog.1)
  - systems & services for the citizen (prog.2)
  - land transport & marine technologies (prog. 3)
  - sustainable management of water (prog. 4)
  - global change, climate & biodiversity (prog.4)
    - (incl. *Global change monitoring*)
  - sustainable marine ecosystems (prog.4)
  - city of tomorrow (prog.4)
  - risks & hazards (generic: prog.4)

  and *EO as a generic technology* (prog.4)

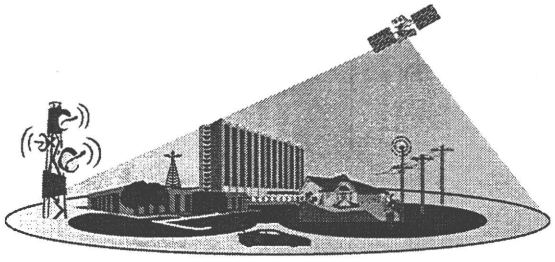
includes the space component of global observing systems

to give an renewed impetus to EO, focussing on applications linked to EU policies

SATELLITE COMMUNICATIONS
AN OVERVIEW OF EC ACTIVITIES

B. BARANI, EUROPEAN COMMISSION, DG XIII ,
TELECOMMUNICATIONS, INFORMATION MARKET AND
EXPLOITATION OF RESEARCH

Satellite Communications
An Overview of EC Activities



ASTRON Information Day - ISPRA- 19/01/99

Bernard BARANI,

European Commission, DG XIII-B

Outline of the Presentation

- **Satcom in FP4**
- **The R&D Working Group**
- **The 5th Framework Programme**
- **Satcoms in FP5**

Satcom Activities of DG XIII

Main Themes relating to Satellite Communications (SAP) addressed by DG XIII:

Completion of the Internal Market

Reinforcement of EU positions in International Fora

More efficient and co-ordinated R&D

Satcoms main Topics in FP4

- *Second Generation S-PCS (S-UMTS):*

Service trials (MPEG4), interoperability with terrestrial UMTS, interoperability between multi space segment providers: SINUS/SUMO/INSURED/TOMAS

- *Broadband/Interactive multimedia systems*

Ka band service demonstrations, mixed Ku/Ka systems using DVB, Interactive SMATV systems;DIGISAT/S3M/ISIS/ SECOMS/ASSET/WISDOM

- *IP/ATM interoperability* **through integration with B-ISDN signalling and network management;COIAS/ACCORD/ VANTAGE**
- *Backbone:* **GAMMA/NICE**

Satcoms main Topics in FP4

- *Technology:*

OSC/NEWTEST/MADS/BISANTE/APOS/UTCSP/ASIA/ NOWCASTING

- *Applications*

Broadcasting; Teleeducation; Telemedicine; Multimedia: CINENET/HYPERMEDIA/MERMAID/EETP/BIC/IDEAL S/SAFETY-NET/TEN/HEROE/ADPS/WINDS

AROUND 34 PROJECTS DIRECTLY RELATING TO SATCOMS

Satcoms in FP4

- *Satcoms activities in FP 4 have significantly increased compared to FP3;*
- *5 Projects, 25 Mecus CCR in RACE 2*
- *About 30 Projects, 50 Mecus CCR in ACTS, 15 Mecus CCR in ESPRIT;*
- *Also Ten Telecom validation projects for about 10 Mecus.*
- *Total Commission effort in Satcoms today: 75MEcus, still modest compared to Space Agencies*

The R&D Working Group (SWG)

The R&D Working Group has primarily provided an analysis on:

- **R&D areas where EU Framework programme provides significant added value. It includes:** ***Integration/interoperability satellite-terrestrial components; Network management of complex satellite-terrestrial networks; multimedia Satellite services and applications demonstrations, integration with existing standards such as DVB/DAVIC, future versions of MPEG, Communication terminals;***
- **R&D areas best tackled at Space Agencies level, with possible FP complement. It includes** ***payload & platform technology development, baseband and R&F components, ground segment specific technologies, support to commercial initiatives of industry.***

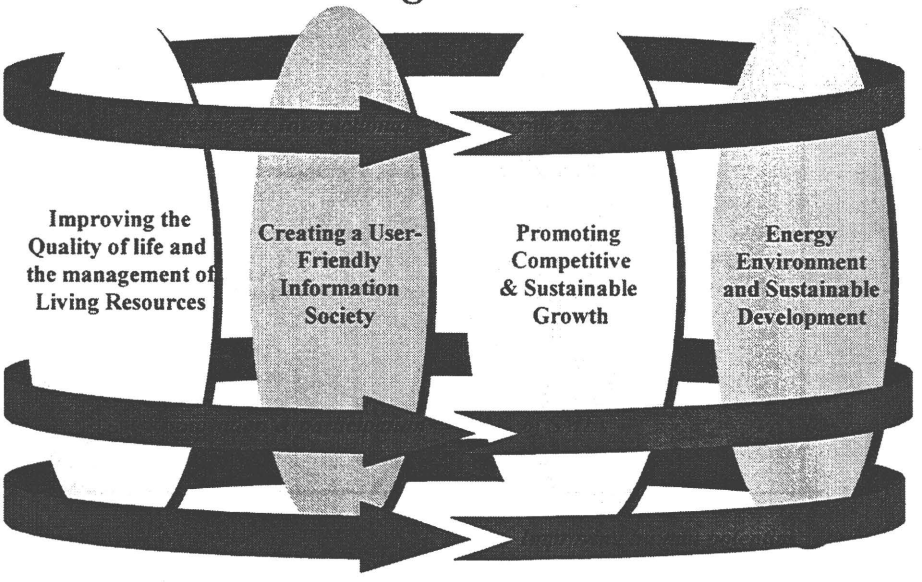
SWG Report are available at:

http://www.ispo.cec.be/infosoc/telecompolicy/en/Study-en.htm

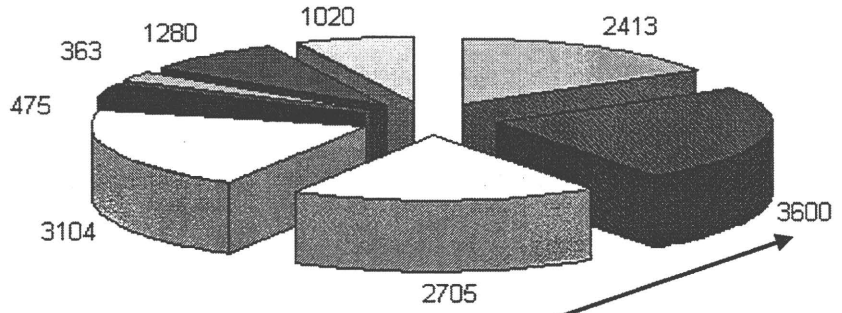
5th Framework Programme

Multiannual framework programme (1998 - 2002)

Themes in the 5th Framework Programme

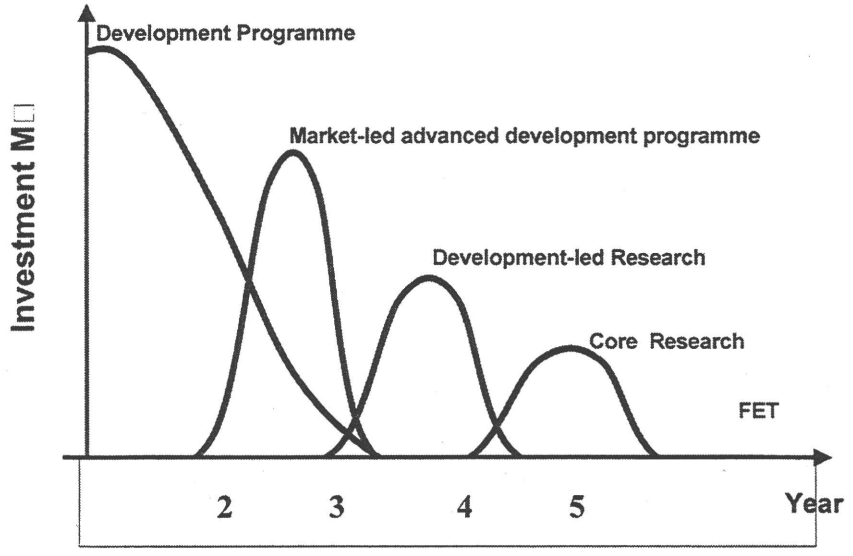


Budget breakdown MEuro

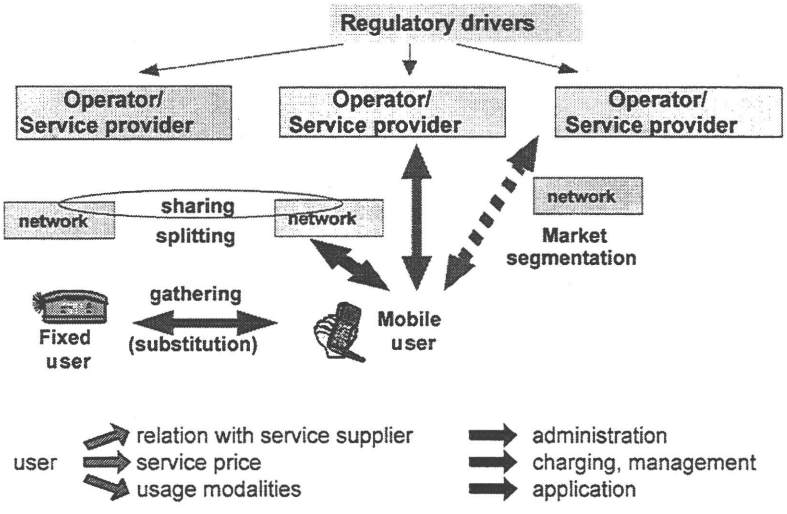


- Quality of life and management of living resources
- User-friendly information society
- Competitive and sustainable growth
- Energy, environment and sustainable development
- Confirming the international role of Community research
- Promotion of innovation and encouragment of participation of SMEs
- Improving human research potential and the socio-economic knowledge base
- Joint Research Centre

A range of investment opportunities



The convergence challenge



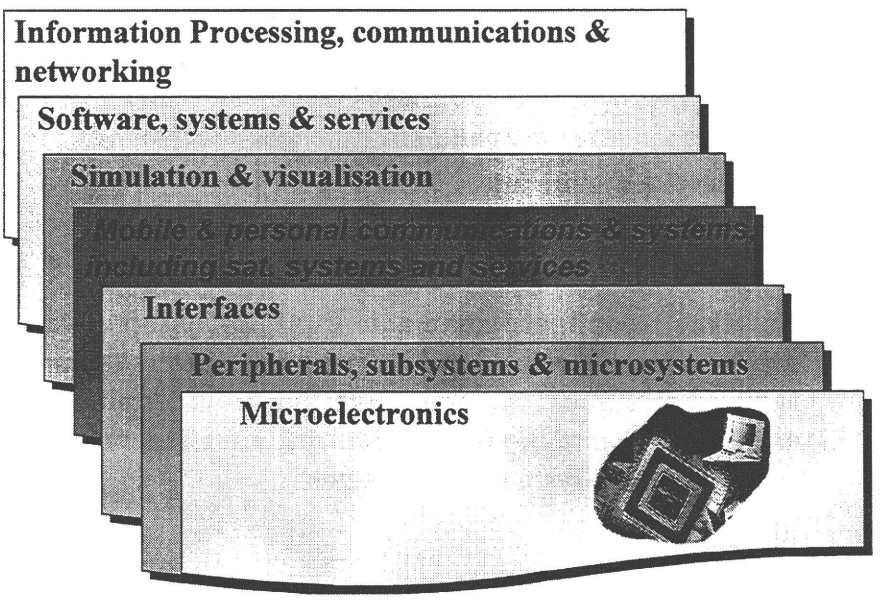
Organisation of the Work

Four *"Key Actions"*

- **Systems and Services for the Citizens 646M**
- **New Methods of Work and Electronic Commerce 564M**
- **Multimedia Content and Tools 547M**
- ***Essential Technologies and Infrastructures* 1363M**

Further activities concerned with
Future and Emerging Technologies **319M**
Research Networking **161M**

Domains of Key Action 4



Mobile and Personal Communications and systems

Focus: ***"the move to an integrated seamless network that ensures global personal connectivity and enables access to broadband wireless multimedia communications and services by anyone, from anywhere, at any time".***

The work will be driven by **advanced re-configurable radio** concepts, extending from the terminal to the network, and permeating terrestrial, **satellite**, fixed and wireless.

It should lead to a radical change in the way today's communication systems and networks and their associated services, will be designed, customised, built, integrated and managed.

Key - Adaptability in Mobile and Wireless Communications

- **Evolution from current systems (backwards compatibility)**
- **Multiple air-interfaces and multiple frequency bands**
- **Terrestrial/satellite integration and control**
- **Technology transparency**
- **Service adaptability to user demand**
- **Ability to reconfigure communications link to suit system, service or standard or optimise radio parameters to match radio environment, extending from the radio terminal of the user, through and beyond the network infrastructures and supporting sub-systems and systems**

Integrated Satellite Systems and Services

Objective: **support development and validation of satellite based communication infrastructures capable of providing access to innovative broadband services to very large quantities of low or high mobility user terminals.**

- **Advanced broadband satellite communication technologies, systems, services and applications supporting interactive, symmetric and asymmetric, multicasting and narrowcasting services as well as mobile and personal communications.**

Terrestrial Wireless Communications Systems and Networks

Objective: Investigate, develop and trial novel and advanced terrestrial wireless systems, architectures and networks and their integration, interworking and interoperation.

- Implementation of an integrated seamless network that ensures global personal connectivity and enables access to adaptive multimedia mobile communications with performance, service capabilities and service quality, comparable to those of fixed networks.
- Broadband wireless networks, systems, architectures and technologies, for services and applications sharing and using different frequency bands, for both public and private environments.
- Where appropriate these services will be integrated with navigation and position fixing services.

Re-configurable Radio Systems and Networks (I)

Objective: Lay the foundations for the introduction of novel re-configurable radio concepts that will lead to a radical change in the way terrestrial & **satellite** based systems & networks and their associated services, will be designed, customised, built, integrated and managed.

- Investigation, development and validation of architectures enabling the transparent access of customised services over heterogeneous (terrestrial, satellite, fixed, wireless) networks operating across different frequency bands;
- Assessment of the implications imposed by such an architecture at the level of service management and bundling (e.g. QoS guarantees, control, billing, security);
- Development of BSs capable of operating over a wide frequency range, implemented by modular software configurable entities;

Re-configurable Radio Systems and Networks (II)

- Development of resources management techniques allowing the network to adaptively and automatically adjust to the experienced load;
- Investigation and validation of flexible channel and spectrum resource allocation and management schemes notably for symmetric and asymmetric traffic as well as circuit- & packet- switched connections;
- Design & development of advanced H/W "minimally intelligent" but software re-configurable terminal architectures (including features such as: "mobile Operating System", wideband RF front-ends);
- Design, development and validation of software downloading mechanisms (e.g. common channel approach versus "channel sniffing" of available air interfaces);

ools and Technologies for Wireless Communications

Objective: investigate, develop, integrate, trial and validate the innovative tools and technologies that are necessary to facilitate a mass market take up of wireless terminals, systems, networks, services and applications, while contributing to the optimal use of the spectrum and allowing for the exploration of higher spectrum regions.

- Such tools and technologies must address the needs of wireless terrestrial and **satellite** systems and networks operating in a broad range of frequencies (100MHz-100GHz).

Implementation Milestones

- **13 January IST Advisory Group**
- **18 January Formal adoption FP5, 130J, SP**
- **27 January IST Committee**
- **10 February Commission Decision (1999 Workprogramme)**
- **16 February 1st Call-Deadline 18 May**
- **16 March 2nd Call-Deadline 15 June**
- **18 May 1st Call Evaluation**
- **From Sept. 99.- Effective project work**

Other Important Events

- **18 Jan. 99 - Call for Exp. of Interest**
- **Call for Evaluators launched**
- **22 Feb. 99.- IST Proposers day (Paris)**
- **25-26 Feb 99 - Launch of the 5th FP- Essen (D)**

In principle Calls for R&D work at 3 month intervals

Main implementation rules (I)

- **Provide support to different type of projects/actions:**
  RTD, demonstrations, SME co-operative research, training fellowships, "exploratory" awards, concerted actions, accompanying measures, etc.
- **Participation by consortia:**
  - ✓at least two EU participants from two different member states;
  - ✓open to International participation (provided mutual benefit);

Main implementation rules (II)

- **Financial conditions:**
  - ✓up to 50% of total eligible cost (e.g. RTD projects); 35% for demonstration projects
  - ✓up to 100% of additional or total eligible costs (e.g. concerted actions, accompanying measures);
- **Proposals evaluation criteria:**
  - ✓S&T excellence and project management plans;
  - ✓community added value and social objectives;
  - ✓Economic development and S&T prospects;

Accompanying measures

- **Trials, Best practice, First-use**
- **SME Support Actions**
- **Interconnection of research infrastructures**
- **Networks and Groups**
- **Project Clusters and Concerted Actions**
- **Analysis, Dissemination and Training**
- **Exploitation of results**
- **Support to Standardisation**
- **Support to conferences, seminars, workshops**
- **Studies**

FP5 IST ENVIRONMENT RTD PRIORITIES AND POTENTIAL AREAS FOR FEASIBILITY STUDIES / PROJECTS RELATED TO ASTRON

W. BOCH, EUROPEAN COMMISSION, DG XIII , TELECOMMUNICATIONS, INFORMATION MARKET AND EXPLOITATION OF RESEARCH

ASTRON INFORMATION DAY

FP5 IST ENVIRONMENT RTD priorities and potential areas for Feasibility Studies / Projects related to ASTRON

JRC - ISPRA - 19th January 1999

Wolfgang BOCH - European Commission - DGXIII
Head of Sector - Telematics Application for Environment
E-mail : Wolfgang.Boch@bxl.dg13.cec.be

SUMMARY OF THE PRESENTATION

Scope of presentation:

✓ *Exploitation of Satellite Technologies by Telematics Application Programme - ENVIRONMENT Sector projects (FP4)*

✓ *Provisional Research priorities for IST - Key action 1 "Systems & Services for the Citizen" applications for Environment protection (FP5)*

✓ *Potential areas of investigation by ASTRON with relevance to the FP5 - Information Society Technologies applications for ENVIRONMENT*

FP4 - Projects exploiting SAT Solutions

Mapping Sat technologies :

- ✓ ***Earth Observation - EO***
- ✓ ***Satellite Navigation - SATNAV***
- ✓ ***Satellite Communication - SATCOM***

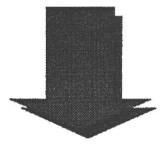
with FP4 - Environmental Telematics Projects indicates the potential use of these technologies in Environment, in particular for Environmental Emergency & Disaster Management.

SAT Technologies - I S T
Environmental Application

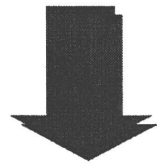
FP4 - TAP-Environment Projects exploiting SAT Solutions

Project	EO	SATNAV	SATCOM
RADATT : Rapid Damage Assessment Telematic Tool	YES	Potentially	Potentially
ENVISYS : Environment Monitoring Warning & Emergency System	YES	Potentially	Potentially
TELEFLEUR : Telematics-Assisted Handling of flood Emergencies In Urban Areas	YES (Weather Forecats)	Potentially	Potentially
DEDICS : Distribuited Environmental Disaster Information System	Potentially	Potentially	Potentially

FP4 - Telematics Applications for Environment



Transition to Framework Programme 5
1999 - 2002



IST - Environment

1999 priorities - provisional information

Intelligent environmental monitoring and management

– **Objectives**

- **Monitoring slow chronic changes and pollution**
- **Assessment of new business models for value-added environmental info-services**
- **Contribution to European and global standards for Data Exchange**
- **Support to environmental planning and early warning**

– **Intelligent information system development, including:**

- **intelligent sensors, detectors and telecommunication networks**
- **integration of diverse networked information sources**
- **advanced data mining, including geo-referenced data, and decision support systems**

1999 priorities - provisional information

Environmental risk and emergency management

– Objectives
  - Develop and demonstrate new tools and integrated systems for consistent emergency management supporting the entire cycle from prevention to follow-up
  - Contribute and establish European standards for emergency management tools
  - focus on floods, forest fires, land slides and industrial accidents

– Emergency management system development, including:
  - intelligent, mobile, and networked sensors for near real-time data collection
  - remote sensing integrated with local continuos or sampled measures
  - risk assessment models and real-time GIS
  - fixed and mobile, point-to-point or multicast telecommunication networks and services

ENVIRONMENT

Tentative priorities 2000

- **Environmental Modelling, Simulation & Forecasting**
- **Risk management of Land-Mines**

- **IST - InfoDay in Paris-La Defence 22 Feb. 1999 (http://www.cordis.lu/ist/infoday.htm)**
- **Launch of the 5th Framework Programme - ESSEN 25 - 26 / 02 /99 (http://events.relatech.fi/fp5/)**
- **First Calls for Proposals February/March 1999**

IST Programme

Information Society Technologies Programme

Information Day- Paris, 22 February 1999

The purpose of this Information Day is to encourage a maximum of interaction between potential proposers and Commission staff and between potential proposers themselves.

The Information Day will consist of:

- A short **plenary session** to outline the contents of the first call for proposals and give information on calendar of the calls and procedures
- An **information fair** designed to facilitate browsing, networking and personal contacts

Fifth Framework Programme launch conference 25 - 26 February 1999, Essen

The purpose of the conference is to present the new features of the programme, to explain to interested parties how to participate, and to give examples of particularly successful European research projects.

The conference will be of interest to current and potential research project coordinators, as well as representatives from science, industry, and those institutions concerned with science and technology.

information society technologies

Relevant Web Sites:
http://www.cordis.lu/ist (5th FP - IST Programme)
http://www2.echo.lu/telematics/environ/environment.html (4th FP Telematics for the Environment)

Potential links between ASTRON and IST - Environment

Preliminary draft Analysis as input for future discussion between DGXIII and SAI

The next slides indicate potential areas of interest for and relevance to Environmental Applications in the Information Society Technologies Programme.

For each area of interest, the topics and issues for investigation by ASTRON are listed, in particular with regard to the feasibility studies.

The basic sat technologies, that play a major role in contributing to the solution of the objectives of each area, are highlighted with different size of font.

Natural Resources Inventory and Intelligent Monitoring

- Measurement of the Natural Resources via Remote Sensing in Quantity and / or Quality
- Monitoring state of health and position of endangered species; supporting Biodiversity
- Measurement of the Quality of Fluids during their movements - Air, Water - with current mobile sensors
- Supporting the Data Collection from isolated areas
- Monitoring slow chronic changes

Earth Observation

Sat. Navigation - GNSS -

Sat. Communication

Issues for studies/ projects:

- Identify the Natural Resources "Measurable" with the actual and near future remote sensing technologies and with existing - planned satellites - ground segment
- Identify affordable architectures
- Identify needs of Standards

Natural and Man-Made Risks and Hazards Monitoring

Monitoring Natural Risks and Hazards - i.e. : risk map for Forest Fires, Rivers Water levels in case of severe floods, oil spills detection & movement, etc.

Monitoring Severe Occurrences of Pollution

Monitoring the Movements of Dangerous Substances

Supporting the Data Collection from Isolated Areas

Earth Observation

Sat. Navigation - GNSS -

Sat. Communication

Issues for studies/ projects:

- Identify the natural and man-made Risks monitorable in near real-time on the basis of actual and near future remote sensing technologies and existing - planned satellites and ground segment infrastructures
- Identify affordable architectures
- Identify needs of Standards

Emergency Management

Monitoring the Status and the Position of Mitigation Resources

Monitoring Severe Occurrences of Pollution

Supporting the Emergency Communications between mobile Mitigation Resources in Isolated Areas not covered by other communication infrastructures (i.e. GSM)

Earth Observation

Sat. Navigation-GNSS-

Sat. Communication

Issues for studies/ projects:

- Identify the New Enablers and Solutions for Emergency Management based on actual and near future Position - Communication and Remote Sensing technologies and existing - planned satellites
- Identify affordable architectures
- Identify needs of Standards

Environmental Risk and Emergency Management focusing on LANDMINES

Monitoring the Status of the Barriers to forbid access to Landmined Areas; inform about that

Detecting unauthorized access to Landmined Areas

Supporting the information to Soldiers - Travellers about APL risks and contaminated areas

Supporting the timely communication in case of APL incidents occurred (position, typology, etc.) in isolated areas

Earth Observation

Sat. Navigation - GNSS -

Sat. Communication

Issues for studies/ projects:

- Identify the Potential Solutions based on of actual and near future Remote Sensing - Position - Communication technologies for Emergency Management in the field of Landmine due to APL contamination

TEN-TELECOM ACTIVITIES IN THE AREA OF SATCOM / SATNAV

M. MONTEIRO, EUROPEAN COMMISSION, DG XIII , TELECOMMUNICATIONS, INFORMATION MARKET AND EXPLOITATION OF RESEARCH

ASTRON Information Day
SAI-JRC, Ispra, 19th Jan. 99

TEN-Telecom Activities in the area of Satcom / Satnav

Manuel Monteiro
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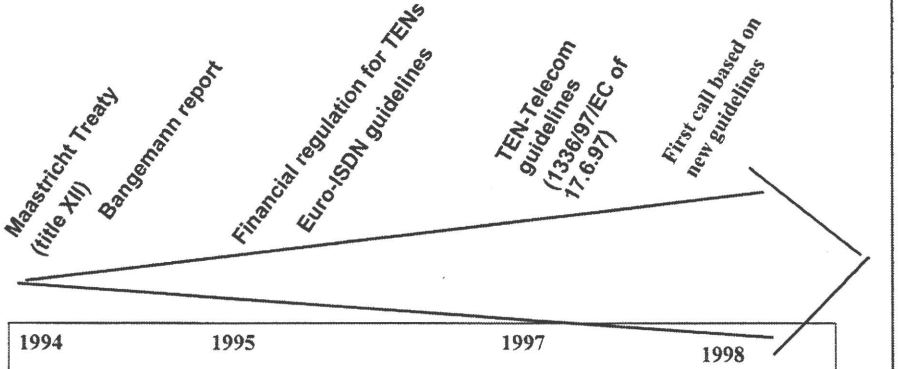
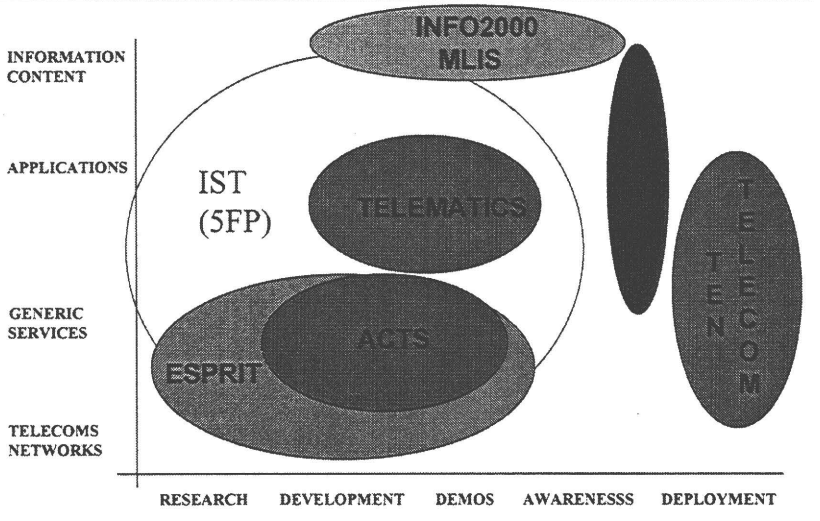
Development of TEN-Telecom



1994	1995	1997	1998
TEN preparatory actions TEN-ISDN TEN-IBC	Euro-ISDN as the first available platform for multimedia services	Enlarges list of projects of common interest. Deployment of telecommunications applications and services. Interoperation and integration of basic networks components.	

TEN-Telecom Versus Other EC-DGXIII Activities



Distinctive features of TEN-Telecom

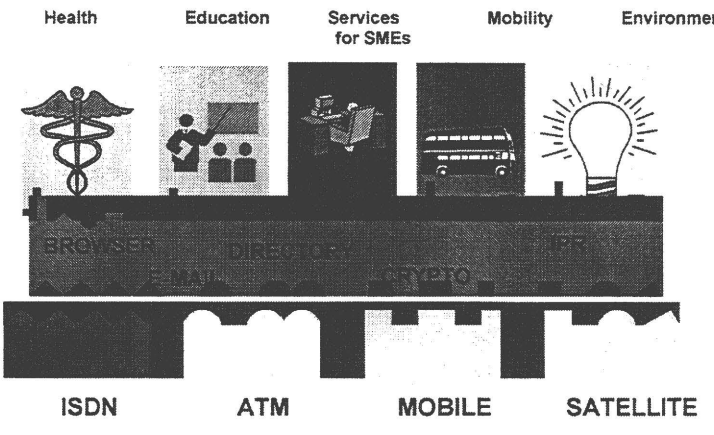
The "Preparation for Roll-Out" Approach - Pro

- Commercial/financial validation and initial roll-out of a sustainable activity.
- Activity meeting the needs of a critical mass of users (a market) and the ability of the partners to capture part of this market.
- Use of mature technology (exploit the results of former R/D activities).
- Economic viability:
  - A business plan and revenue forecasts
  - A financial plan
- Solid commitment from partners

Three Reasons for joining TEN-Telecom

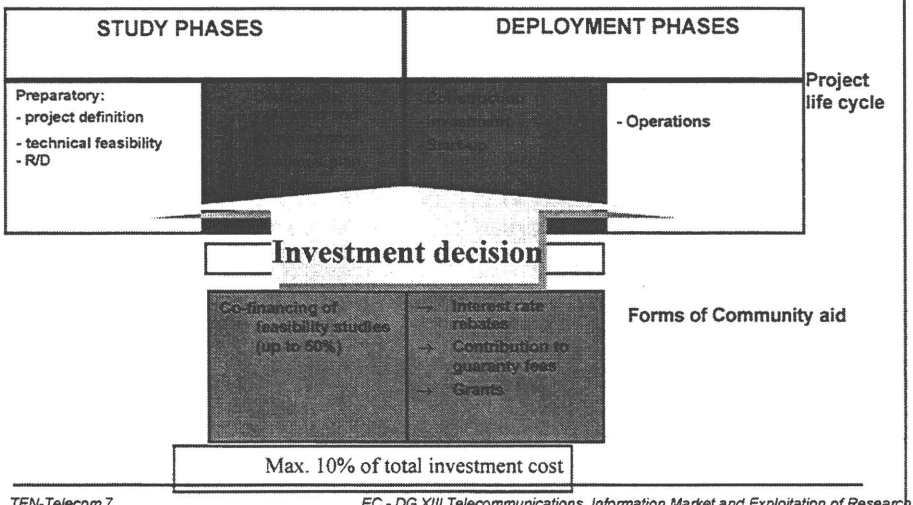
- launching a project on a trans-European dimension, where this is difficult to be achieved without Community support
- covering areas where uncertainties on the short term commercial viability increases the financial risk and discourages private ventures.
- developing and implementing partnerships with public entities or equivalent entities.

Priorities at three levels



To support the interoperation and the strategic development of interconnected networks

Forms of Community aid in relation to the project



Summary action areas

- **Applications of public interest**
  - telecommunications networks for *education and training*
  - telecommunications networks for *access to cultural heritage*
  - trans-European telecommunications *applications and services for SMEs, including electronic commerce*
  - trans-European telecommunications networks for *transport and mobility*
  - trans-European telecommunications networks for *environment/emergency management*
  - telecommunications networks for the *health sector*

Summary action areas

- Trans-European Generic Telecommunications Services
  - Internet-based generic services
  - Electronic commerce support services
  - Multimedia support services
  - Support of mobility
- Basic networks
  - Strategic development and *global interoperation* of telecommunications networks *(satellite, mobile, fixed broadband and ISDN networks)*

TEN-Telecom projects (Call 98/1-2)

- SANARIS:A Satellite Network for Natural Risks Monitoring with Fast Deployment and Close-To-Target Capabilities in Emergency Situations
  - Data Integrity
  - Models for simulation and risk assessment
  - User friendly interface for data and information
  - Data dissemination to end-users
- MULTIMETEO XXI: Multilingual Production of Weather Forecasts into the XXIst Century
  - New faster and better weather information services
  - Internet and telephone
  - 5 languages (FR,SP,DE,NL and EN)

TEN-Telecom projects (Call 98/1-2)

- UFOS: Ultra Violet Forecasting Operational Service
  - Monitor ground level of U.V. (based on ENVISAT data)
  - User application & commercial network requirements
- A-CDM-D: Air Collaborative Decision Making Demonstrator
  - Integration of networks (Eurocontrol, air control and airport authorities, airline operation centres)
  - On line data to improve decision making
- TESSYN: Trans European Satellite based SYstem for Navigation
  - Integration of navigation and Telecommunication networks
  - User orientated and value added services

TEN-Telecom Support Actions (Call 98/3)

- TUSAM:
  - Observatory/Monitoring
  - Communication networks market and technology
- Telecom 2000:
  - Awareness/Synergy from running activities
  - Preparation of future activities

Main Conclusions of TEN-Telecom Workshops

(in collaboration with Telematics Programme - DGXIII.C6)

Priorities given by users:

- Emergency services Management at Pan-European level
- Remote sensing services to produce synthetic and continuously update picture of the state of Environment
- Tools and services at low cost to access Environment data

Information Service Chain:

- Data suppliers, content organisers, service providers, information distributors (telecom operators) and users

The 1999 call for proposals

- One single call addressing projects of particular importance for the development of the information society, as identified in the guidelines
- issue of interoperation and development of networks addressed in the context of an application
- better focus in the terms of reference of each project
- *budget: 14 MEURO*, no predefined allocation among sectors
- Tentative *date for the Call : 1st March 1999*
- Tentative *date for Information Day in Brussels: 16th March 1999*

Sectoral terms of reference (3)

- **Transport and mobility**
  - user-oriented value-added services in the areas of logistical support for transport industries, and travel/traffic information
  - telematic services in urban areas
  - based on fixed, mobile and satellite components of infrastructure networks

Sectoral terms of reference (4)

- **Environment and emergency management**
  - environmental information systems
  - global emergency management systems
  - exploit synergies between communication and positioning network components, plus earth observation systems

Project type (1)

- **Feasibility studies:**
  - market validation
  - Community aid of 50% of the costs of the work packages
  - expected duration: 12-18 months

Project type (2)

- **Deployment:**
  - implementation and investment plan
  - Community aid is up to 10% of investment costs, remaining 90% from well identified and committed sources
  - Community on the first 2 years of investment
- ***If the aid applies to feasibility studies, the project will not, as a rule, benefit from additional support at the deployment stage***

TEN-Telecom on the Web

- On-line information on the Web:
  - TEN-telecom work programme
  - Calls information packages
  - National contact points, seeking partners
  - News and ongoing activities
  - Projects information

http://www.echo.lu/tentelecom

Potential links between TEN-Telecom and ASTRON

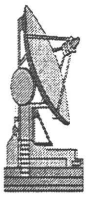
- Some ASTRON R&D activities could originate new mature products to be deployed under TEN-Telecom
  - EO information services (e.g. UFOS project)
  - New applications and services for the Environment using EO
- ASTRON studies on the developments of new services and applications supported by integration of EO with Satcom and Satnav may be of interest for TEN-Telecom

THE SPACE APPLICATIONS INSTITUTE (SAI) IN THE 5 th FRAMEWORK PROGRAMME (1999-2002)

J. ASCHBACHER, JRC, JOINT RESEARCH CENTRE

ASTRON Information Day
19 Jan 1999, JRC Ispra

The Space Applications Institute (SAI) in the 5th Framework Programme (1999-2002)



Josef Aschbacher
SAI Directorate, TP263, I-21020 Ispra

Sai Space Applications Institute

JOINT RESEARCH CENTRE
European Commission

JRC's Mission Statement

"To provide demand-driven scientific and technical support for the conception, implementation and monitoring of EU policies.

As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of commercial or national interests."

Sai Space Applications Institute

JOINT RESEARCH CENTRE
European Commission

SAI's Mission Statement

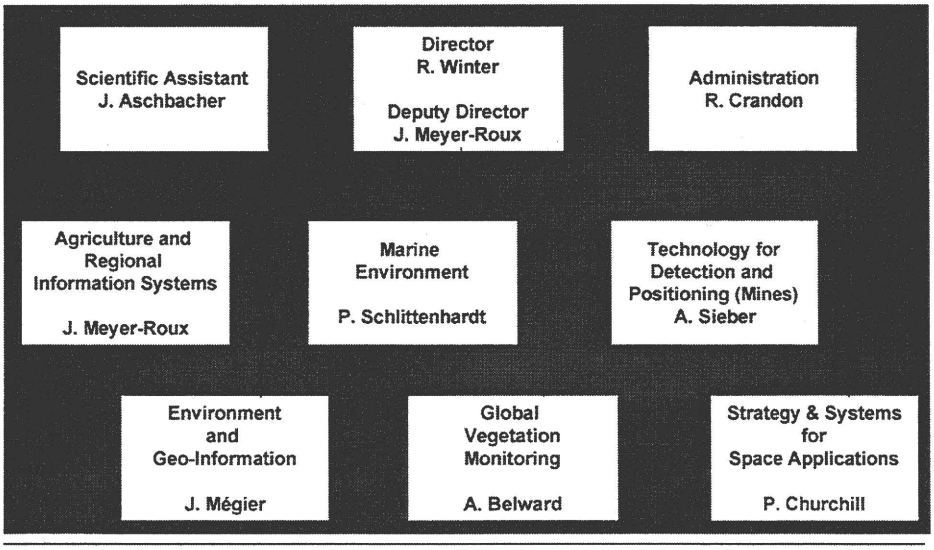
"The primary mission of SAI is to develop and promote the use of space derived data and geo-spatial data from other sources in the service of EU policies, especially those relating to agriculture, fisheries, transport and anti-fraud.

SAI also seeks to make the best use of information from space systems, to maximize the return from European investments in space and to help the Union reinforce its role in international action on the environment and sustainable development."

Sai Space Applications Institute

JOINT RESEARCH CENTRE
European Commission

SAI's Organisation



Sai Space Applications Institute

JOINT RESEARCH CENTRE
European Commission

SAI's evolution from FPIV to FPV

SAI at the beginning of FPIV

- ⇨ 1 strategic project: MARS
- ⇨ many 'smaller' activities
- ⇨ CEO migrated to SAI (from ISIS) during 1995
- ⇨ 90 statutory staff

SAI at the beginning of FPV

- ⇨ 5 strategic projects: MARS, Mines, GEIS, CEO, ASTRON
- ⇨ streamlining of small activities into larger projects: Euroland, Coast, GI/GIS
- ⇨ new initiatives: SIGMO, Air Quality, Hazards
- ⇨ CEO evolved from 'market development' to 'systems' and 'strategy'
- ⇨ 136 statutory staff

From 'Remote Sensing' to 'Space'

During FPIV - SAI has extended its mandate from 'remote sensing applications' to 'space applications'

- ⇨ synergy of EO with satellite telecommunication (SATCOM)
- ⇨ synergy of EO with satellite navigation (SATNAV)

Renaming of the Institute in 1996

- ⇨ Before: Institute for Remote Sensing Applications (IRSA)
- ⇨ Now: Space Applications Institute (SAI)

Synergy of EO with SATCOM and SATNAV

- ⇨ Preparatory work on ASTRON: 1996-1998
- ⇨ Launch of ASTRON Project: 1999

From 'Space' to 'Spatial'

During FPIV - SAI has developed 'space-based' activities into 'spatial information services'

- ⇨ integration of space data with non-space data ('information')
- ⇨ development of services based on space data ('services')

SAI was given new sub-title in 1998

- ⇨ Before: no sub-title
- ⇨ Now: Spatial Information Services

Examples of Spatial Information Services

- ⇨ GI & GIS: Harmonisation and Inter-operability
- ⇨ MARS: production estimates and fraud control
- ⇨ European Soil Bureau
- ⇨ Forest Fire Web
- ⇨ Monitoring of Urban Dynamics (from 1950s to 1990s)

Space Applications Institute

JOINT RESEARCH CENTRE
European Commission

11 SAI Projects in FPV (1999-2002)

Serving the Citizen

- ⇨ *SAI-X1: Sampling of Information on GMOs (SIGMO)*
- ⇨ *SAI-X2: Demining Technologies*
- ⇨ *SAI-X3: Natural Hazards*

Enhancing Sustainability

- ⇨ *SAI-X4: European Landscape (EURO-LANDSCAPE)*
- ⇨ *SAI-X5: Coastal Monitoring & Management (COAST)*
- ⇨ *SAI-X6: Global Environmental Information Systems (GEIS)*
- ⇨ *SAI-X7: Air Quality Monitoring Using Space Techniques*
- ⇨ *SAI-X8: Monitoring of Agriculture with Remote Sensing (MARS)*

Underpinning European Competitiveness

- ⇨ *SAI-X9: Centre for Earth Observation (incl. Post-Kyoto)*
- ⇨ *SAI-X10: Synergy of EO with SATCOM and SATNAV (ASTRON)*
- ⇨ *SAI-X11: GI & GIS Harmonisation and Interoperability*

Space Applications Institute

JOINT RESEARCH CENTRE
European Commission

I. Serving The Citizen

Sampling of Information on GMOs (SIGMO)

- ⇨ Use of area sampling techniques for the tracking of GMOs, and especially GMCs
- ⇨ DGXXIV

Demining Technologies

- ⇨ Implement a strategy aimed at improving the overall effectiveness of civilian demining actions
- ⇨ DGs IA, IB, III, VIII, ECHO

Natural Hazards

- ⇨ Develop European risk indicators for the protection of individual citizens against natural hazards (fires, floods, land slides, droughts)
- ⇨ Council of Europe, DGs III, XI

II. Enhancing Sustainability

EURO-LANDSCAPE

- ⇨ Use of EO for assessing, mapping and monitoring the European landscape (focus on sustainable development, environmental conditions and bio-diversity)
- ⇨ DGs VI, VII, XI, XII, XVI, Eurostat, EEA

Coastal Monitoring and Management (COAST)

- ⇨ Support the Community Strategy for Integrated Planning and Management of Coastal Zones
- ⇨ DGs IB, III, VIII, XI, XII, XIV

Global Environmental Information Systems (GEIS)

- ⇨ Provide timely and accurate information on changes in the location and condition of global vegetation types, for the implementation and verification of environmental treaties
- ⇨ DGs IB, VIII, XI

II. Enhancing Sustainability (2)

Air Quality Monitoring (AIR)

- ⇨ produce satellite-derived maps of air pollution caused by particles and ozone, and improve ozone pollution maps through assimilation models
- ⇨ DGXI

Monitoring of Agriculture with Remote Sensing (MARS)

- ⇨ develop methods to provide early estimates of agricultural crops at European level, and use remote sensing for the control of farmer's declarations
- ⇨ DGVI

III. Underpinning European Competitiveness

Centre for Earth Observation incl. Post-Kyoto (CEO)

- ⇨ (i) to support the development of an operational EO capability to meet the requirements of the Kyoto protocol and EU policies
- ⇨ (ii) to develop and operate systems that facilitate the use of spatial information and EO data
- ⇨ (iii) provide strategic support related to space applications
- ⇨ DGs IB, III, VII, VIII, XI, XII, XIII

Synergy of EO with SATCOM and SATNAV (ASTRON)

- ⇨ to identify applications, follow evolutions and undertake feasibility studies related to synergistic applications of EO with Satcom and Satnav
- ⇨ DGs III, VII, XIII, SG-UCLAF (and JRC SCG)

III. Underpinning European Competitiveness (2)

GI and GIS Harmonisation and Interoperability (GI/GIS)

- ⇨ to conceive, create and harmonise European databases, develop integrating spatial models and support the interoperability of spatial data
- ⇨ DGs IA, III, XI, XIII, XVI, Eurostat, EEA

New Challenges

EU's political challenges

- ⇨ Further integration of the EU: need for harmonised information across Europe
- ⇨ EU enlargement: need for baseline information
- ⇨ common foreign and security policy: need to monitor security of EU's citizens

Technological challenges

- ⇨ new generation of sensors and missions: high resolution, hyper-spectral, multi-satellite constellations
- ⇨ rapid developments in information technology: internet, telecoms, navigation

Re-structuring of space industry and operators

- ⇨ market driven, commercial operators are emerging; existing operators are re-structuring themselves

Future Roles of SAI

Implement the new JRC mission statement

- ⇨ support of EU Policies
- ⇨ in close collaboration with EU Member States
- ⇨ continue to develop technological expertise through strong R&D Programme

Programmatic orientation of SAI

- ⇨ Develop 'Spatial Information Services'
- ⇨ Develop from 'EO applications' to 'space applications'

Seek close collaboration with EU Member States

- ⇨ to ensure active exchange of R&D results across Europe
- ⇨ to ensure high quality of JRC's technical support to the EC Services
- ⇨ to support the development of European space organisations and industry

Concluding Remarks

- **SAI is seen by the outside world (EU and beyond) as more than a research centre**
- **We are seen as a partner in evolving European space activities**
  - ⇨ We are the EC's technical reference point for space applications
  - ⇨ We work with other European (and non-European) institutional entitites (ESA, EUMETSAT, Natl. Space Agencies, etc.)
  - ⇨ We participate in international fora (e.g. CEOS, IGBP, G7)
  - ⇨ We are seen by industry as an informed gateway to elements of EU policy offering opportunities for the development of new sensors and systems

SESSION 3
Non-EC Projects / activities relevant to ASTRON

DISSEMINATION METHODS FOR METEOROLOGICAL DATA

W. DILLEN, EUMETSAT

Dissemination Methods for Meteorological Data

Walter Dillen, EUMETSAT

ASTRON Info Day

19 January '99

Outline

- Current EUMETSAT data dissemination
- Trends and Issues
- How to analyse potential future dissemination methods
- Synergy considerations
- Conclusion

EUMETSAT data dissemination

- Redistribute processed meteorological satellite data originating from the EUM programmes, and from third parties
- Both near real-time (NRT) and historical data

Near Real-Time (NRT) data dissemination

- Current practice: All MTP and MSG-1, -2, -3 spacecraft (GEO systems):
  - Dissemination using dedicated on-board transponder, covering Europe and Africa
  - Two types of user receiving stations, high rate - low rate
- MSG spacecraft beyond MSG-3: alternatives studied, i.e. dissemination through specialised services
- EPS spacecraft (LEO systems): No geostationary transponder available, but "direct read-out" of local data possible during satellite pass - dissemination of global data planned to use a specialised (TBD) service - detailed concept under definition
- Also: low-volume data dissemination via WMO GTS terrestrial network

Historical data dissemination

- Current practice:
  - dissemination from the MARF (Meteorological Archive and Retrieval Facility)
  - Most deliveries on off-line media, some on-line via Internet
- Future:
  - Improved archive access services planned, in the context of the multi-mission archive (U-MARF) project.
  - Prerequisite for these will be high-speed on-line access, using low-cost, widely available services

Trends and Issues

- Trends
  - Arrival of commercial broadband communications systems (both satellite and terrestrial)
  - Strong growth of the Internet and Internet technology
  - Increased interest/demand for meteorological data and products
    - with arrival of MSG as a new generation of GEO meteorological satellites
    - expected to further increase with arrival of EPS as a LEO meteorological system
    - with arrival of U-MARF incl. on-line user services
- Issues
  - New satellite comms services are only just emerging, not operationally and commercially proven, and may yet evolve rapidly (e.g. satellite return channel)
  - Unresolved QOS issues on Internet
  - Full-size meteorological data (still) tend to be of high-volume, seen by today's communications services bandwidth offerings

How to analyse potential future dissemination methods

- (Continue to) monitor the the arrival of commercial broadband systems, in particular regarding the following aspects
  - technical
  - operational
  - standardisation
  - economical
  - regulatory
- Compare cost/performance of new services with current methods
- Identify migration and evolution paths - look for ways to embed new capabilities in current applications (e.g. integrate satellite high-througput and multicast capabilities in current dissemination and delivery schemes)

How to analyse potential future dissemination methods (2)

- Attempt to establish an "architectural model" of each data dissemination application, into which current and future communications services can be "plugged in", according to the requirements to be fulfilled (e.g. NRT vs. historical, point-to-point vs. multicast, push- vs. pull-type, etc.)
- Identify technical and service-level interfaces to services offered (applying to provider and user)
- Gather field experience, e.g. through pilot projects

Synergy considerations

- In the past and to date, dissemination of meteorological data has been highly specialised, and tightly coupled with the observation satellite system itself
- Emerging communications services may present alternatives, allowing to decouple data dissemination from the primary satellite mission(s).
- This could allow meteorological data dissemination to benefit from:
  - general developments of data dissemination services, e.g. public networks, new protocols, QOS, etc.
  - specific developments, e.g. the arrival of EO dissemination networks/services

Conclusion

- Satellite communications are likely to remain an important means of disseminating meteorological data
- For future GEO and LEO missions, specialised communications services, emerging today, may represent an attractive alternative to today's dedicated on-board systems
- In order to be attractive for providers and users, communications services have to be modular, standardised and interoperable, allowing to combine, e.g. both satellite and terrestrial services into one integrated application, widely available, at low cost

SPOT IMAGE AND THE NEW TELECOMMUNICATION ERA

L-F. GUERRE, SPOT IMAGE

SPOT IMAGE and the new telecommunication era

Louis-François Guerre
Philippe Delclaux

January 1999

Table of content

1)The geographic information demand

1.1) More and more geographic information on digital form

- raw information for exploitation and processing
- various layers for GIS analysis and compilation
- final information & products for exploitation and use on digital equipment

1.2) Strong requirements on fast access to the geographic information

- specific applications dealing with emergency responses (pollution, natural risks, military crisis, ...)
- customers often request short delivery time

1.3) The increase in information exchange concerns also geographic information

- more and more networking between projects partners, companies, people
- increase in the multi source data collection and exploitation

2) Spot Image assets

2.1) A world-wide activity and network

- 1998 turnover of around 40 Million Euro
- several thousand of customers in the world
- 80 distributors and 4 subsidiaries in the world
- a network of 23 ground receiving stations
- many international partnerships

2.2) An activity completely oriented towards geographic information

- digital images from all over the world (more than 6 million images in archive)
- thematic or basic value-added geographic information products
- end-user solutions & services to respond to geographic information demands

3) Constraints for a wider use of on-line services

- Internet infrastructures do not guarantee the bandwidth
- Security and integrity of transmission is not guaranteed
- Point-to-point transmission still expensive
- SATCOMs offer currently mainly regional services
- Infrastructures and networks connection not always developed to transmit data to up-link hubs for broadcast

4) Different types of requirements and current solutions

4.1) From the acquisition antenna to the production facilities

Very high volume of data (GBytes) to transmit daily to a short distance

=> needs of 50 to 100 MB/s transmission flow with a point-to-point communication link

Current solution: low-tech system (pick-up truck)

SPOT IMAGE

4.2) Within Spot Image organisation

(communication with SICORP in the US, SSC-SB in northern Sweden, Ground Receiving stations, VITO in Mol...)

High volume of data (hundreds of MBytes) to transmit daily (scenes, programming & processing orders, WEB, catalogue updating)

=> needs of hundreds of KB/s transmission flow with permanent point-to-point communication link between 2 places

Current solution: VSAT antenna with a 2 way communication link of 64 to 256 KB/s between Spot image, Sicorp, SSC-SB and VITO (could be other technologies as well, like ground network; only criteria: "quality of service over price" ratio)

SPOT IMAGE

4.3) On-line delivery to customers

Medium volume of data (dozen to hundreds of MBytes) to transmit occasionally (from once a week to once a month) with a point-to-point communication link

=> needs of tenth to hundreds of KB/s transmission flow with point-to-point communication link to various locations in the world for occasional exchanges

Current solution : ISDN communication services with some customers on an experimental basis; Internet could be an alternative if guaranteed bandwidth world-wide.

4.4) On-line catalogue services

Permanent connection between Spot Image and the customers world-wide for catalogue querying, scenes searching, scene ordering, ...

Current solution: Internet communication and connection to a WEB site with an interactive catalogue (currently DALI; coming in 1999: SIRIUS)

5) New Spot Image on-line services in 1999

- New on-line catalogue : SIRIUS
- On-line delivery service
- VEGETATION on-line delivery

5.1) SIRIUS on-line catalogue

Querying of all the existing products of Spot Image, including "ready to be made" products

➔Access to metada about imagemaps, thematic & general public products
➔Access to SPOT scene metadata
➔Access to quick-looks of scenes and of products as well,
➔Navigation by application and product type category
➔On-line ordering

5.2) On-line delivery service

- "Electronic DHL" for our customers and distributors (limitation to a selected number of users in 1999 for a test period)
- All Spot Image's products
- ISDN transmission: less than 1hour for a SPOT scene with a 64KB/s bandwidth
- Service based upon subscription

5.3) Distribution of VEGETATION data

- SPOT IMAGE represents the Distribution Entity,
- the ordering process goes through SPOT IMAGE, from the CTIV web server hosted by VITO in Mol (Belgium),
- the invoicing process goes from SPOT IMAGE to the distributors or to the end user,
- the products can be delivered electronically from the CTIV server through Internet or ISDN.

6) Spot Image involvement in European application development projects with a telecommunication component

- MANHUMA
- ISIS
- RAMSES

7) Perspectives of new services in the telecommunication era (some examples)

7.1) Fast exploitation of the information and data

7.2) New data distribution services

7.3) A better world-wide access

7.4) New opportunities for data collection

7.5) Inter-active uses of EO data and derived information

7.1) Fast exploitation of the information and data

- Quick transmission of raw data after acquisition for exploitation.

  Crucial for application & services related to emergency response and hazard monitoring, defence and surveillance, precision farming ...

- Fast diffusion of the final information: information derived and compiled from any sources can be sent to end-users.

  Again essential in the framework of emergency services mentioned above for operational personal and decision makers

7.2) New data distribution services

- improved distribution services of the data and information (fast delivery coupled with rush production, time saving because of customs procedure delays, ...)
- coupling of interactive digital services and tools such as catalogue research, data extraction, order, delivery

7.3) A better world-wide access

- access to customers and users with poor infrastructures for the diffusion of information (raw, final information)
- access to places with destroyed infrastructures (e.g.: in case of disasters)
- access to remote places with no infrastructures (e.g. : projects including fieldwork, work in remote places, ...), for the diffusion of information or for the collection of data

7.4) New opportunities for data collection

- improvement of dedicated information systems including the collection and data transmission of associated observation systems:

  - other satellite data,
  - in-situ camera,
  - airborne data

  to derive a final information (e.g.: agriculture production estimate, deforestation monitoring, drought monitoring coastal pollution monitoring, water quality monitoring, land use monitoring, ...)

- data-bases interconnection

7.5) Interactive uses of EO data & derived information

- connection to Web sites (where data and tools can be found) to perform applications and, derived or retrieve final information
- ease of the diffusion and the penetration of the final information (such as maps, GIS, demonstration sample, ...) to the desk of the end-users
- broadcast of raw or final information to multiple users such as media, partners in scientific projects, education programmes
- remote-training and education services of customers, students, decision makers, ...
- remote-work between 2 or 3 location using shared and common data

SPACE IMAGING EUROPE, IKONOS SYSTEM, DATA SPECS., APPLICATIONS, ASTRON AND SIE

N. SPIROPOULOS, SPACE IMAGING EUROPE

ASTRON Information Day

Ispra, Tuesday, January 19, 1999

Space Imaging Europe SA
5 Erithrou Stavrou
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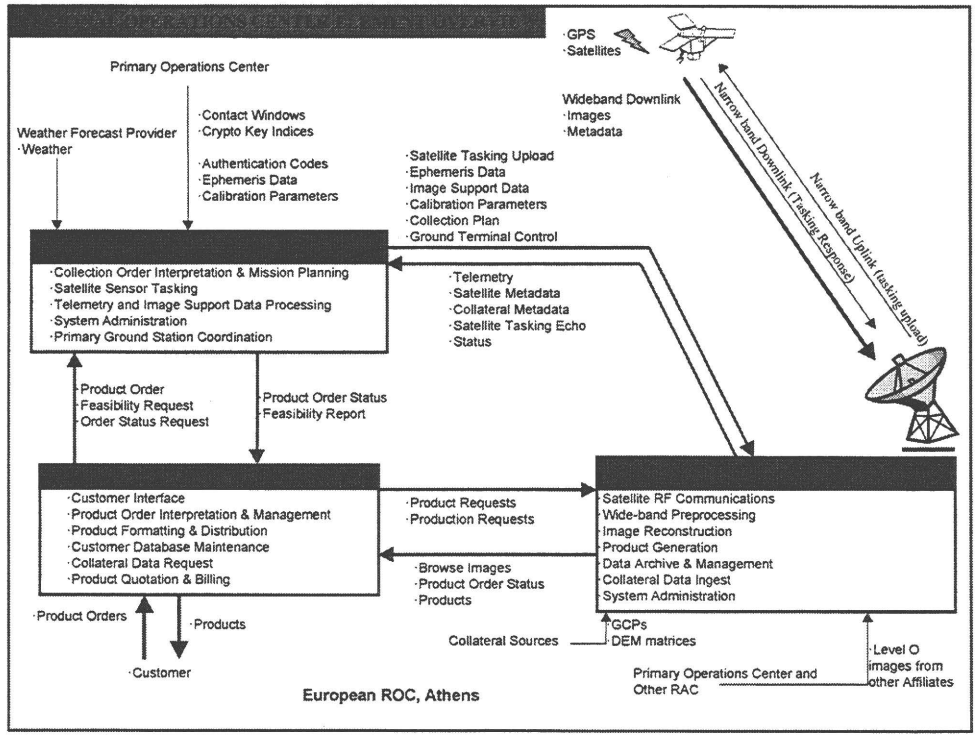
Topics of discussion

- Space Imaging Europe (SIE)
- IKONOS system
- Data specs
- Applications
- ASTRON and SIE - **Synergy of SatCom and EO**

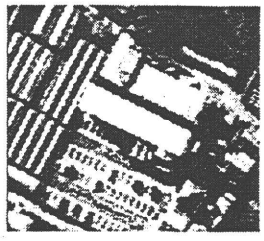
Space Imaging Europe

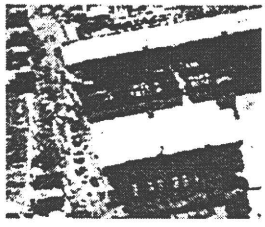
- **Mission**
  become the leading provider in geographic information
- **Coverage**
  territory that includes over 54 countries covering a excess of 15 million square km encompassing Europe, North Africa and Middle East
- **Capability**
  Targeted acquisition rate over 1.5 million square km per year



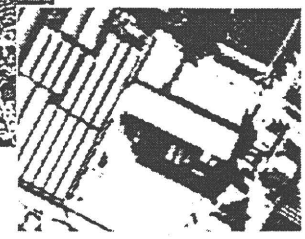
11 Bit Data vs 8 Bit Data

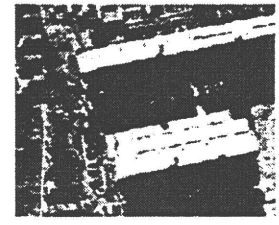
11 bit processing





8 bit processing





AREA 1: Bright Areas

11 bit data makes structures distinguishable

8 bit data leaves bright areas overexposed

AREA 2: Dark Areas

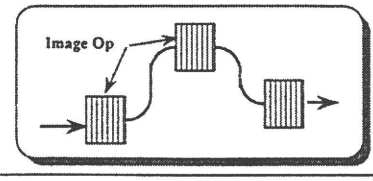
11 bit data makes shadowed features distinguishable

8 bit data loses features to shadows

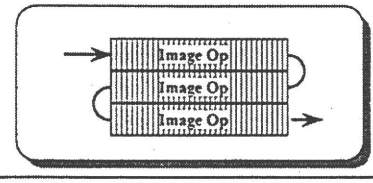
China City, Japan

Collection Scenarios

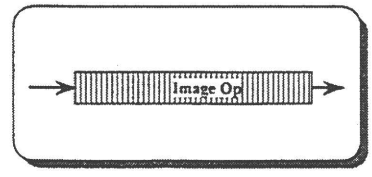
Point targets
Smallest area to be collected is 11.3 km.
x 11.3 km. at nadir
Least efficient due slew times



Area targets
More efficient due to longer scans
Limited by acceleration capability



Continuous strips
- Single image operation
- Low acceleration impact

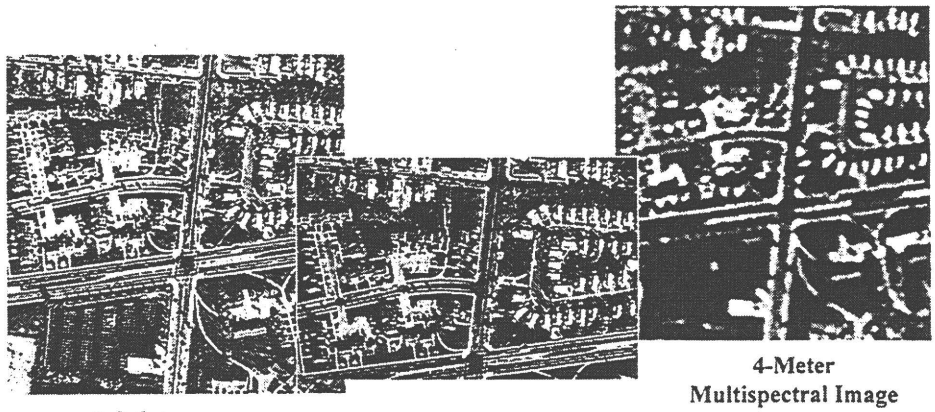


Spacecraft Key Features

- Unibody Construction
  - Commercial Components & Practices
  - Design Life 7-years, MMD 5+ years
  - Body Size - 6' x 5' (1.8 x 1.6 m)
    - Solar Array Extended - 15.5' (4.7 m)
  - Weight - 1800 Pounds (817 kg)
  - Power - 1100 Watts
  - 3 Axis Stabilized; Body Agile
  - Commandable Off-Nadir pointing
  - 64 Gb solid state memory
- Digital Panchromatic and Multispectral Sensors
  - Aperture 0.7 Meter
  - 1 m to 26° Obliquity
- Communications
  - Downlinks (X-Band)
    - Imagery and Metadata - 320 Mbps
    - Telemetry Data - 32 Kbps
  - Uplinks (S-Band)
    - Tasking & Command - 2 Kbps

Orbit: 680km, sun-synchronous, 98.2 inclination

Standard Products
Pan-Sharpened Imagery

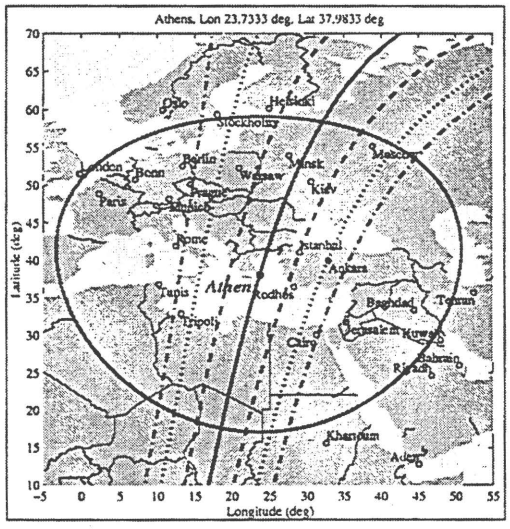


1-Meter Panchromatic Image

4-Meter Multispectral Image

1-Meter Pan-Sharpened Image

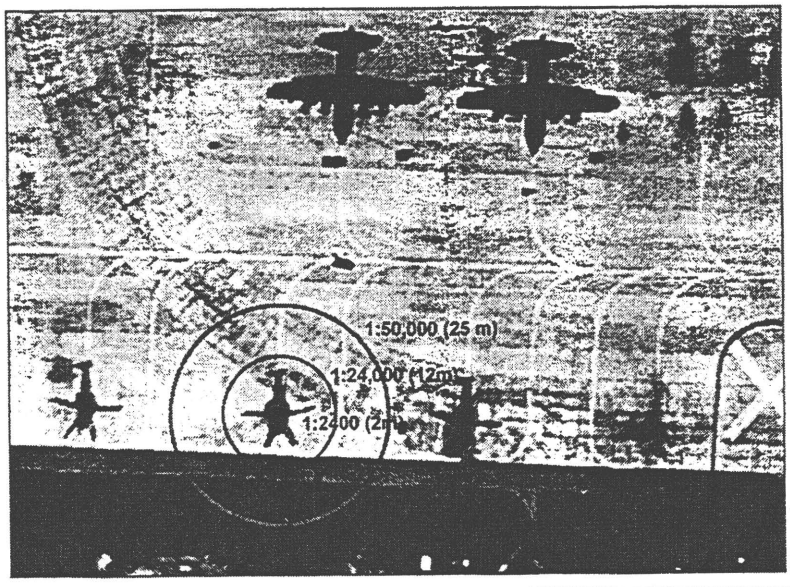
Collection Access



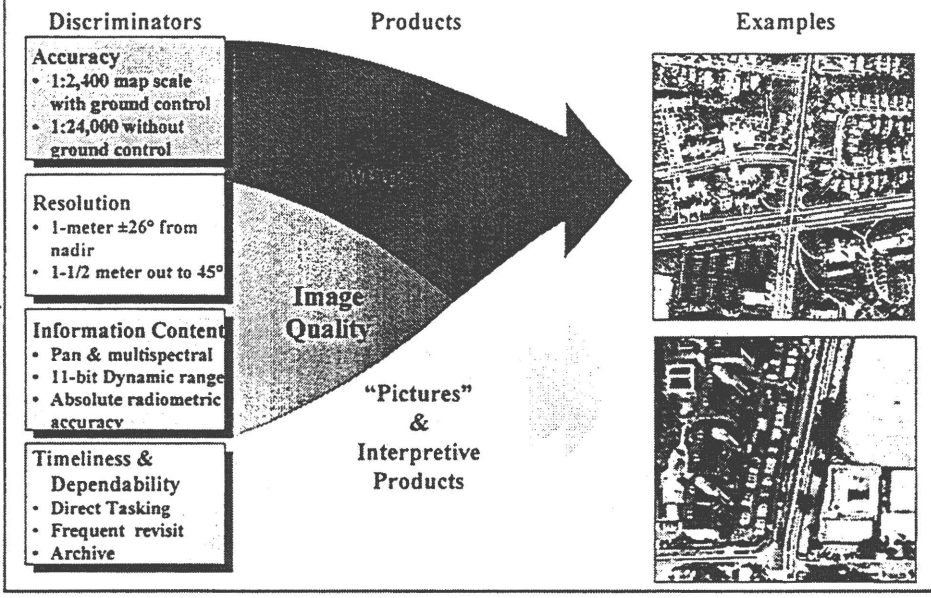
- Typical access to 45 degree obliquity (1.56 m GSD)
- Some limitations on access to 51 degree obliquity (2.0 m GSD)

GSD (m)	Obliquity (deg)	Cross-track (km)
1.0	26	350
1.5	44	700
2.0	51	930

Metric Accuracy
Horizontal Precision



Key Product Discriminators



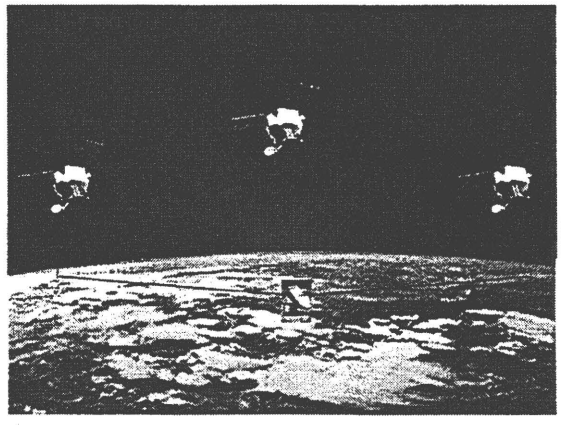
Timeliness
Tasking Planning

30-Day Plan
- Request contact windows
- Conduct resource allocation
- Consider historical weather

3-Day Plan
- Fix contact windows
- Consider forecast weather

24-Hour Plan
- Perform detailed rev planning
- Consider current weather

Rev-by-Rev Planning (98 minutes)
- Consider latest weather data
- Consider late-breaking, high-priority tasking
- Pass plan review

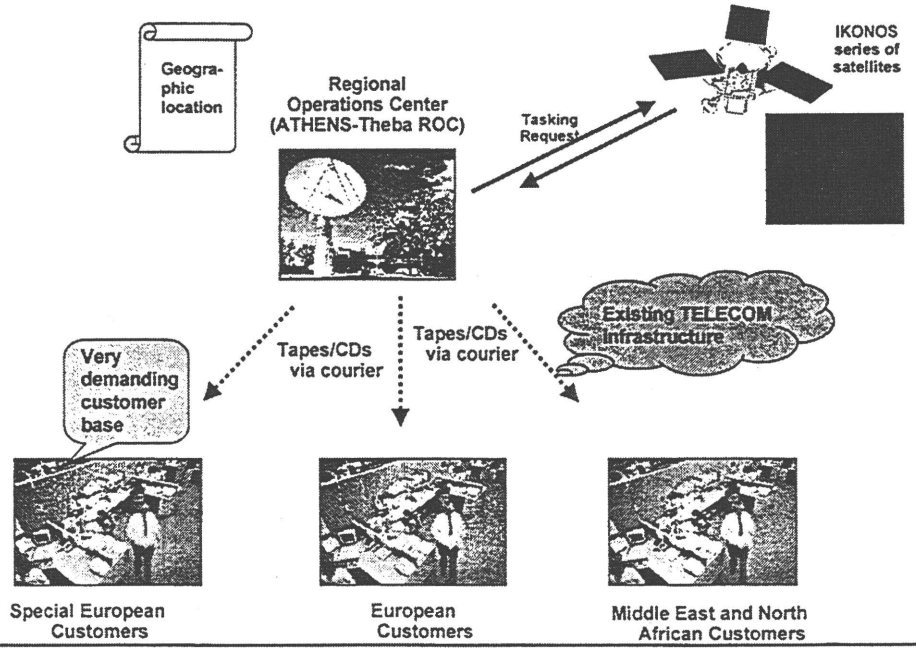


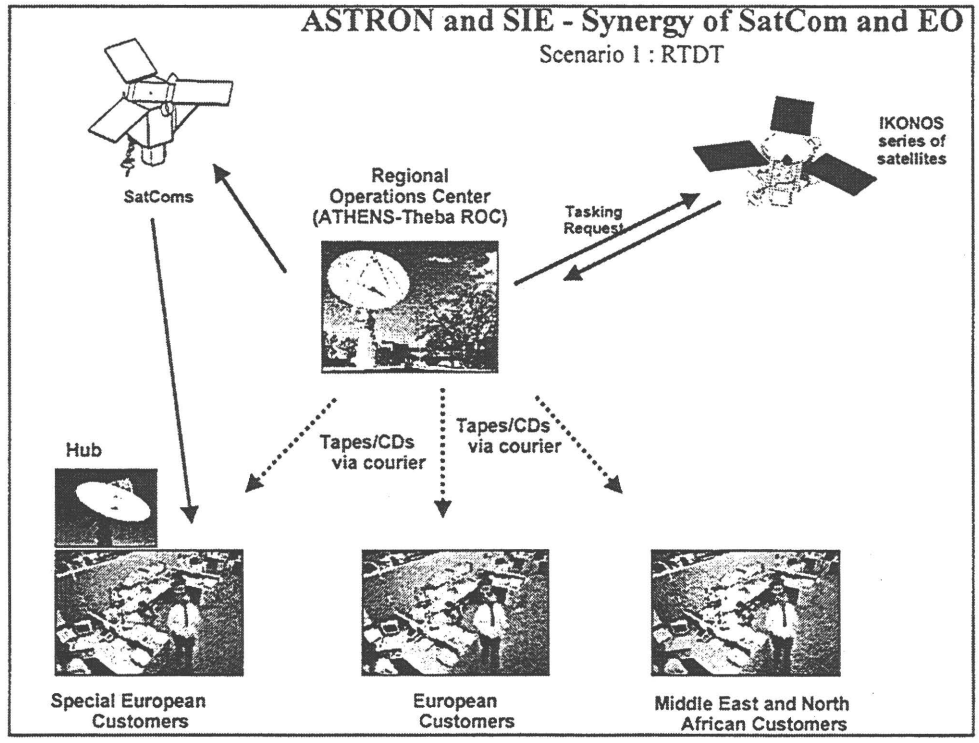
Applications

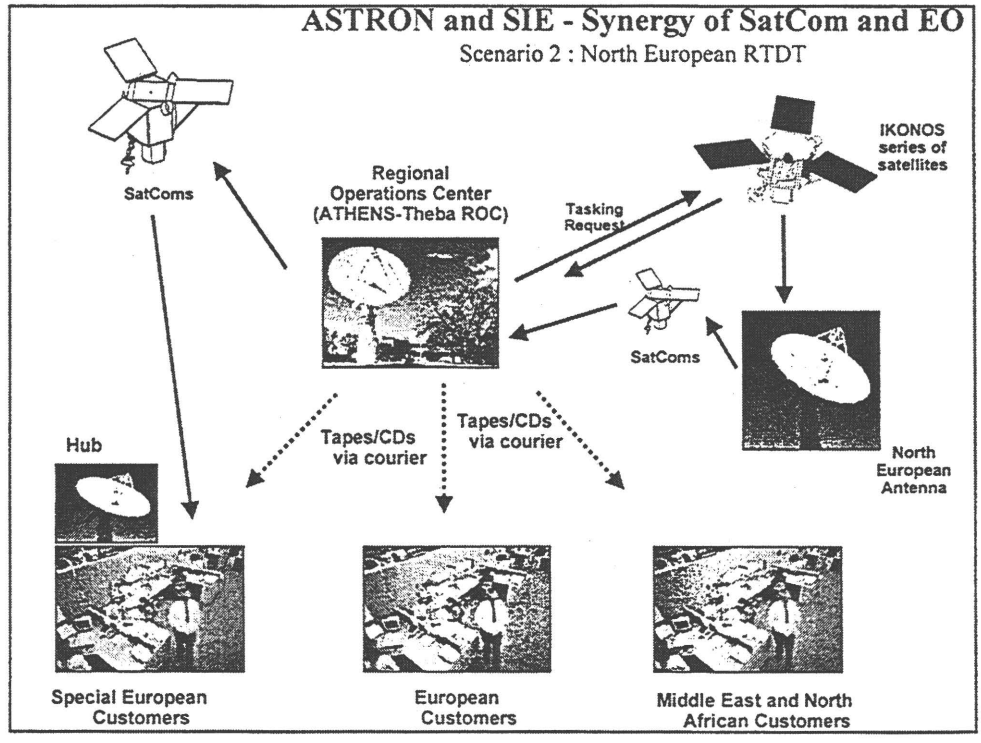
- Real Estate
- Civil Government
- Utility Companies
- Oil/Gas Exploration
- Environmental Assessment

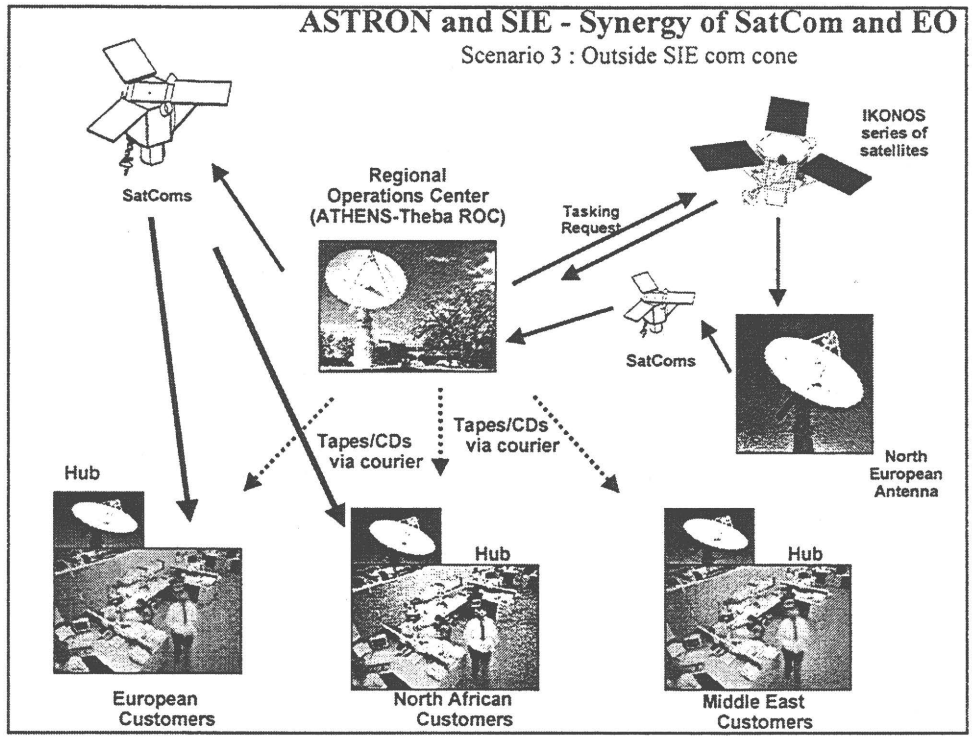
- Media
- Insurance
- Agribusiness
- Telecommunications
- Forestry
- Transportation

ASTRON and SIE - Synergy of SatCom and EO




ASTRON and SIE - Synergy of SatCom and EO
Scenario 1 : RTDT
SatComs
Regional
Operations Center
(ATHENS-Theba ROC)
Tasking
Request
IKONOS
series of
satellites
Hub
Tapes/CDs
via courier
Tapes/CDs
via courier
Special European
Customers
European
Customers
Middle East and North
African Customers

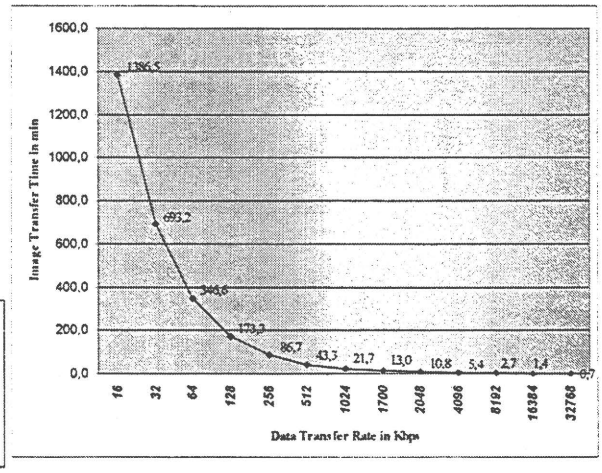

ASTRON and SIE - Synergy of SatCom and EO
Scenario 2 : North European RTDT
SatComs
Regional
Operations Center
(ATHENS-Theba ROC)
Tasking
Request
IKONOS
series of
satellites
SatComs
Hub
Tapes/CDs
via courier
Tapes/CDs
via courier
North
European
Antenna
Special European
Customers
European
Customers
Middle East and North
African Customers



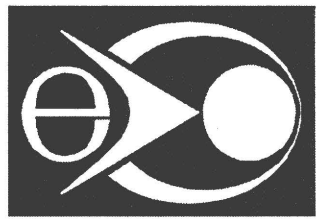
Transfer Time of Images at Different Data Transfer Rates

Transfer Rate (Kbps)	Transfer Time (mins)
16	1386,5
32	693,2
64	346,6
128	173,3
256	86,7
512	43,3
1024	21,7
1700	13,0
2048	10,8
4096	5,4
8192	2,7
16384	1,4
32768	0,7

Image Size= 11Kmx11Km
Resolution= One pixel per m^2
Number of Bits/Pixel=11
Total size of image=
11000*11000*11=1,331Gbits



EMSAT: THE SATELLITE-BASED MOBILE TELEPHONY SERVICE FROM EUTELSAT



M. NICOLAIDIS, EUTELSAT

emsat

the satellite-based mobile telephony service from EUTELSAT

J.N. Colcy & M. Nicolaidis
EUTELSAT

Tel: +(33) 1 53 98 47 86 & 53 98 47 22
Fax: +(33) 1 53 98 4798
email: jcolcy@eutelsat.fr & mnikolai@eutelsat.fr

1. Services

***emsat* provides 5 services throughout Europe :**

1 - Voice	Digital at 4.8 kbps, PSTN connected, CUG capabilities, normal or priority access
2 - Facsimile	Group 3, via the 2.4 kbps voice circuit with FEC (forward error corrections), then 4.8 kbps
3 - SMS	Packet switched data, 44 bits/packet (user data) with acknowledgment, suitable for SCADA or Position Reports
4 - Data	Dial-up circuit switched connection, 2.4 kbps with FEC (4.8 without), RS 232 (Asynchronous)
5 - Positioning	GPS Card integrated, use SMS channel

2. The market of *emsat*

3 major "classic" markets:

1 - Mobile Fleet operators requiring voice

"Too many unexpected situations where urgent calls are required"

Just-in-Time delivery, valuable and hazardous good transport, etc.

⇒ Productivity gains *plus* immediate reaction to unexpected situations

2 - Mobile Fleet operators needing full security, confidentiality and availibility of the voice service used

"Too many grey areas and block-outs with terrestrial cellular networks"

Civil Security, gas and electricity network maintenance, peace keeping forces, Governmental and non-governmental organisations, etc.

⇒ Full reliability and availibility of the communication means used

3 - Extension of the terrestrial cellular networks

"Need for a reliable voice and data service even beyond the reach of PSTN"

Companies from the energy sector, civil engineering, shipowners, etc.

3.Other potential Applications/ Markets

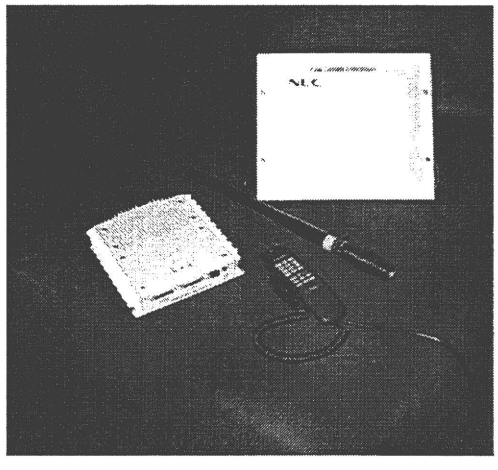
The inherent features of ***emsat*** make it very suitable for a number of other applications/markets :

- Leisure boat communication & navigation (market identified in Mediterranean countries).
- Fishing fleets communications & management in coastal areas.
- Fire Brigade vehicles communication, surveyance & management (forest fires etc.)

3.Other potential Applications/ Markets (contd)

- Low bitrate data collection & transmission from various sensors (thermometers, anemometers, floaters, etc.) for the prevention of natural disasters.
- Establishment of emergency communications after a natural catastrophy (earthquake, flood etc.)
- *Much more to think of !!*

4. The Mobile Terminal



- Easy to mount: small and compact terminal
- Easy to use: international country code available: 882-13
- Several manufacturing sources (photo: NEC MT)
- Available Antenna:
  - Mast for cars
  - Flat dome for trucks
  - Dome for maritime
  - Fixed antenna for fixed applications or SCADA
- Cost: around $ 3000

4. Technical characteristics

emsat

- EMS payload:
  - Developed by ESA for Mobile Services
  - Orbital position: 16.4°E
  - 2 transponders (1 forward, 1 return)
  - Capacity: 168 equivalent 19 dBW circuits (EUTELSAT capacity)
  - Can accommodate 40 000 EMSAT terminals ($^1/_3$ mast antenna+2.5 mn/day/terminal)
  - Forward link: Hub to satellite: Ku Band (14GHz) converted in L-band (1.550 GHz) for transmission to mobile
  - Return link: mobile to satellite: L-band (1650 GHz) converted in Ku-band (12 GHz) for transmission to Hub

Permits the use of small, easy to install, low-cost antennas

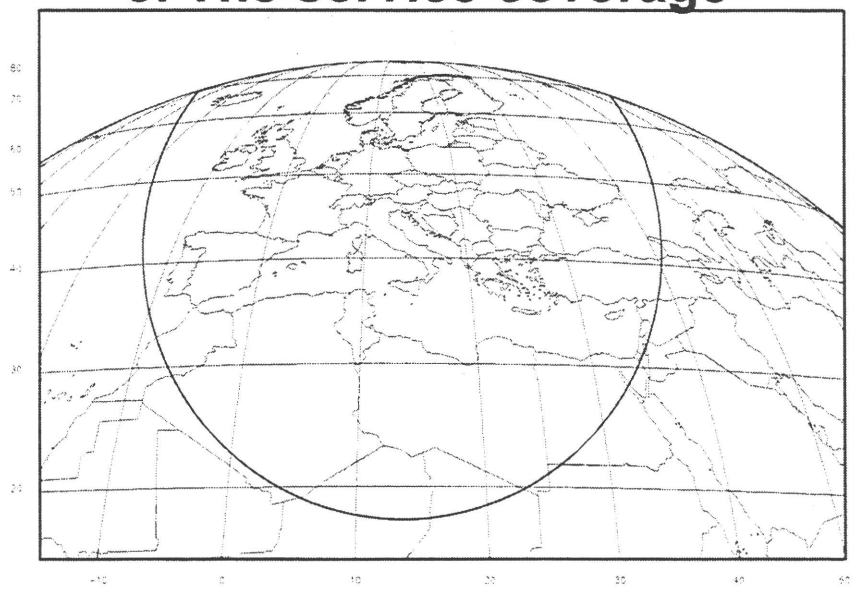
4. Technical Characteristics

emsat

- Frequency range:
  - Tx: 1631.5 - 1660.5 MHz
  - Rx: 1530.0 - 1559.0 MHz
- Power supply & Consumption :
  - 11-31 volts DC
  - stand by 15W
  - transmit 30W
- RF Output :
  - power: 3W nominal
- Weight: 4.5kg
- Antenna
  - Mast (motorized): 7dBi
  - Planar: 12dBi
  - Marine: 12dBi

5. The service coverage

emsat

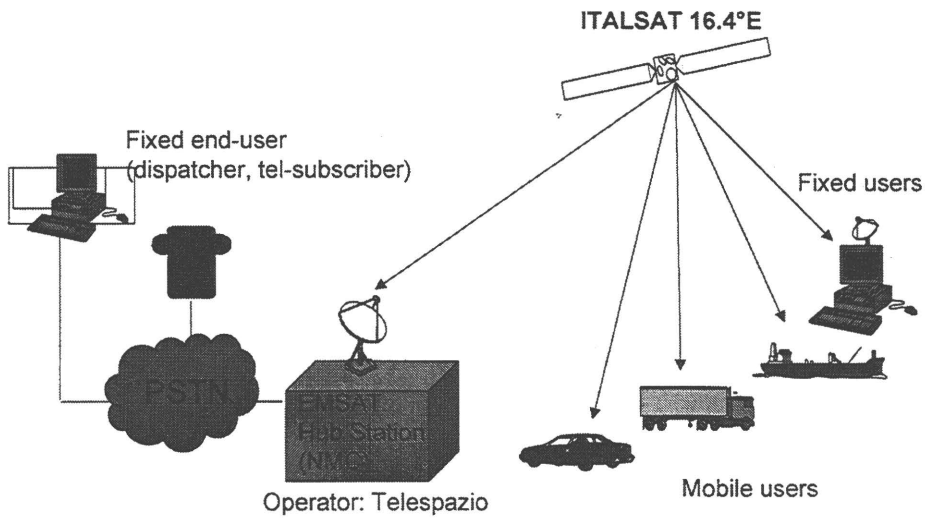


EUTELSAT (Div. 3) - emsat2.ppt

EMSAT Service Coverage

6. The network architecture

emsat



EUTELSAT (Div. 3) - emsat2.ppt

8. *emsat* tariff in Euro: EUTELSAT cost

	1998-2001	> 2001
Connection fee	30	30
Monthly fee	15	13
Cost / minute	0.8	0.6

10. Advantages of *emsat*

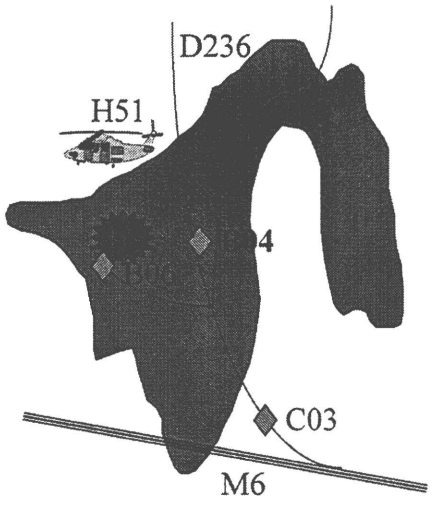
- Reliability:
  - uses a proven technology for the terminal
- System and service prices:
  - 50% less expensive than Inmarsat mini-M and 75% less expensive than Iridium for the service
- The range of services proposed via a single terminal:
  - voice, data, fax, SMS and positioning
- Ease of use (GSM-like)
- Network architecture:
  - centralised allowing to offer added-value services highly sought after by fleet operators

11.The Marriage between Earth Observation & Communications

emsat

- VEHICLE STATUS
  B06: IN SITU
  B04:REACHING
  C03: APPROACHING

- AIRBORNE ASSIST.
  H51: REACHING



12. Conclusion: the advantages of *emsat*

emsat

- Outstanding quality and performance of EMSAT services
- Different sources of terminal with proven technology
- Most regulatory issues resolved
- Numerous tests underway
- EMS and EMSAT fully available and functioning nominally
- Possibility for pilot projects in the domain of Natural Disasters
- Possibility of combination with EO systems for enhancing capabilities
- 3 Service Providers already approved:
  Telespazio (I), MAREMS (Ru), Compucom (Monaco), Greece underway

ASTRA MULTIMEDIA SERVICES

P. GLOVER, SES/ASTRA

ASTRA Multimedia Services

ASTRON - 19/01/99

Penny Glover

Structure

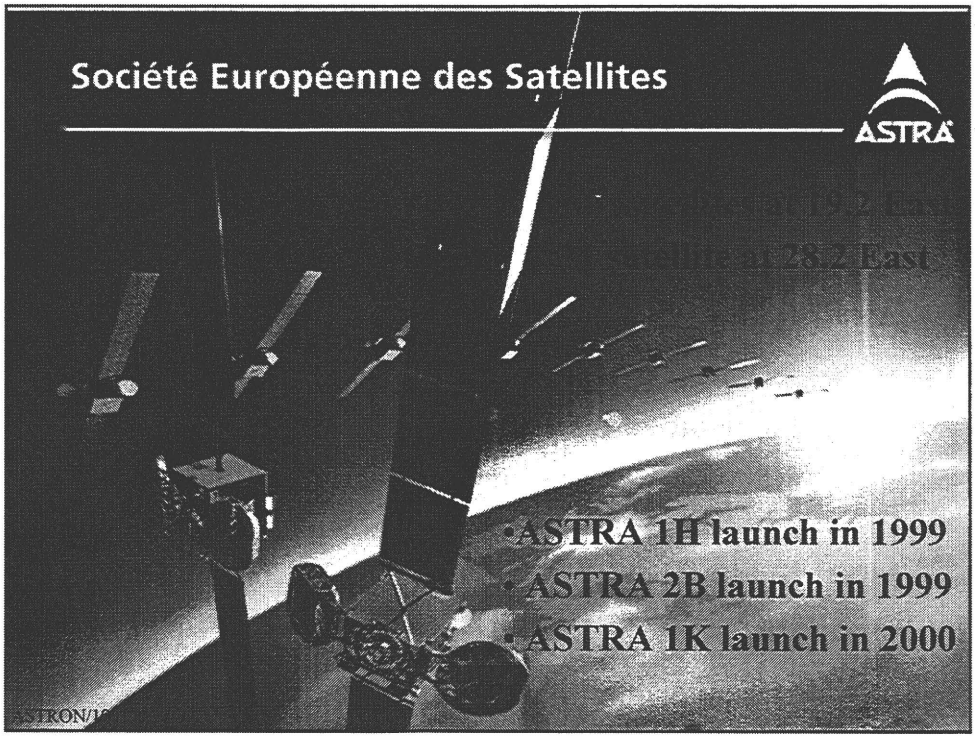
- Introduction to SES/ASTRA
- ASTRA-NET existing 1-way services
  - business users
- ASTRA-NET 1-way service expansion
  - home/office users
- ASTRA-NET 2-way services
  - data collation and contribution links

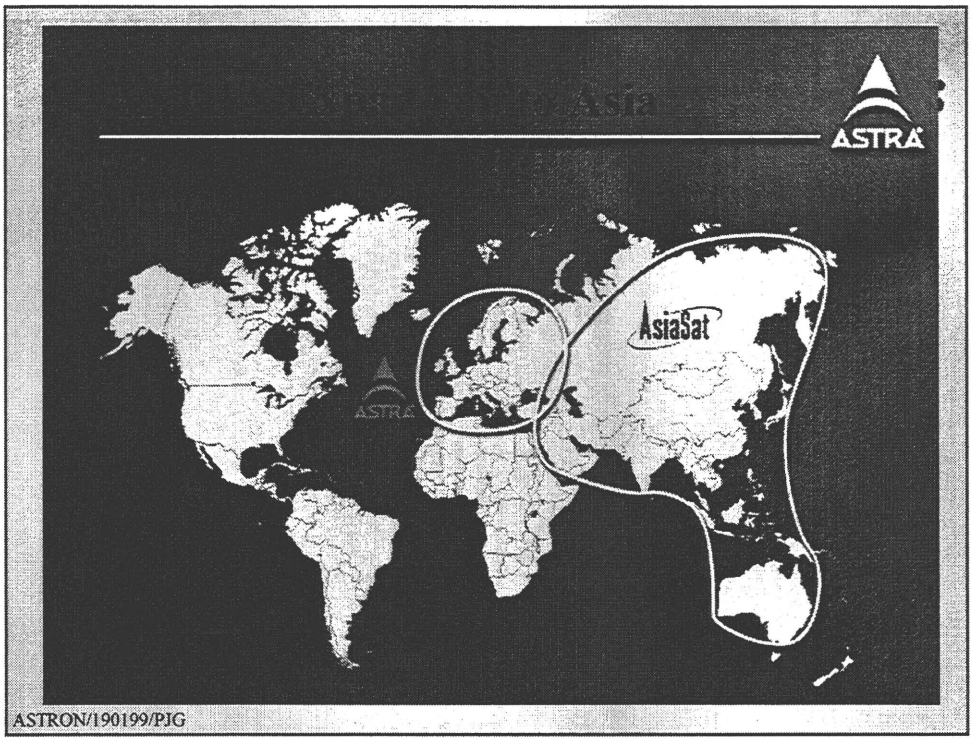
SES - an introduction

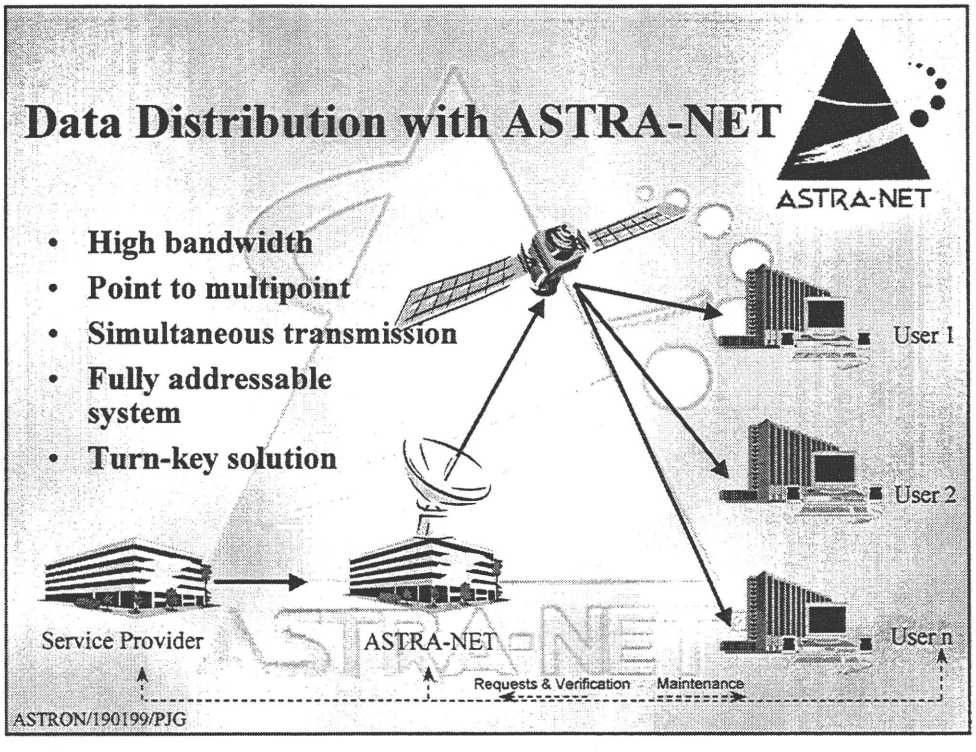
ASTRA-NET

- Public company based in Luxembourg
- Listed on Luxembourg stock exchange
- Operator of "ASTRA Satellite System"
- 270+ employees from 22 countries
- 1997 turnover: US$ 476 M
- DTH television broadcaster since 1989
  - 73 million homes in Europe!

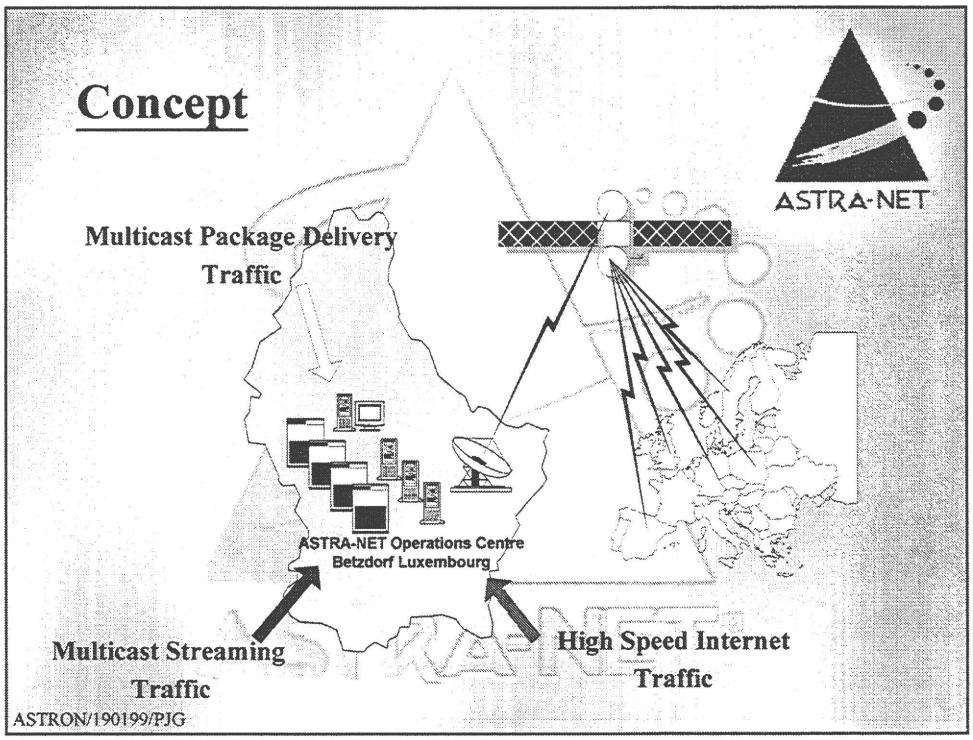
ASTRON/190199/PJG




Asia
ASTRA
AsiaSat
ASTRA
ASTRON/190199/PJG

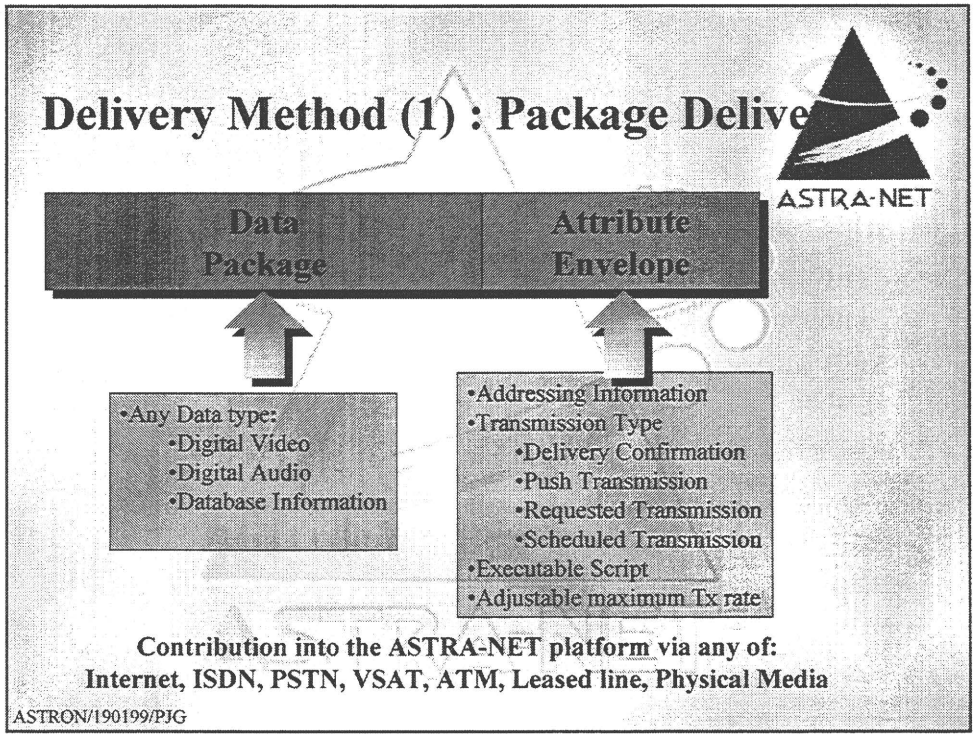

Data Distribution with ASTRA-NET
ASTRA-NET
• High bandwidth
• Point to multipoint
• Simultaneous transmission
• Fully addressable system
• Turn-key solution
User 1
User 2
User n
Service Provider
ASTRA-NET
Requests & Verification
Maintenance
ASTRON/190199/PJG

Concept



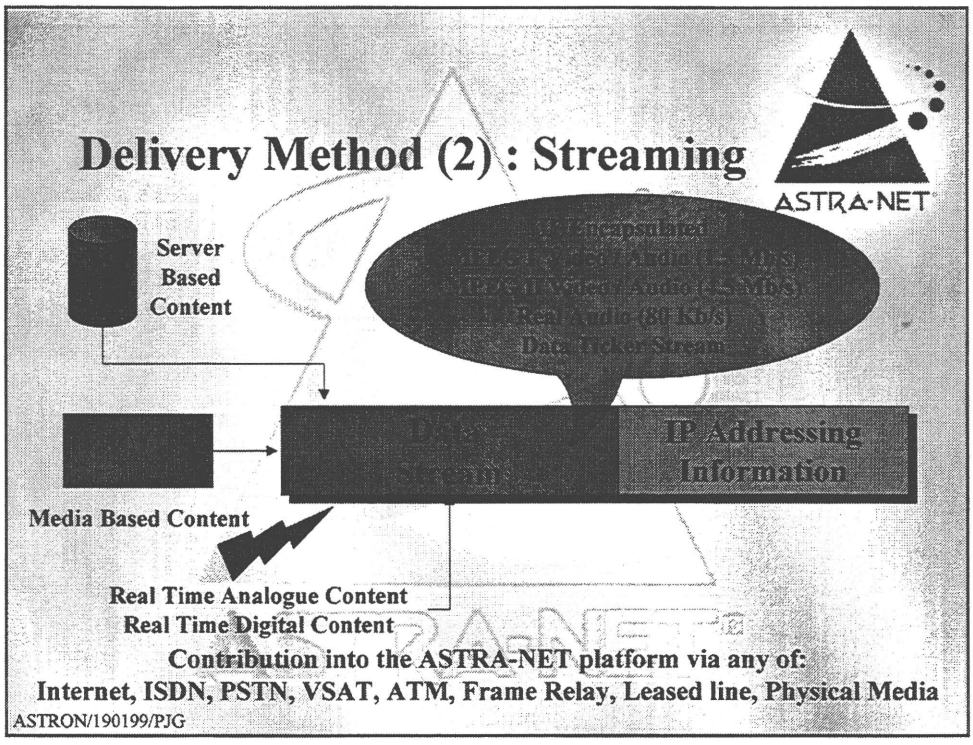
ASTRON/190199/PJG

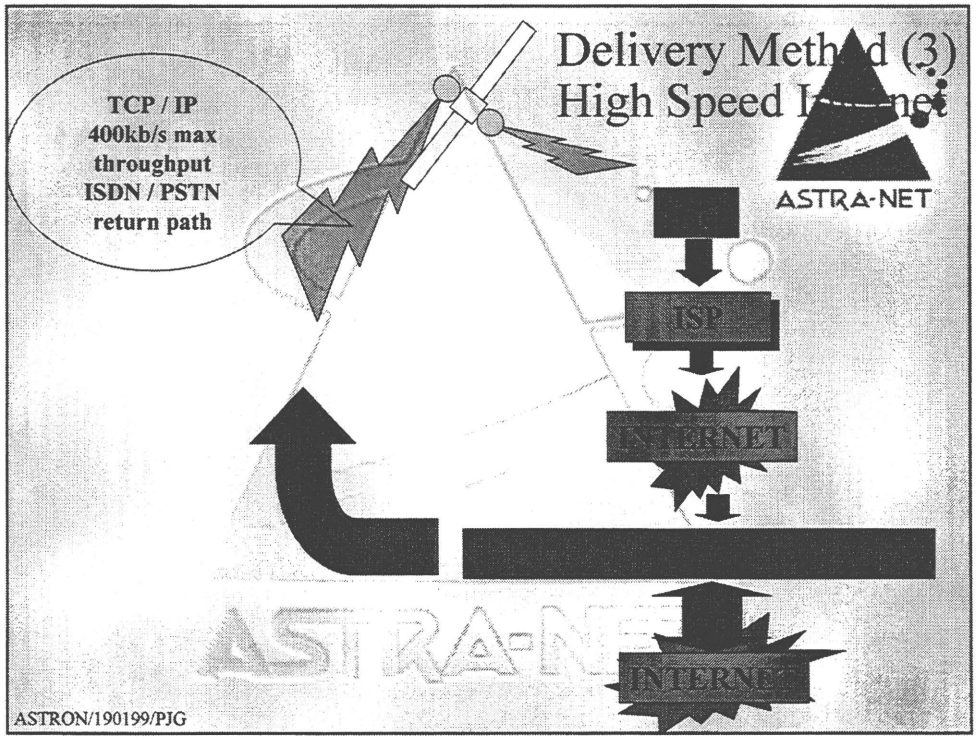
Delivery Method (1) : Package Delive



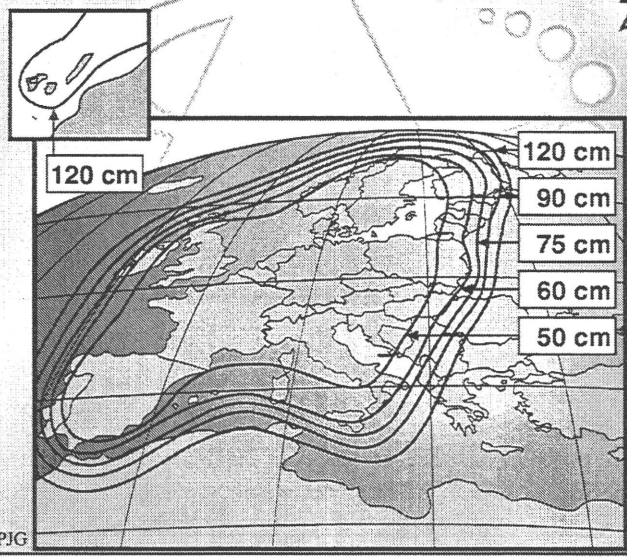
Contribution into the ASTRA-NET platform via any of:
Internet, ISDN, PSTN, VSAT, ATM, Leased line, Physical Media

ASTRON/190199/PJG


Delivery Method (2) : Streaming
ASTRA-NET
Server
Based
Content
IP Addressing
Information
Media Based Content
Real Time Analogue Content
Real Time Digital Content
Contribution into the ASTRA-NET platform via any of:
Internet, ISDN, PSTN, VSAT, ATM, Frame Relay, Leased line, Physical Media
ASTRON/190199/PJG


TCP / IP
400kb/s max
throughput
ISDN / PSTN
return path
ASTRA-NET
ISP
INTERNET
INTERNET
ASTRON/190199/PJG

ASTRA-NET Coverage Area
(Astra 1G)



ASTRON/190199/PJG

ASTRA-NET Standards

- **Transmission**
  - **MPEG II DVB compliant.**
  - **MPEG II multiprotocol data encapsulation**
  - **DES Encryption / 3DES key management**
- **Data**
  - **IP Multicast**
  - **TCP/IP**
- **Security**
  - **3 DES Key Management / DES bulk Encryption**
  - **Full control of addressed groups**
  - **Optional DVB Conditional Access**

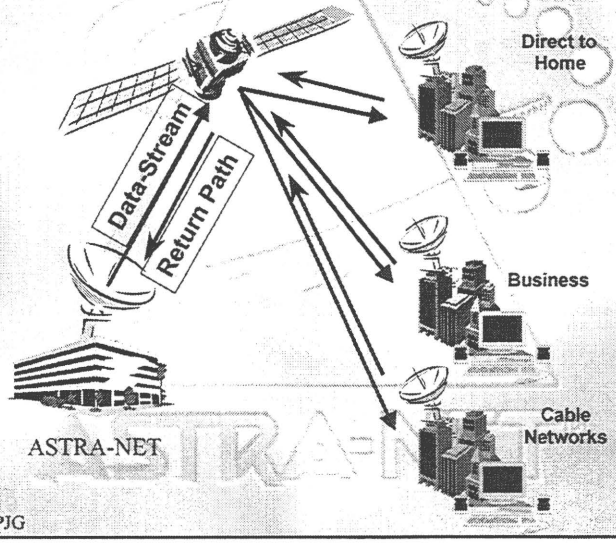
ASTRON/190199/PJG

ASTRA-NET Home/Office

- Multiple vendor DVB/MPEG2 card
  - free to air services
- Support for emerging standards
  - MPEG4 and IPv6
- Web based customer interface (applets)
- Scalable over multiple transponders
- Security and CA capability
- DVB receiver cards & IP gateways already tested
  - successful unscrambled streaming broadcasts

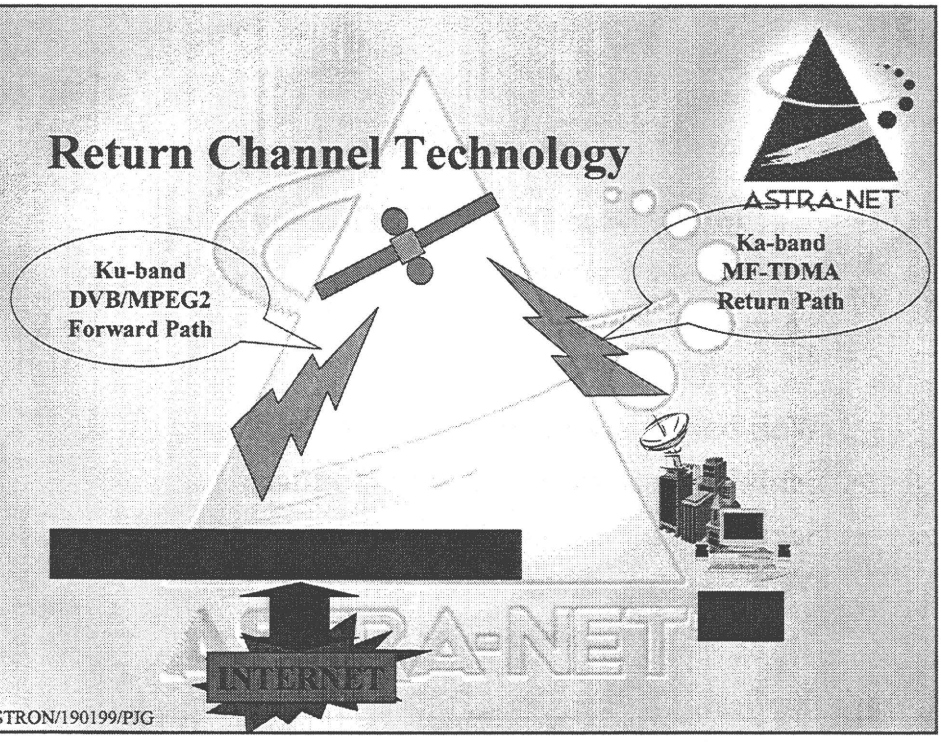
ASTRON/190199/PJG

ASTRA-NET Ka-band Return Channel



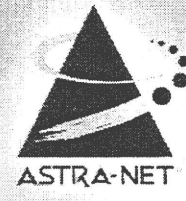
ASTRON/190199/PJG

Return Channel Technology



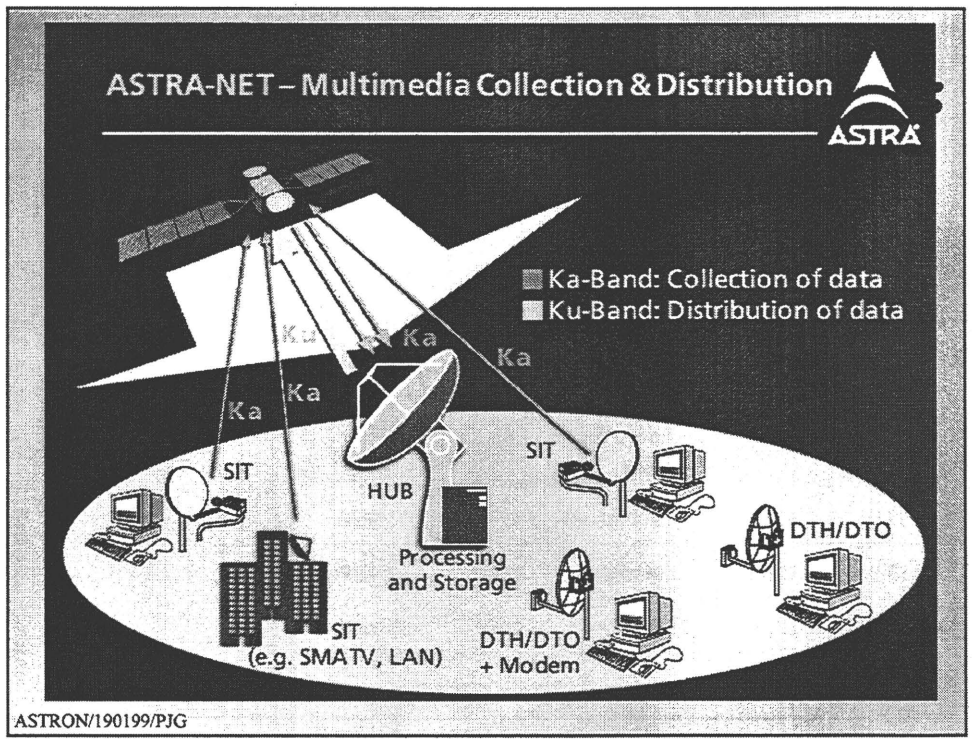
ASTRON/190199/PJG

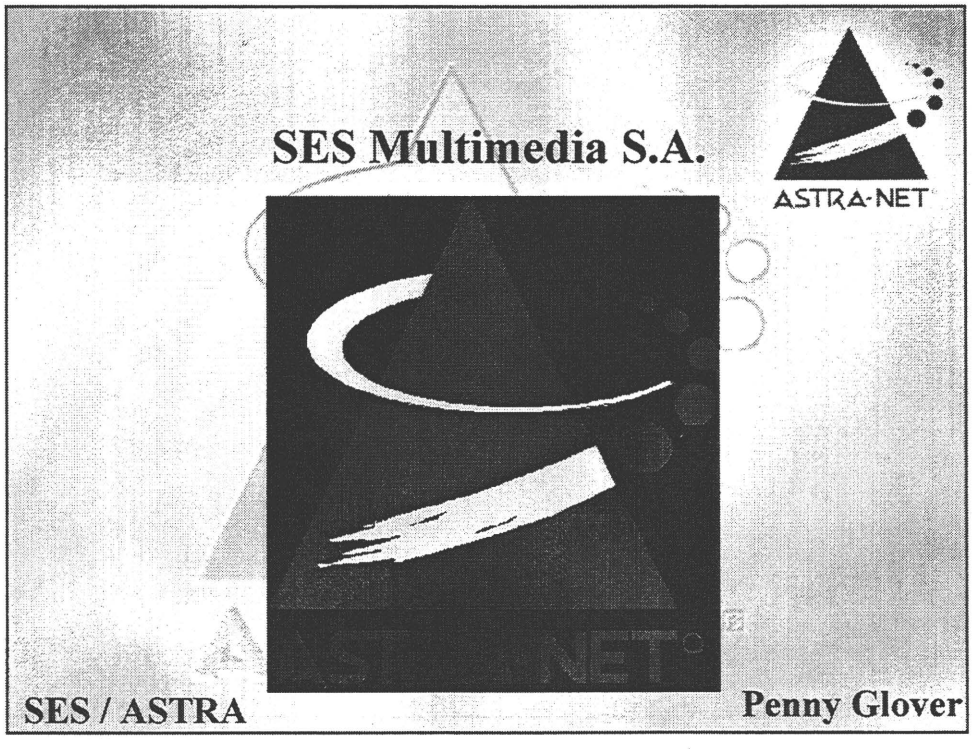
Return Channel Technology & Standards



- DVB/MPEG2 compliant forward link
  - using Multi-Protocol Encapsulation
  - (reliable) multicast supported
- MF-TDMA return link
  - 53 byte ATM -like containers
  - bandwidth-on-demand
  - evolution to support QoS
- DVB CA and IPSec implemented
- 1Q 2000 full commercial launch

ASTRON/190199/PJG

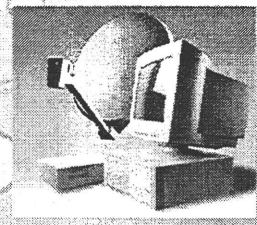

ASTRA-NET – Multimedia Collection & Distribution
ASTRA
Ka-Band: Collection of data
Ku-Band: Distribution of data
Ka
Ka
Ka
Ka
Ka
SIT
HUB
SIT
DTH/DTO
Processing
and Storage
SIT
(e.g. SMATV, LAN)
DTH/DTO
+ Modem
ASTRON/190199/PJG


SES Multimedia S.A.
ASTRA-NET
SES / ASTRA
Penny Glover

Satellite Interactive Terminals (SITs)

ASTRA-NET

SIT ex-factory price
~ 2000 ECU at launch
~ 1000 ECU target in 2001+



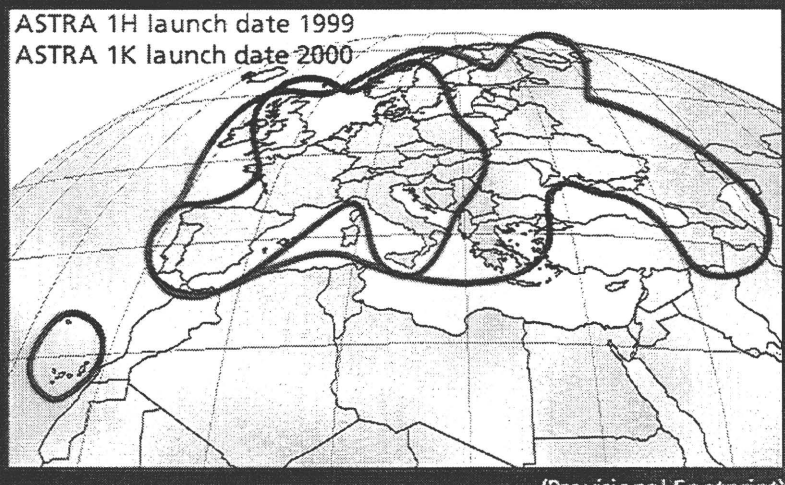
Type*	Dish size	Transmit Bitrate	Power	Receive Bitrate
SIT I	60 cm	150 kbit/s	0.5 W	38 Mbit/s
SIT II	90 cm	384 kbit/s	1.0 W	38 Mbit/s
SIT III	120 cm	2,048 kbit/s	2.0 W	38 Mbit/s

* other types are under consideration for additional applications

ASTRON/190199/PJG

Return Channel Coverage

ASTRA



ASTRON/190199/PJG

REMSAT - EMERGSAT

E. RAMMOS, ESA

REMSAT
-
EMERGSAT

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esa

REMSAT - Real-time Emergency Management via SATellite

Real time communication services
providing
voice, data, localisation services

between
on site staff and a centralised operation Control Centre

will enhance
operational efficiency and security
in emergency situations

esa

R E M S A T - Real-time Emergency Management via SATellite

ESA REMSAT activity

Objective
Demonstrate the use of
real time satellite Communications, Localisation, EO, Meteo services

using
hand-held terminals
existing technologies

via
pilot demonstration involving end-users

esa

R E M S A T - Real-time Emergency Management via SATellite

The work includes

•system architecture and optimisation
•integration and testing of a REMSAT system
•real size simulations and evaluation
•pilot demonstration in real emergency
• direct involvement of end-users

Emphasis on

operational and financial sustainability of the system.

esa

R E M S A T - Real-time Emergency Management via SATellite

The REMSAT demonstration uses existing satellite systems

Composite configuration
consisting of
Hand-held User Terminals (HUT)
communicating via more powerful, transportable
Intermediate Satellite Mobile Terminals (IMT)
with an
Emergency Management Control Centre (CC)

esa

R E M S A T - Real-time Emergency Management via SATellite

First REMSAT demonstration application

FOREST FIRES

Contract with

Mac Donald Dettwiler (BC-Canada)
and
British Columbia Forest Services Protection Program

esa

R E M S A T - Real-time Emergency Management via SATellite

The BCFS Protection Program is fighting forest fires in BC

- **an area of over 1 million square kilometres**
- **$15 billion of annual economic activity**
- **3,000 fires annually**

REMSAT seen to provide a missing link in BCFS fire suppression activities

esa

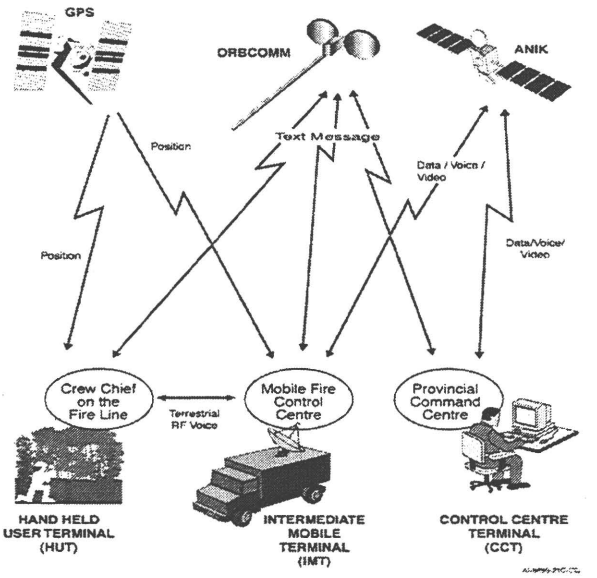
R E M S A T - Real-time Emergency Management via SATellite

Care to make the REMSAT system compatible with generic needs of other types of emergencies such as

- **earthquakes,**
- **floods**
- **exceptionally heavy winter conditions,**
- **hazardous materials related emergencies**
- **etc.**

esa

R E M S A T - Real-time Emergency Management via SATellite



esa

R E M S A T - Real-time Emergency Management via SATellite

Multiple satellite system baselined for the first demo

Localisation via GPS
Messaging via ORBCOMM - LEO satellite system
Low/High data rates, voice and video services via ANIK - GEO satellite system.

REMSAT adaptable to alternative satellite systems selection depending on geographical area of interest.

esa

EMERG-SAT

Near Real Time Satellite Delivery of Earth Observation Data
for Decision Support in Emergency Scenarios

esa

PROJECT OBJECTIVE

Demonstrate the use of near real-time (space-borne) Earth Observation data, in combination with meteorological updates and information from GIS databases, for managing emergency situations

- Fast delivery of EO data to end users (CPA)
- Thematic processing of EO data to allow easy and efficient usage by end users
- GIS based GUI tool to handle thematic products and to allow emergency management activities

esa

Define, Procure, Install, Commission
an EMERG-SAT
Decision Support Network

Operate a 6 month pilot demonstration in a realistic user environment

Selected Applications

Forest Fires - Flush Floods

The applications selected for the pilot demonstration offer a concrete opportunity for evolution to an operational network with real cost benefits.

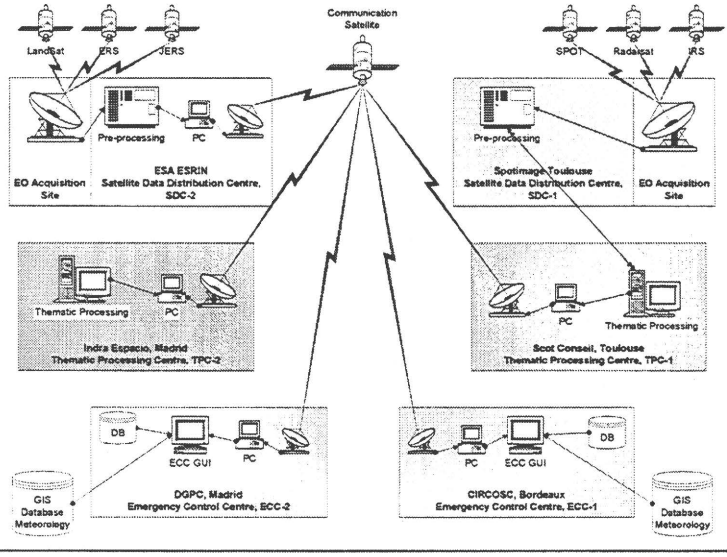
Other possible applications include:

- oil spill disasters
- forest fires
- flash (or plain) flooding
- earthquakes
- humanitarian missions

SYSTEM OVERVIEW

- Two end-users involved in EMERG-SAT project
  - French CIRCOSC, Bordeaux
  - Spanish Civil Protection Authority, DGPC, Madrid
- Parallel EO data processing chains (TPCs):
  - Scot Conseil, Toulouse
  - INDRA ESPACIO, Madrid
- Common communication infrastructure
- Common EO data acquisition and pre-processing facilities (PAFs):
  - ESA-ESRIN, Frascati
  - SPOTIMAGE, Toulouse

EMERG-SAT PILOT NETWORK



METEOR - CLS ARGOS

CENTRE NATIONAL D'ETUDES SPATIALES

G. BLONDEAU, CNES

METEOR

THE PROGRAMME

•*Objective : To give easier access, for end-users, to useful earth observation, with the best cost possible,*

•*Principle : To set up a service network dedicated to the distribution of earth observation (start up in Euro-Mediterranean regions),*

•*Means : - Earth observation : to define and evolve services meeting the users requirements and with regard for cost effectiveness,*

- Telecommunication : to make use of existing or emerging technologies (associated terrestrial and spatial) enabling today interactivity, accessibility, high level of data rate and security.

METEOR

WHICH TYPES OF SERVICES ?

•*Electronic service offers :*

- *Interactive user assistance,*
- *Catalogue offers (products and services, data and information),*
- *Electronic orders (quotations, orders, invoicing).*

•*Electronic products delivery :*

- *Earth observation imagery,*
- *Topographic and thematic maps,*
- *More elaborated geographic information.*

•*On Line services :*

- *Tele-training: water management, coastal planning, natural hazards,*
- *Real time hazards management : floods pollution, forest fire, other natural hazards,*
- *Direct access to servers of data and services : imagery sub area selection, digital image processing, ...*

METEOR

WHICH PARTNERS ?

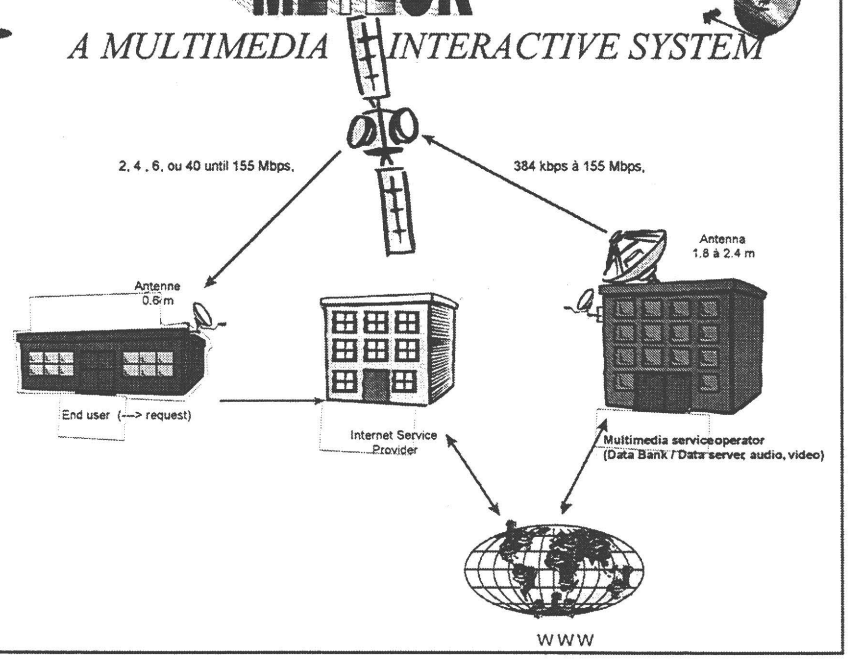
- ***The end users :***
  - *Private companies : users or potential users,*
  - *Security institutions : ministries, local, national or regional agencies,*
  - *Cooperatives, associations, schools, universities,*
  - *Individuals, ...*

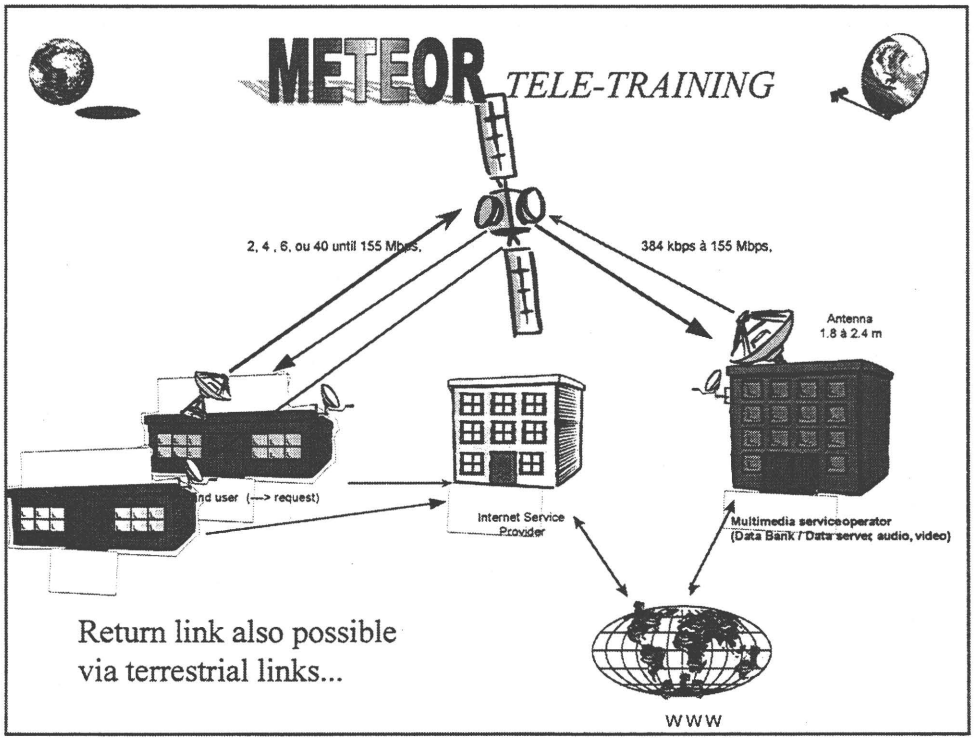
- ***The service providers :***
  - *Earth observation data reception/distribution operators,*
  - *Value added/consultancy bodies,*
  - *Local agents and distributors,*
  - *Training institutes.*

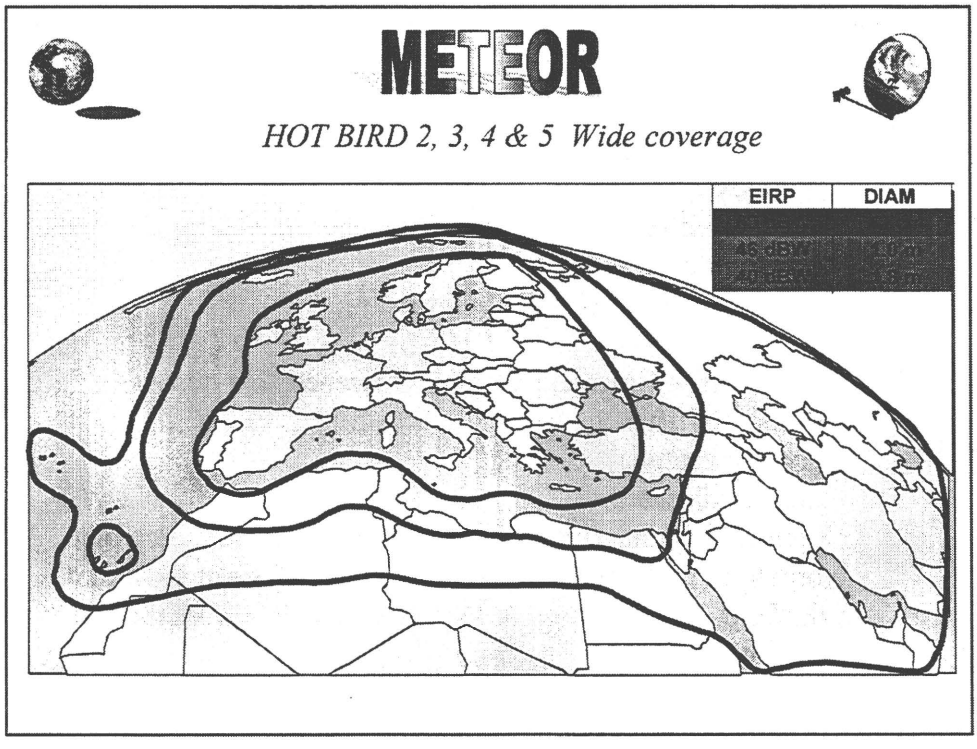
- ***The Telecommunication operators :***
  - *Ground segment : Internet Service Providers, Telecom operators (specialised links,...)*
  - *Space segment : Eutelsat, Astra, Orion, etc... + trials on STENTOR (CNES), ...*

METEOR

A MULTIMEDIA INTERACTIVE SYSTEM




METEOR TELE-TRAINING
2, 4 , 6, ou 40 until 155 Mbps.
384 kbps à 155 Mbps.
Antenna
1.8 à 2.4 m
nd user (---> request)
Internet Service
Provider
Multimedia serviceoperator
(Data Bank / Data server, audio, video)
Return link also possible
via terrestrial links...
WWW


METEOR
HOT BIRD 2, 3, 4 & 5 Wide coverage
EIRP
DIAM

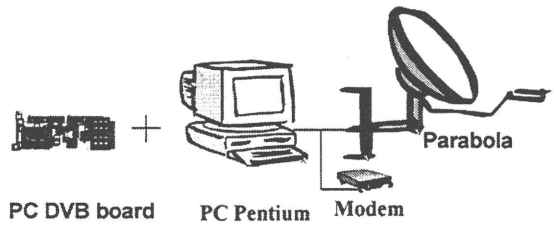
METEOR

Example: MULTIMEDIA EUTELSAT PLATFORM
(Hardware for Receiving on Personal Computers)

DVB MPEG-2 cards

- ADAPTEC
- COMATLAS - VLSI
- COMSTREAM
- DASSAULT
- MDS
- MEDIA 4
- NMC
- PACE
- PHILIPS
- SAT - SAGEM
- X-COM

A low cost hardware (Rx only) < $ 800



standard DVB Solution
inter-operable (card / IP Gateway)
Multi-providers
Multi-services

METEOR

PLANNED SCHEDULE

Q1/Q2/1999 : Hardware tests, protocol, security, invoicing software developments.
First trials via an EUTELSAT satellite.

Q3/Q4/1999 : Test of interactive videoconference (full duplex)
Multicast diffusion
Sky ring protocole
Internet via satellite
Exchange of data (updating in real time of an off shore platform with Earth observation data, data analysis at the remote platform, dissemination of the elaborated data from the off-shore platform).

What the market is

- **The chemical industry is shipping millions of tons of chemical products every year, most of which are hazardous to some level**
- **The industry is getting more and more sensitive to the impact on the environment**
- **Monitoring closely the transport of hazmats is a way to improve safety and operations**
- **There are about 100K containers worldwide for hazmats transport and 200K railcars in Europe**

The market requirements

- **Requirements vary depending on the transport and the product:**
  - for long international transports (i.e. Europe to Asia), one position every few days is enough;
  - for intra European transports, several positions every day are required;
  - for temperature sensitive products, monitoring the temperature of the products to prevent problems is a must.

What is needed

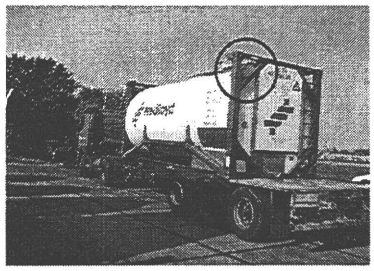
- **Customers only need:**
  - transmitters to install on containers/railcars;
  - subscription to service;
  - and Internet access to retrieve data.
- **Advantages of Argos are:**
  - easy set-up, easy to use;
  - unobtrusive transmitters;
  - long battery life, low maintenance.

Benefits

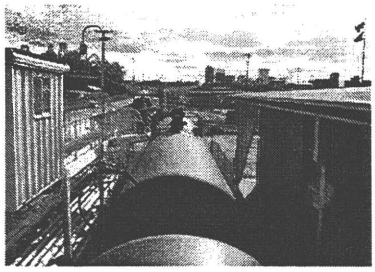
Benefits include

- **Better safety: several customers prevented incidents with Argos;**
- **Better control on transports through monitoring what subcontractors do;**
- **Better quality of service to shippers;**
- **For some products, transport monitoring is required (nuclear).**

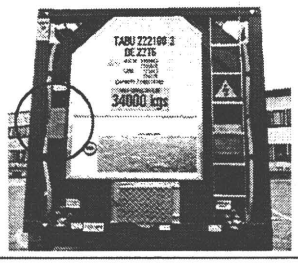
Some examples



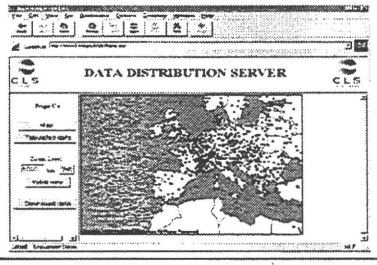
Two Tank containers



A Tank railcar

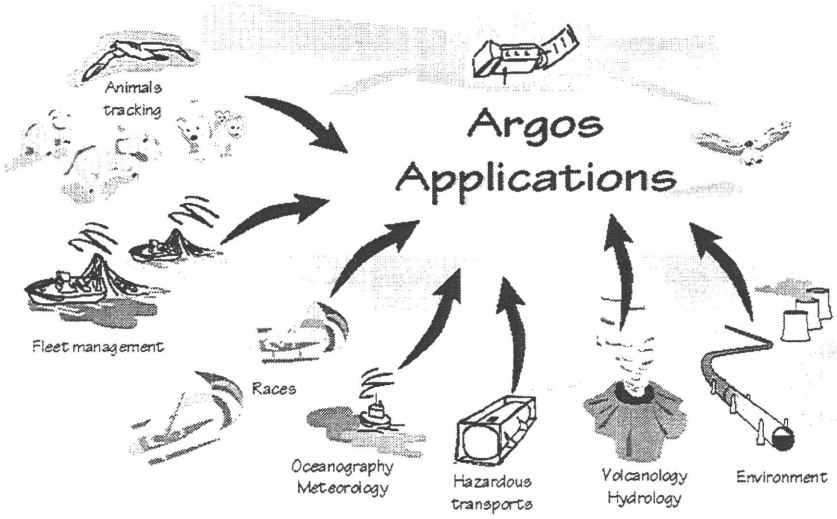


The WEB site to access data



CLS

Argos applications



CLS

UK SATELLITE SYNERGY

R. ROBINSON, BNSC

UK SATELLITE SYNERGY

Support development of applications from satellite synergy

WHY?

BNSC putting space to work

UK SATELLITE SYNERGY

- Better ways to meet market demand (user requirements)

- Customers will drive future satellite missions

- Will perpetuate satellite operations to meet all needs

BNSC putting space to work

UK SATELLITE SYNERGY

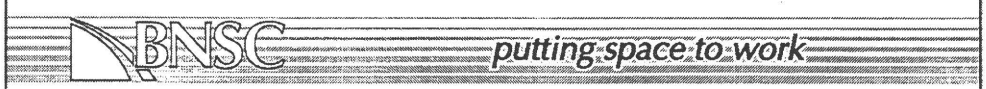
ACTIVITIES (1 of 2)

- National satcoms programme
- ESA ARTES programme
- National EO programme

UK SATELLITE SYNERGY

ACTIVITIES (2 of 2)

- National small satellite programme
- & now ASTRON



UK SATELLITE SYNERGY

OPPORTUNITIES

- Speed
- Capacity
- Current infrastructure

UK SATELLITE SYNERGY

WARNINGS

-do not do it just because it is there (technology push)

- must be a good business case

ANNEX:

LIST OF PARTICIPANTS

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ASTRON Programme

JRC Ispra, Amphitheatre

19/01/1999 - 19/01/1999

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