

# **Workshop on The Utilisation of a Future European Space Weather Service**

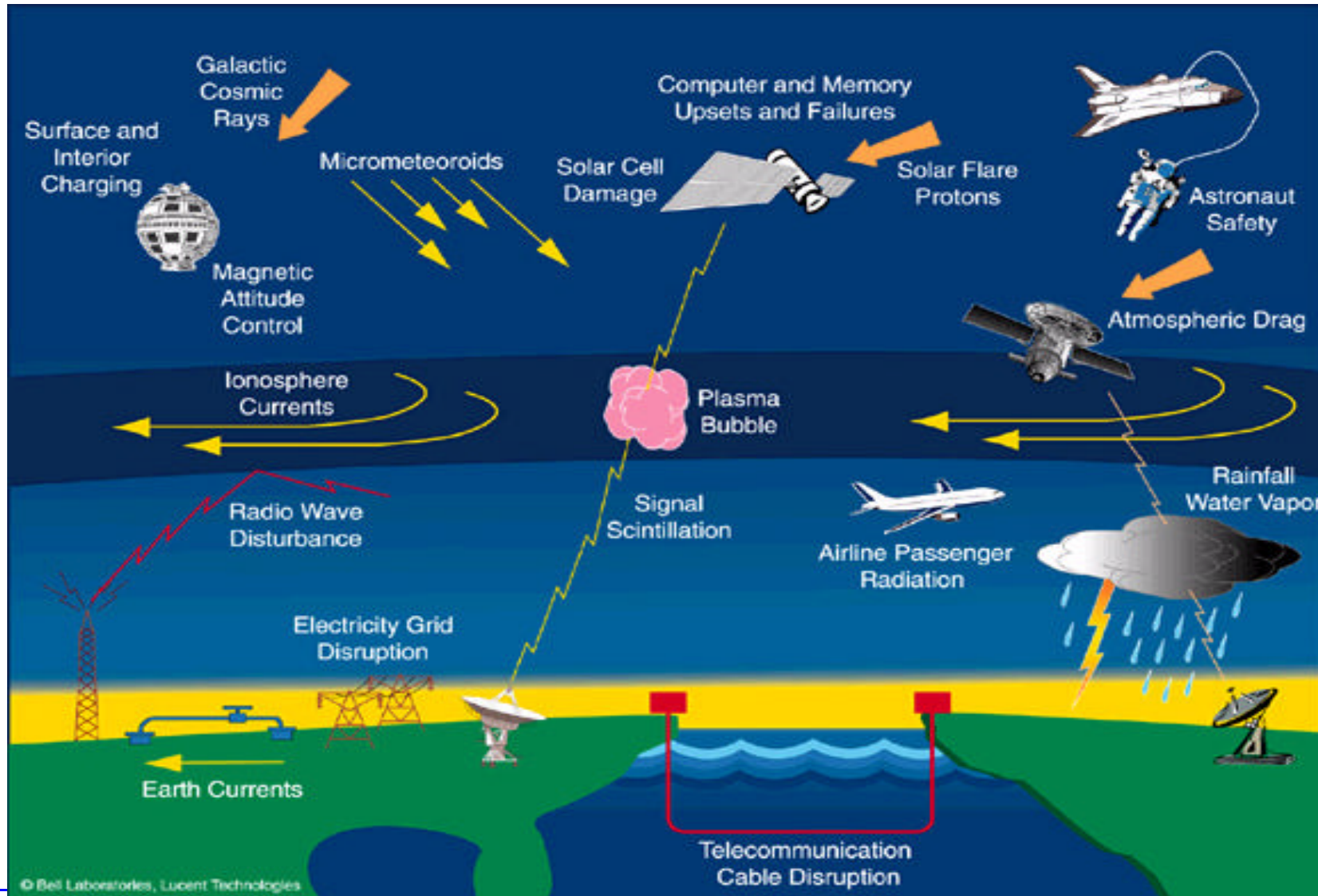
**12 December 2000  
ESTEC, Noordwijk, The Netherlands**

- 10:00 Introduction (E. Daly, ESA)
  - 10:30 Status of RAL Study (M. Hapgood, RAL)
  - 11:00 Status of Alcatel Study (B. Huet, Alcatel)
  - 11:30 Discussion of Needs and Benefits [ [assessment Matrix](#)    [Key Animators](#)
  - (15 minutes per sector)
  - (+5 minutes for Key issues)
  - 13:00 Lunch Break
  - 14:00 Poster Viewing
  - 14:30 Continuation of Discussion of Needs and Benefits [ [assessment Matrix](#)    [Key Animators](#)
  - 17:00 Conclusions & Recommendations
  - 17:30 Cocktail in Poster room
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# ***Context***

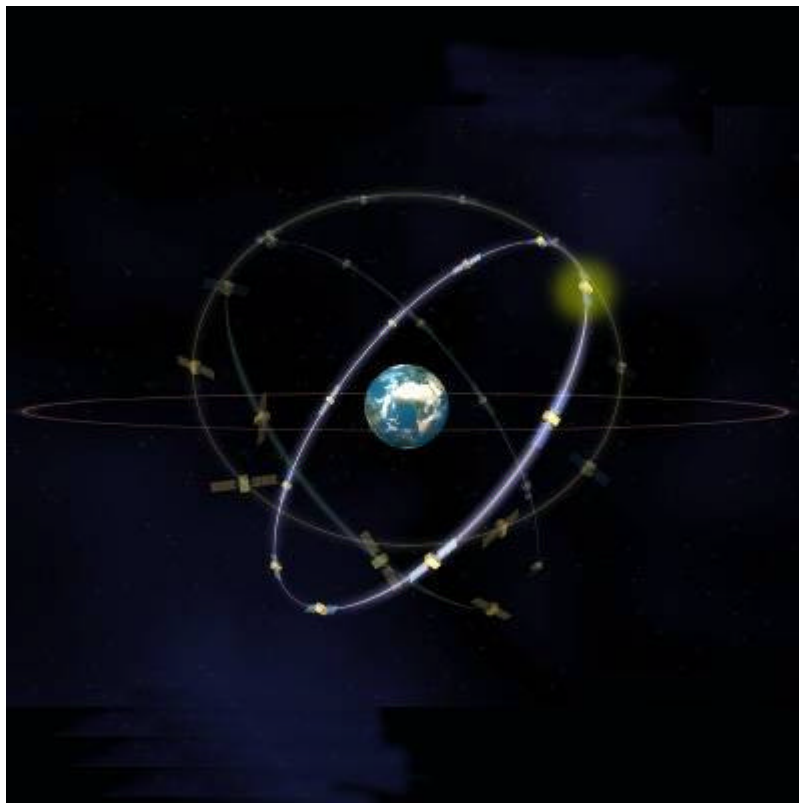
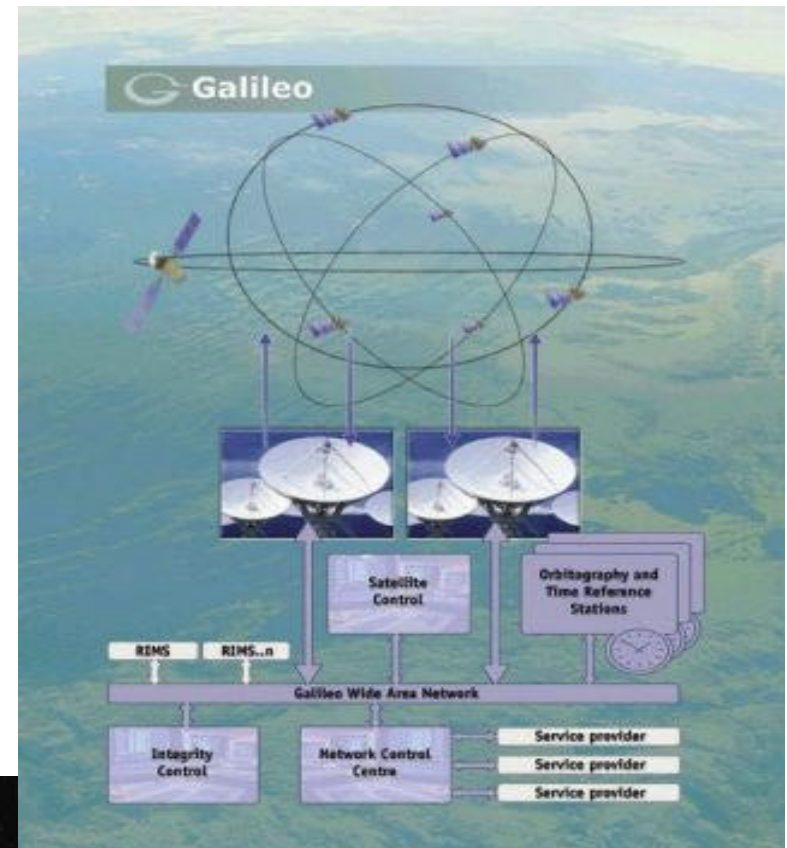
- Space Weather has important effects on technological systems
  - What scale of programme do these effects justify?
  - Space Weather is a hybrid between science and applications
  - Note US NSWP and Living with a Star Initiatives
  - Should there be an ESA/European programme?
  - Needs careful identification of needs, economic impacts, economic value and programme cost
  - Important, high-quality studies under way led by Alcatel and RAL
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# Summary of Space Weather Effects



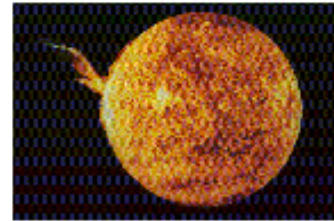
# Galileo

- Navigation system (MEO, GEO)
- 30 satellites over next 10 years
- 3B€ total cost
- market 90B€/20 years





# DISTURBANCES AND IMPACTS



## Electromagnetic Radiation

### EFFECTS

- HF RADIO BLACKOUT
- SATCOM INTERFERENCE
- RADAR INTERFERENCE
- SATELLITE ORBIT DECAY
- GEOLOCATION ERRORS

## High Energy Charged Particles

### EFFECTS

- SATELLITE DISORIENTATION
- SPACECRAFT DAMAGE
- FALSE SENSOR READINGS
- LAUNCH PAYLOAD FAILURE
- ASTRONAUT HEALTH

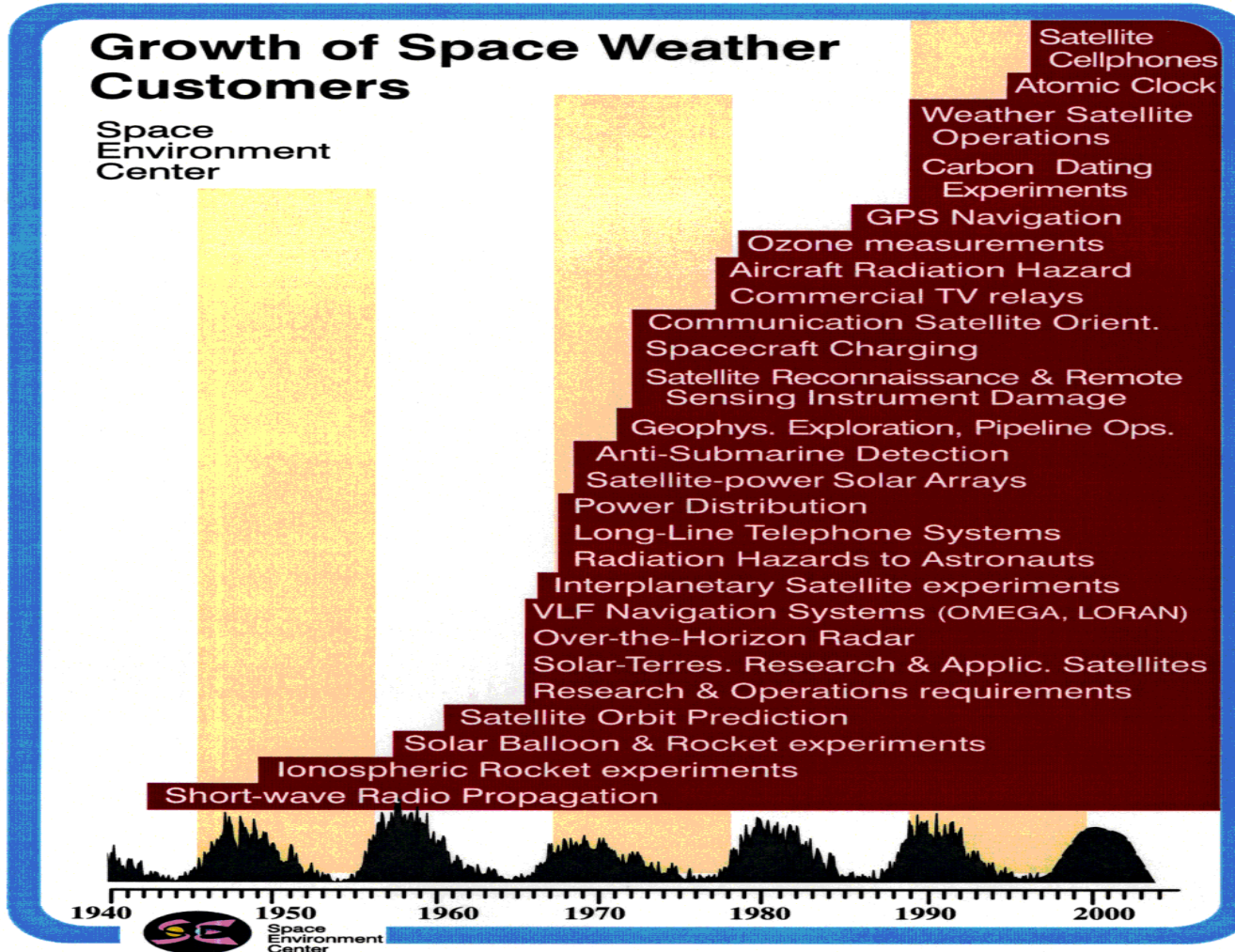
## Electrically Charged Particle Clouds

### EFFECTS

- GEOLOCATION ERRORS
- SATCOM DISRUPTIONS
- SPACECRAFT ANOMALIES
- SATELLITE ORBIT DECAY
- RADAR FALSE TARGETS

### Sample Impacts (Solar Max, 1989)

- SATCOM interruptions (Desert Storm)
- Worldwide HF comm blackouts
- Lost contacts with Air Force One
- Premature satellite orbit decay
- Hundreds of satellite ops disruptions
- Dozens of failed satellite subsystems
- NORAD lost 1300 orbiting objects
- Six million people lost electrical power



# ***Arguments for a Space Weather Programme***

- Strategic
- Technological
- Scientific
- Economic  - difficult to estimate

Reason for this **WORKSHOP**

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# ***Objectives***

- To finalise user requirements gathering activities
  - To identify “markets” and service requirements
  - To attempt to quantify the economic value and economic benefits
  - Not necessarily direct markets
    - but ultimately may evolve;
    - commercial activities encouraged
  - To prepare ground for system definition and programme proposal
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## Economic Value of Space Weather Related Phenomena and Consequent Economic Impact of a Space Weather Service

Please contribute to [ANY](#) box and send info to [swwt@wm.estec.esa.nl](mailto:swwt@wm.estec.esa.nl)  
or fax to Space Weather Working Team Secretariat: +31 71 565 5420

Sector	Effects and Needs for each Sector			Economic Impact (+justification)				Potential benefits of deployment
	Met needs (in term of information on space weather, forecast, nowcast, historical)	Present or near-term un-met needs	Effects trends	value of systems affected (note 1)	value or amount of manpower affected (note 2)	value of system deployed to prevent or take action in response to space weather effects (note 3)	value or amount of manpower deployed to prevent or take action in response to space weather effects (note 4)	
S/C and Launchers development								
S/C and launchers operations								
Manned Space Flight								
Aircraft crew and avionics								
Defence								
Oil and Mineral industry								
Electrical power								
Insurance (S/C,...)								
Radio Communications								
Positioning								
Education Sector, Public interest, Scientific Tourism.								
Scientific community								
Remote sensing								

## ***Effects Domains***

- Spacecraft Development
- Spacecraft Operations
- Manned Spaceflight
- Aircraft (Crew/Avionics)
- Defence (many sectors)
- Oil and Mineral Industries
- Insurance
- Radio Communication
- Trans-ionospheric communication
- Positioning Systems
- Education and Public Interest
- Tourism
- Science
- Launchers
- Remote Sensing

**&**

## ***Economic Data***

- ***Effects***
  - ***Met needs***
  - ***Unmet needs***
  - ***Effect Trend+ Future needs***
  - ***Systems affected***
  - ***Man power affected***
  - ***System deployed***
  - ***Man power deployed***
  - ***Total (EU)***
  - ***Value of Enhanced Service***
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