CASSINI-HUYGENS IN THE EUROPEAN CONTEXT

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WHAT IS CASSINI-HUYGENS?
WHAT IS HUYGENS?

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Planetary Exploration within ESA

- In 1970, ESRO’s LPAC decides not to plan any planetary mission because too expensive
- Cooperation with NASA (or USSR) was the only option for Europe to participate in the exploration of the Solar System
- First change in that policy was ESA’s SPC 1980 decision to launch a fast fly-by mission to Halley’s comet (March 1986)
- In 1982, a group of European and US scientists propose a Titan Probe as an element of the US Cassini mission
Then came Horizon 2000

- EURECA missions: astronomy and solar physics
- Small size projects: (incl. collaborative programmes)

Solar Probe
HOEM

S.T.P.
Solar/Plasma Heliospheric Missions

Mars-Rover

Planetary
Mission to Primordial Bodies including Return Pristine Material

ULYSSES
ISPM

HIPPARCOS

High Throughput
X-Ray Spectroscopy Mission

ST
ISO

GIOTTO

High Throughput
Heterodyne Spectroscopy Mission

2D-opt/I.R./mm interferometry

Space science Horizon
Horizon 2000 and planetary exploration

- Although not identified as a new strategic orientation, Planetary Expl. becomes possible through the CNSR cornerstone mission (now Rosetta) and the medium (“blue”) missions.

- The Titan Probe is selected by ESA’s SPC in Nov. 1998 as the first “blue” mission of Horizon 2000 and renamed Huygens.

- The CNSR and Huygens were the only planetary missions of Horizon 2000.
At the end of the (SPC) meeting the Director of the Science Programme reminded delegations that the Saturn moon Titan had been discovered in 1655 by the Dutch astronomer Huygens. In response to the Swiss request, he therefore proposed that the European contribution to the American Cassini project henceforth be known as "Huygens".

The Netherlands Delegation very much appreciated this proposal to pay homage to a Dutch astronomer. The Chairman of the SSAC (Prof. Balsiger, Switzerland), speaking on behalf of the scientific community, happily accepted the proposal to call the next European mission "Huygens".
In 1994, the new Survey Committee identified a Cornerstone mission to Mercury,

- A Mars orbiter,
- Then came Smart-1 and Venus Orbiter.
- The outer Solar System could only be reached via cooperation with NASA: Huygens is “the” model!
Selection process in ESA’s Science program: the Huygens Model

- 1982: call for ideas
- 1983: pre-selection by SSWG
- 1984-1985: feasibility study
- 1986: selection for Phase-A and ESA-NASA studies
- 1987-1988: phase-A
- 1988: selection by SPC (against VESTA, LYMAN, QUASAT, GRASP)
- 1989-1990: payload selection
- 1990: selection of Aerospatiale as Prime Contractor
- 1991: start of Phase-B
- 1997: launch
- 2005: landing on Titan
Planetary Exploration within present ESA’s scientific program

- Giotto, 1986, 1992: two comets
- Huygens, 2005: Titan
- Mars express, 2004: Mars
- Smart-1, 2005: the Moon
- Venus Express, 2006: Venus
- Rosetta, 2014: two asteroids and one Comet
- Bepi-Colombo 2015(?): Mercury
- What else? Cosmic Vision
Smart-1
Rosetta

Encounter with and landing on Comet 67P/ Churyumov-Gerasimenko in 2014!
Why Titan?

Saturn's Satellites and Ring Structure

Saturn

This graphic is available in color if required.
What is Titan?

- The biggest moon of Saturn
- An Earth “in the fridge”
- A unique laboratory for pre-biotic studies in the S.S.

However, its surface cannot be seen
Without Huygens, Cassini, most likely, would have been dropped by NASA!
International Cooperation

• The Cassini Payload
  – 12 instruments, all of them involving international teams
  – 2 European Principal Investigators:
    • D. Southwood (UK), Dual Technique Magnetometer
    • E. Gruen (Germany), Cosmic Dust Analyzer

• The Huygens Payload:
  – Huygens Atmospheric Structure Instrument M. Fulchignoni, Italy
  – Gas Chromatograph Mass Spectrometer H.B. Niemann, USA
  – Aerosol Collector and Pyrolyser G. Israel, France
  – Descent Imager/Spectral Radiometer M.G Tomasko, USA
  – Doppler Wind Experiment M.K. Bird, Germany
  – Surface Science Package J.C Zarnecki, UK
The Technological Challenge

Synergy with military technology was key in selecting the Prime Contractor
Industrial Cooperation

United Kingdom
- Airbus
- Flight Software
- MBDA
- Descent Subsystem
- EGG
- Parts Procurement
- Avionics
- Parachutes

Belgium
- ESA/ESCA
- Power Subsystems

Ireland
- Independent S/W validation

USA
- Boeing
- Accelerometers
- Batteries
- Insertion System
- G Switches
- LCDs
- PIDD cartridge

Spain
- CASA
- Internal Structure
- HazMat
- Flight Dynamics
- Parts procurement
- ORPA
- Mass dynamics
- ASA
- Project control

Italy
- Thales
- Data handling subsystem
- Information systems
- Communication subsystem
- Probe Data Relay Subsystem (PDSS)

Switzerland
- Contraves/Verry
- Front shield structure
- Back cover structure
- Mechanisms
- ISP
- P/I/PM interface simulator

Austria
- ESA
- MGSE
- Thermal Blanket
- Swivel
- Shock
- PDRS EGSE

Netherlands
- Fokker
- Balloon drop test model

France
- Aerospatiale
- Prime Contract
- Aerothermodynamics
- Thermal protection
- Dynamic Propagation
- Pyro devices
- Framantamb
- Unibial connectors

Germany
- DASA
- System Integration and Test
- Thermal control

Sweden
- Saab/Scania
- Probe Transmitter Antenna
- Receiver Front End
- Exorger
- Balloon drop test

Norway
- NIF
- Systems EGSE
- ISSM
- Reliability Analysis
- Cost Analysis
- Documentation

Denmark
- ESA
- D/C/DC converters
- Mission timer unit

Finland
- Vinnava

Hong Kong
- British Aerospace

Holland
- ESA

Madrid
- ESA
The Long Journey
Exciting times are coming...

1. 25/12/04: release Huygens from Cassini,
2. 14/01/05 Entry of Huygens in Titan’s atmosphere,
3. 2,5 hours later: landing?
The Last Phase of Huygens’ Journey
The societal aspect of Huygens

• On board Huygens ESA has embarked a CD carrying several hundreds of testimonies from Europeans of all ages, and of citizens from all around the world: drawings, paintings, texts, poems, messages etc...

• No attempt was made to filter these testimonies so that they constitute a “snap-shot” of the way of thinking and of the imagination of our civilization in the mid 1990’s

• May be, one day, another mission (civilization?) will recover this CD and may even attempt to decipher it!
What after Huygens?

Impossible to plan a mission to Saturn without RTGs or without cooperation with NASA.
Would have Huygens been selected in the framework of ESA’s Aurora Exploration program?
The End