

Proba-1

An exceptional journey for a small satellite

René Wittmann

Proba-1 CHRIS end of mission Workshop

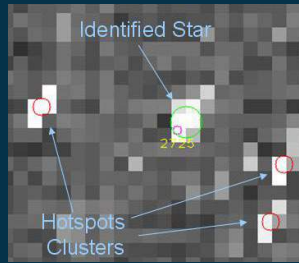
Ghent, 18/01/2024

Proba-1 Mission Timeline

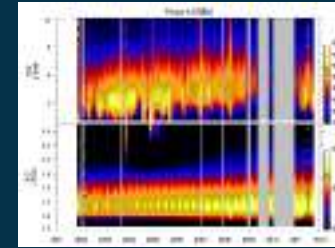
Launch
•22/10/2001



First CHRIS image
•Venice:
14/05/2002



Routine OPS 20 years later
•Until Jan. 2023



New Horizons
•2024+

Routine OPS & automation
•Starting May 2002



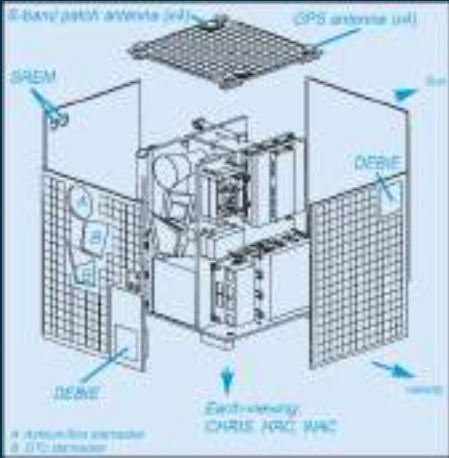
Midlife Crisis
•S/C heating up
•“Eye surgery”



Achievements
•CHRIS EOL Workshop,
18/01/2024



The journey begins!



22/10/2001

Launch with PSLV
Sriharikota Range
(East India)



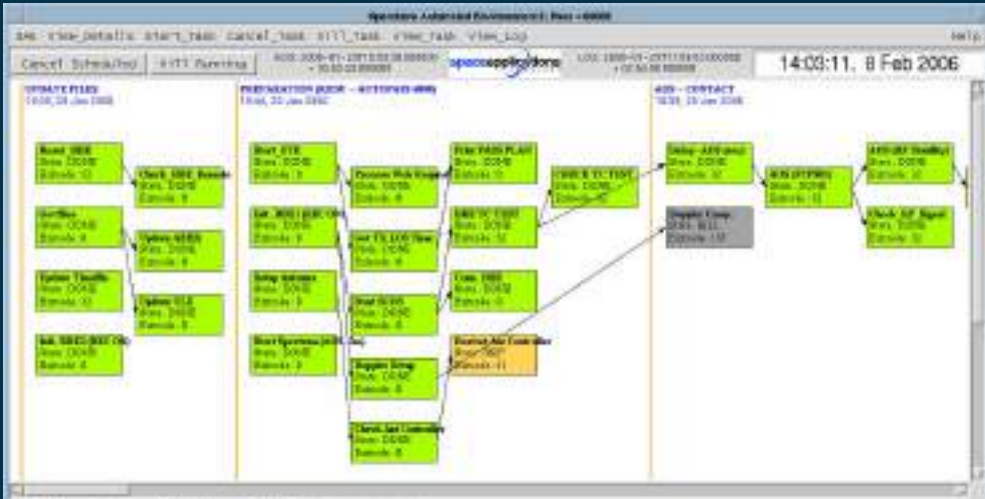
GSTP contract kick-off in 1998, awarded to Verhaert as prime contractor.

- S/C dimensions:
- 60x60x80 cm
 - 94 kg

Total industrial cost (excluding CHRIS and DEBIE) until routine OPS: 15.6 M€



Weekends for everyone: why we love automation



Proba-1 features

- Early PUS mission
- ESA's first Li-ion battery
- On-board target visibility calculation
- Star Tracker in the gyro-less attitude control loop
- ESA's first automated mission



Lessons Learnt

- Designed for autonomy**
 - Platform autonomy:
 - Fault Detection & Recovery
 - On-board mission functions
 - Ground segment automation:
 - Hands-off system
- The power of automation**
 - Platform availability and reliability
 - Small operations team (6)
 - (Cost) efficiency
- Choose the right tool**
 - The automation system must be
 - Reliable
 - Flexible
 - Easy to use
- Ready for the future**
 - PROBA already implemented the EGS-CC goals for over 20 years!
- Future Missions**
 - The PROBA approach will be applied to upcoming missions:
 - Proba-3 (Formation Flying)
 - AltiUS (Earth Observation)

Routine Operations @Redu

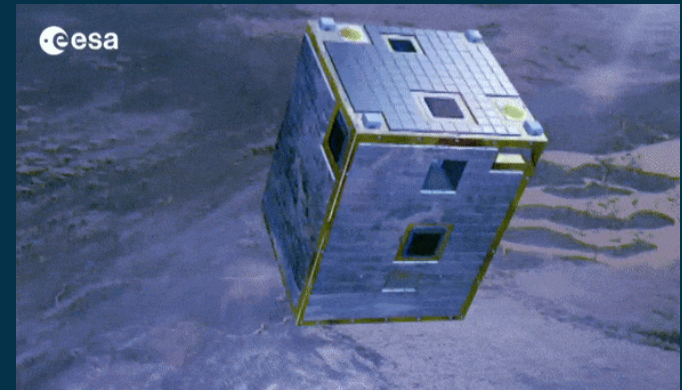


First CHRIS image: Venice
2002-05-14T10:13:00Z

esa MEMO

no/da: 21 May 2002 | re/af: DTOS-REDU-PROBA-WREP-0001-00 | pa/par: 1/0

no/da	titolo/tema	re/af
no/da	F. Testa, E. Ciarroli, J. Crochet, B. Vukobratovic, D. Hsieh, S. Negarajan, M. Schanz, T. van Oortwijk, S. Elkola, Pa. Poona, E. Altamir, E. Daly, G. Deotobigen, A. Mollmannsdottir, P. Sankaran, M. Stacey - ESTEC	re/af
	W. Wimmer, W. Trank, G. Wimmer, K. Morgan, A. Smith, M. Kozmgoran - ESOC	
	M. Abian - ESRF	
	D. Benisek, K. Gasteris, D. Gieris, F. Van der Bruggen - VERBAERT	
	F. De Maessene, B. Deschamps, F. Alouf, A. Dupont, M. Stern, C. Dujon, F. Bouchet, V. Coman - REDU	
	J. Kuchera - FOMI-Facilities	
	F. Hecker - PSI	
	P. Furlan - ESAC	
	M. Coma, L. Telen - Sira Electro-Optics Ltd	
	D. Beaudin, L. Deschamps - Spacebit	
	M. Eklund - SA	
	F. de Lathauze - CDS	



PROBA Weekly Status Report #1

Reporting period: First Monday (11 May) to Sunday (19 May) 2002

1. Activities Log

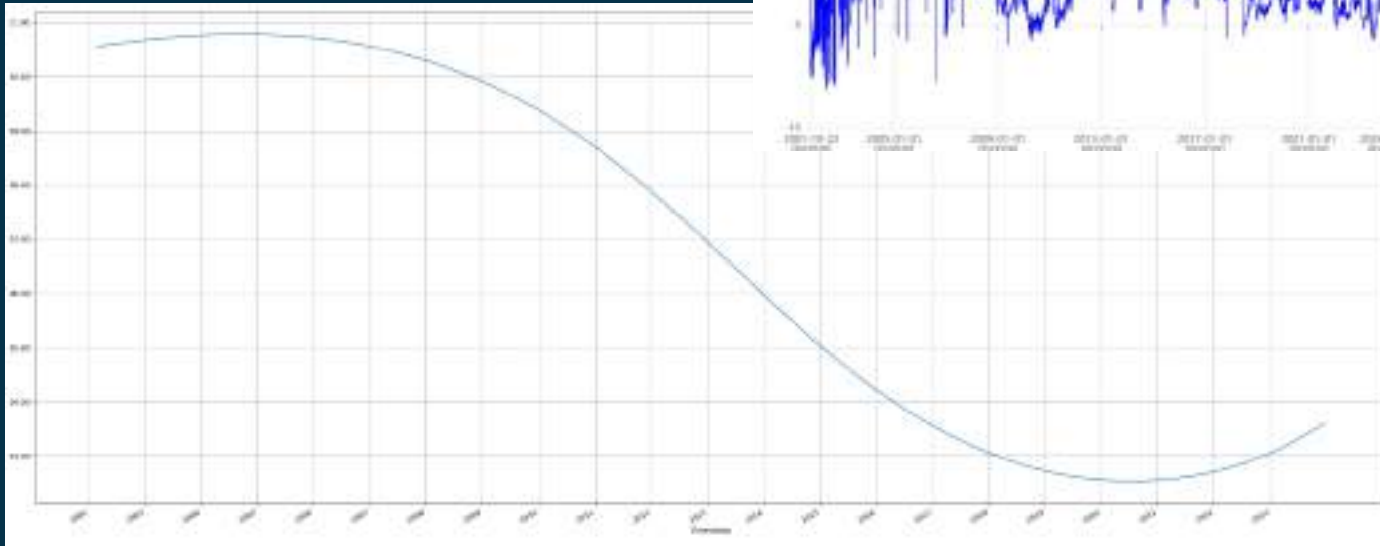
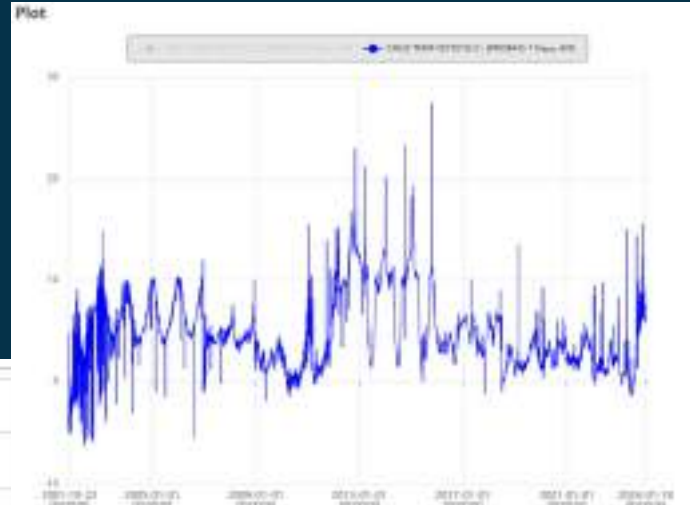
Date	DOY	Time	ORFID # (MPS #)	Status/Activity	Source
Mon 10 Mar 02	141	04:23:00	001	PCP/02/0001	REDU
Mon 10 Mar 02	141	04:50:00	001	PCP/02/0001	
Mon 10 Mar 02	141	05:26:30	001	OPAS/02/0001	



The Issues of Exceeding Expectations

Orbital drift

- Designed as a 1.5 years mission.
- Unfavourable illumination conditions
- Loss of Eclipses
 - Increasing heat
 - Loss of control
- Imagery on ascending part of the orbit (instead of descending at start of the mission)



2012: Eye Surgery for a Spacecraft

- Radiation damage to Star Tracker CCDs
- Hotspots masking stars
- Upgrade of ASC software
 - Re-used on Proba-2, Smart-1, GOCE, SWARM



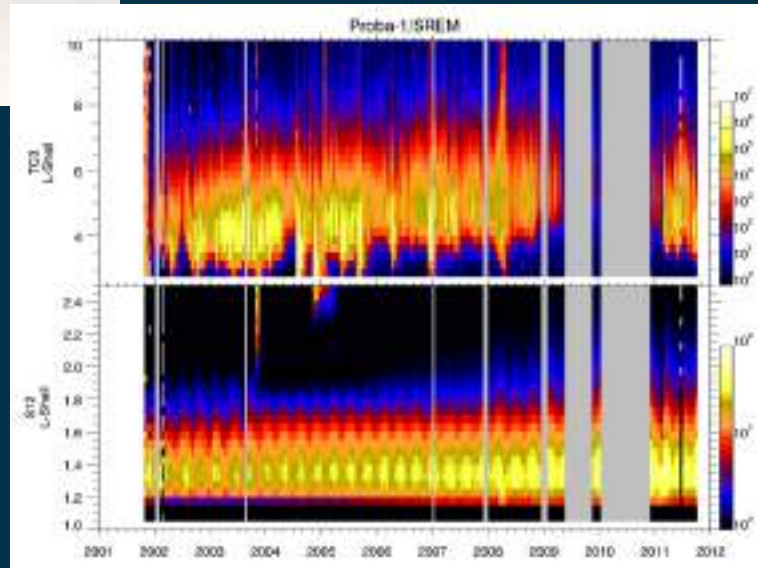
Reduced Mission Phase

- Started on 01/01/2023
- Focussed on operation of secondary payloads
 - DEBIE: DEBris In orbit Evaluator
 - SREM: Standard Radiation Environment Monitor
 - Occasional HRC images

SREM



DEBIE



Operations Statistics

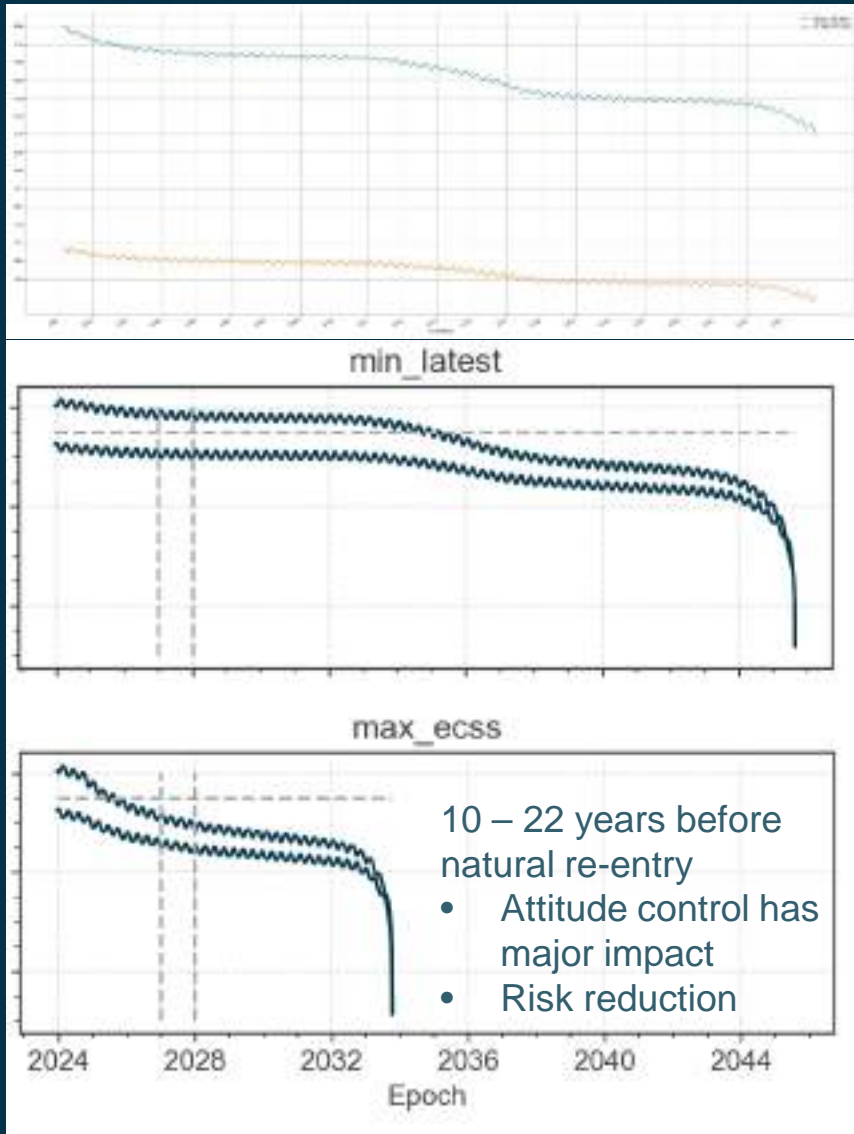
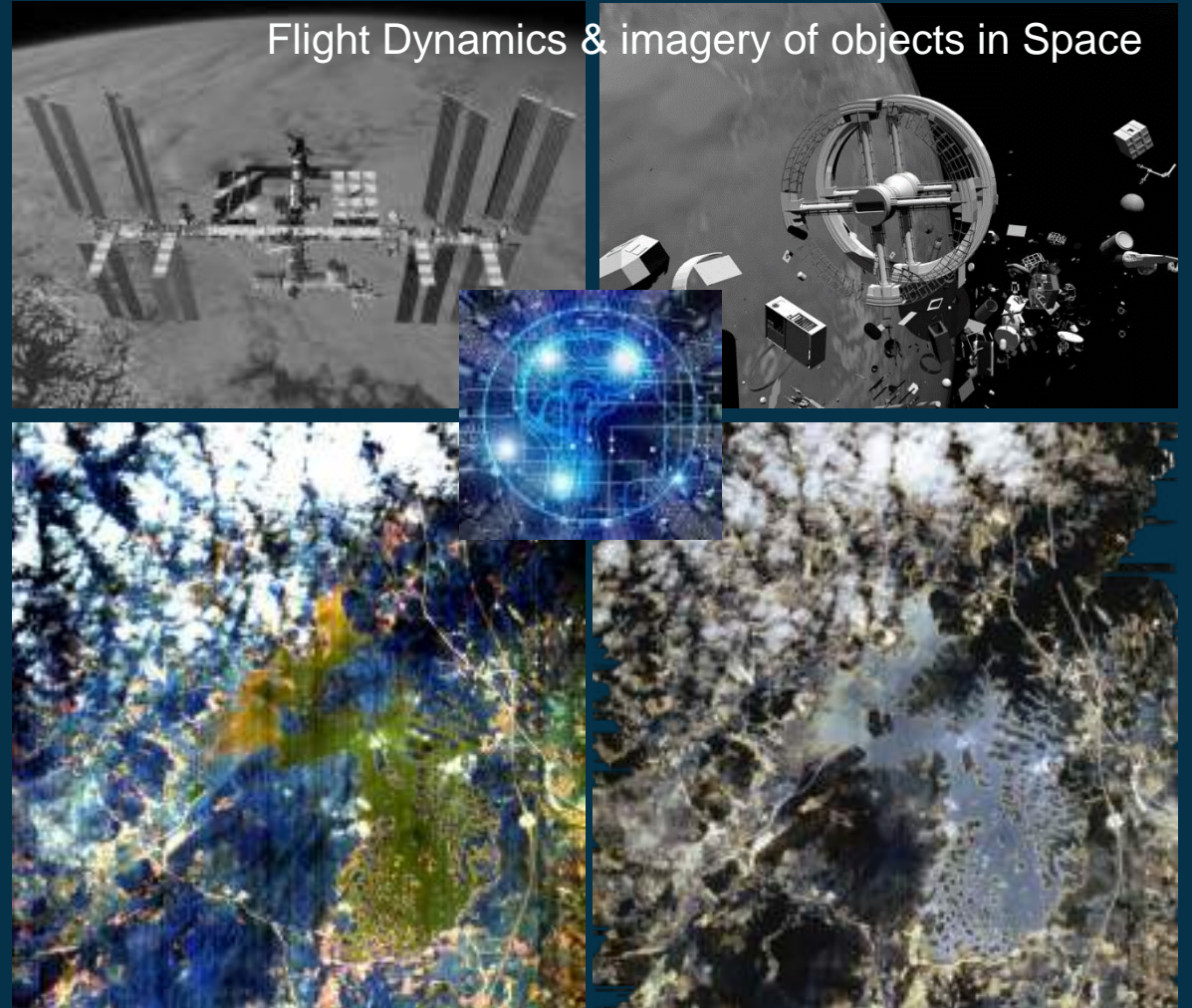
Orbits since launch	121131
Days in space	8122
Distance travelled since launch	5.322 billion km (~today's distance to Pluto)
Number of passes since launch	Total: 65090 Redu: 32201 Kiruna: 32889
Platform Availability: (observation & manoeuvres for observation & calibration during mission phase)	~93% (including long period of platform unavailability in 2011-2012 due to degraded star tracker performance and orbit drift)
Science products (based on requests)	Chris: 93550 images HRC: 40515 images
Science products availability (good data / collected data)	Chris: ~96% HRC: ~98%

Data from launch to 17.01.2024

New Horizons: 2024+

Internships 2024

Flight Dynamics & imagery of objects in Space



AI-based image processing for CHRIS



Proba-1 CHRIS End of Mission Workshop

18-19 January 2024 | Ghent, Belgium

