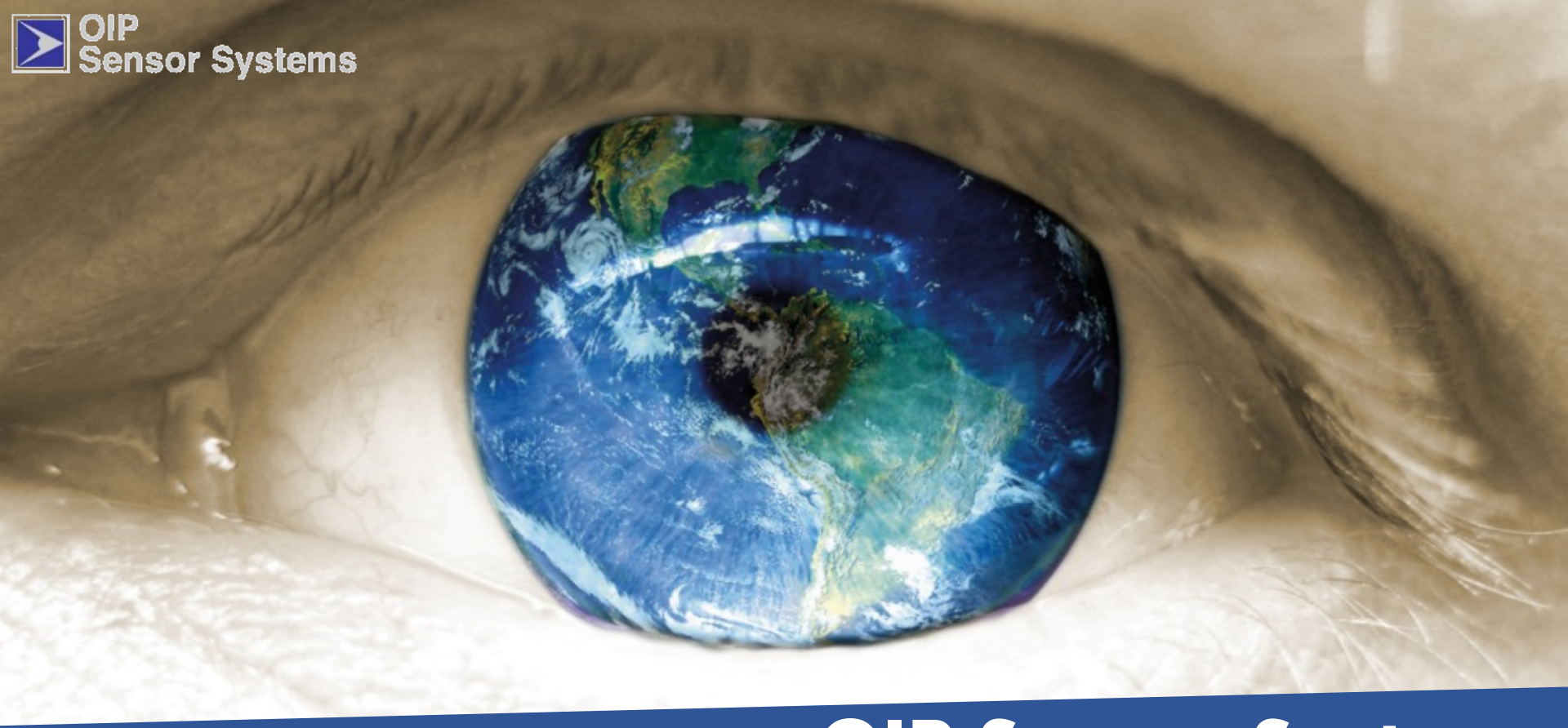
OIP Sensor Systems



OIP Sensor Systems

Your partner for Space & Security missions

NOMAD
Instrument for Mars atmospheric analysis, searching for traces of life

OIP Space Systems

Switch to Space 3 | 19/10/2022

What is NOMAD?

- Spectrometer
- A payload of the Exomars 2016 mission
- In orbit around mars
- Chemical composition of Mars atmosphere
  - Methane
  - Other trace gases

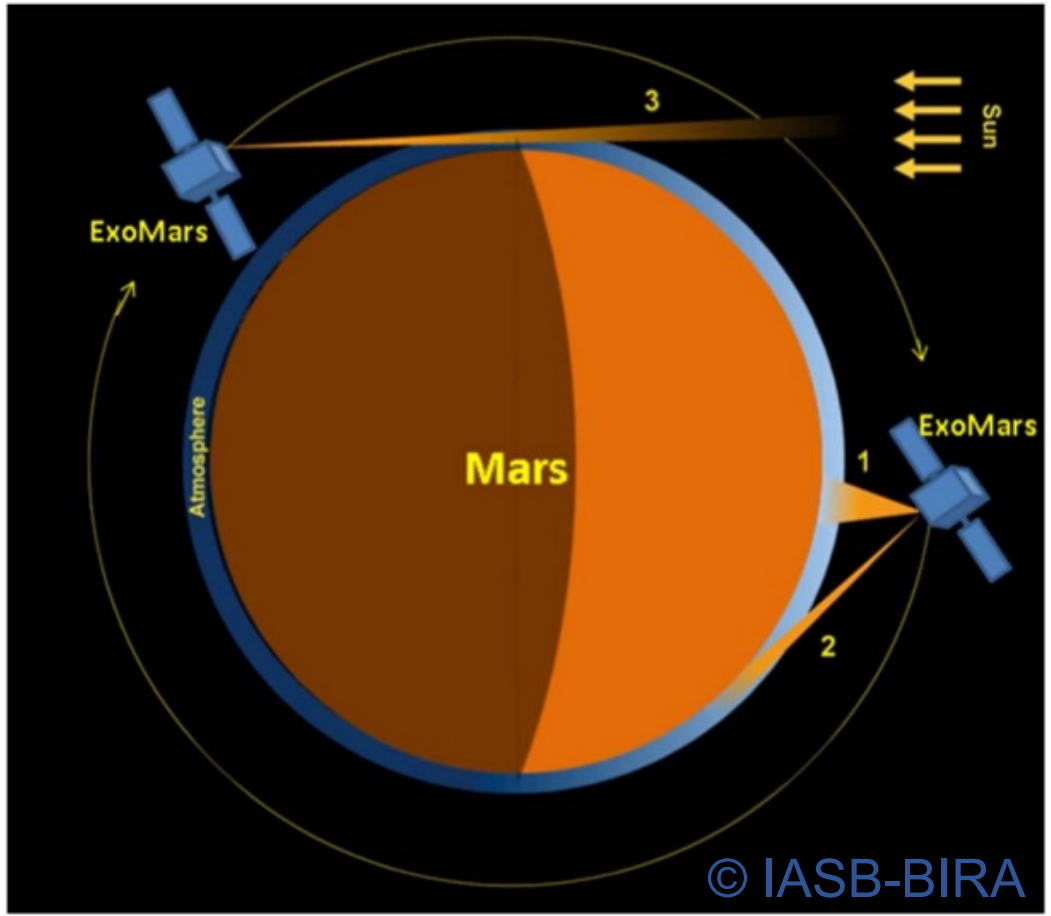
What is NOMAD?

- 3 channels:
  - SO: infrared spectrometer
  - LNO: infrafred spectrometer
  - UVIS: UV & visual spectrometer

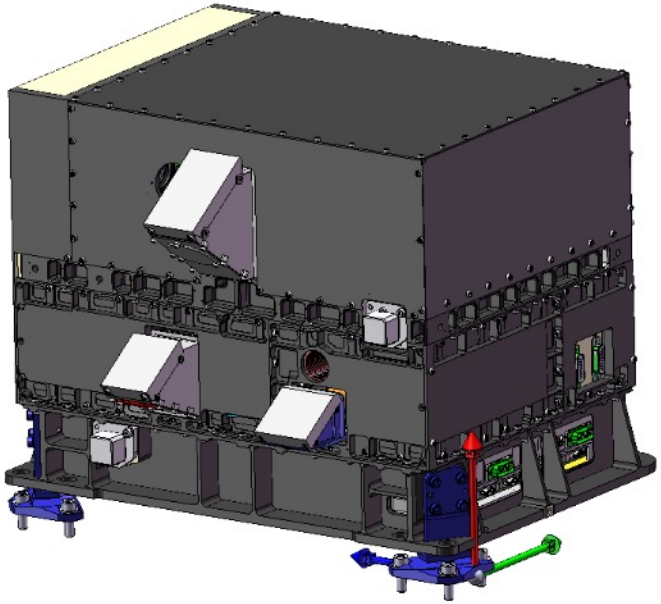
- OIP activities
  - Industrial lead: project management and system engineering
  - SO & LNO: optical and mechanical design
  - Overall assembly and testing

Working principle

1. Nadir
2. Limb
3. Occultation



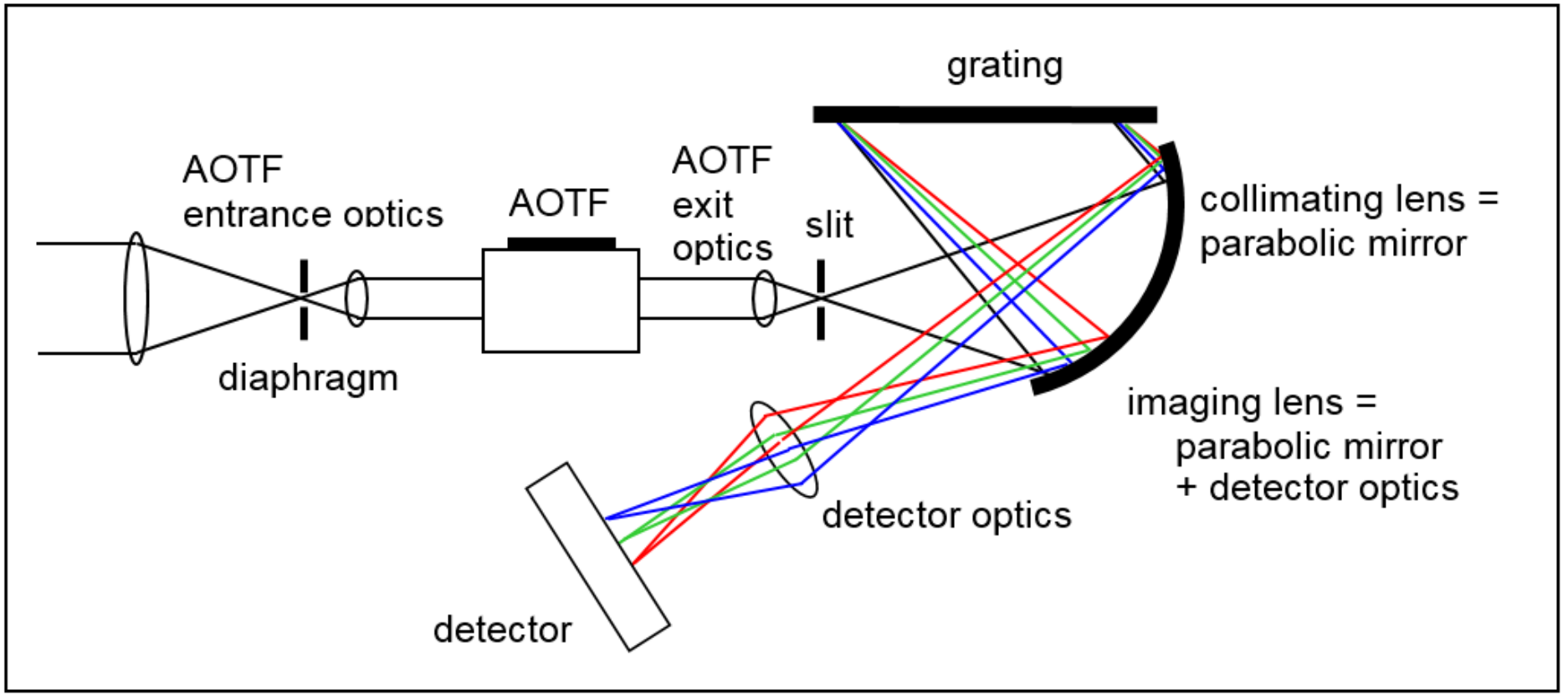
NOMAD



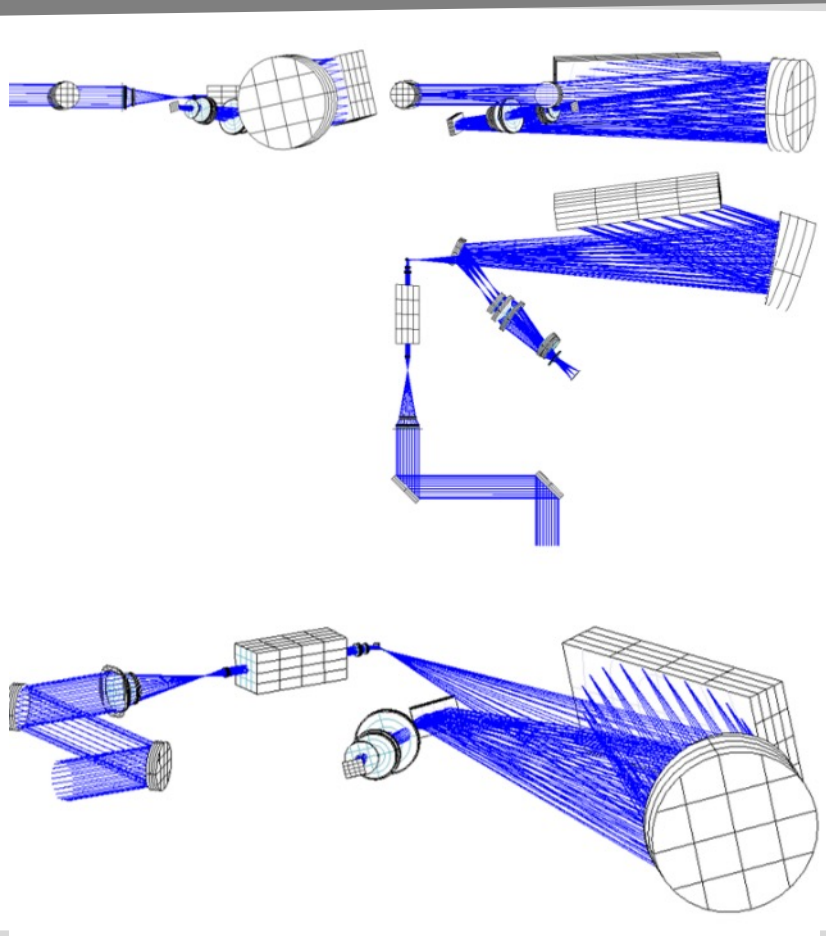
Timeline

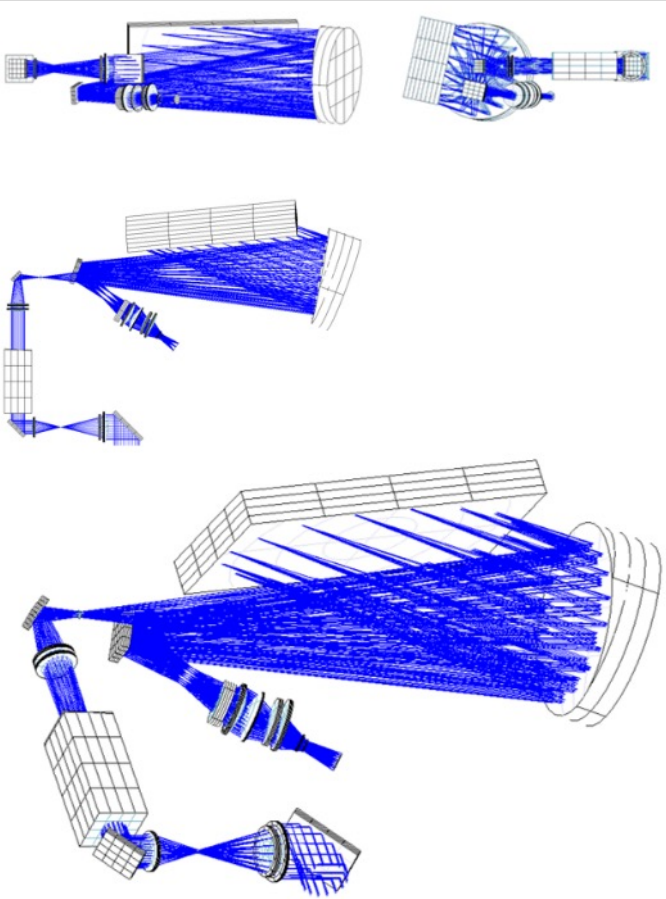
- 5 years from idea to finished instrument
  - 2010-2013: design phase
  - 2013-2015: build, test & delivery
- March 2016: launch
- October 2016: arrival at Mars and orbit insertion
- 2018 up to today: science mission

Schematic optical design



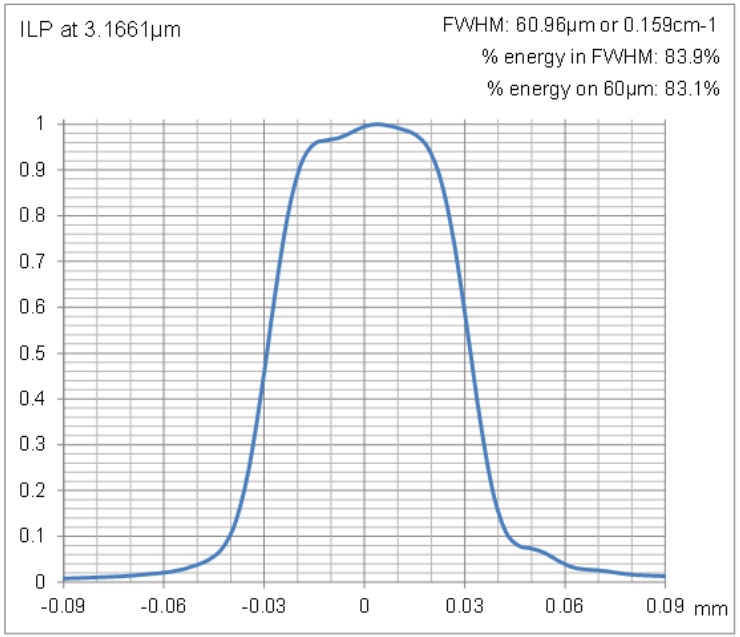
Detailed optical design





Detailed optical design

Analyses: feasibility, performance, tolerances, thermal,...



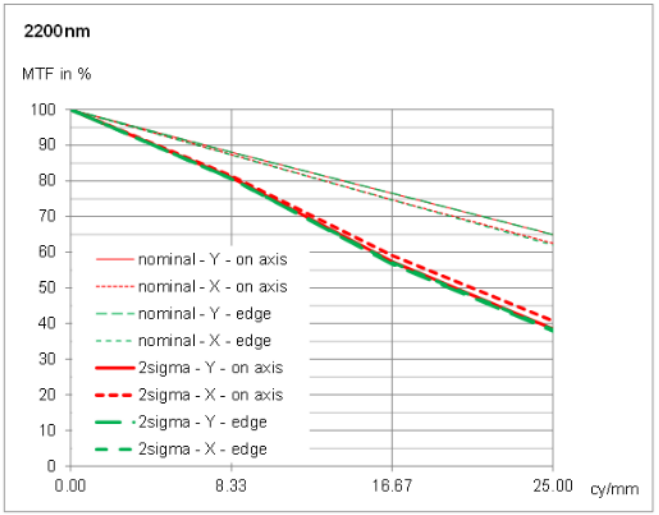
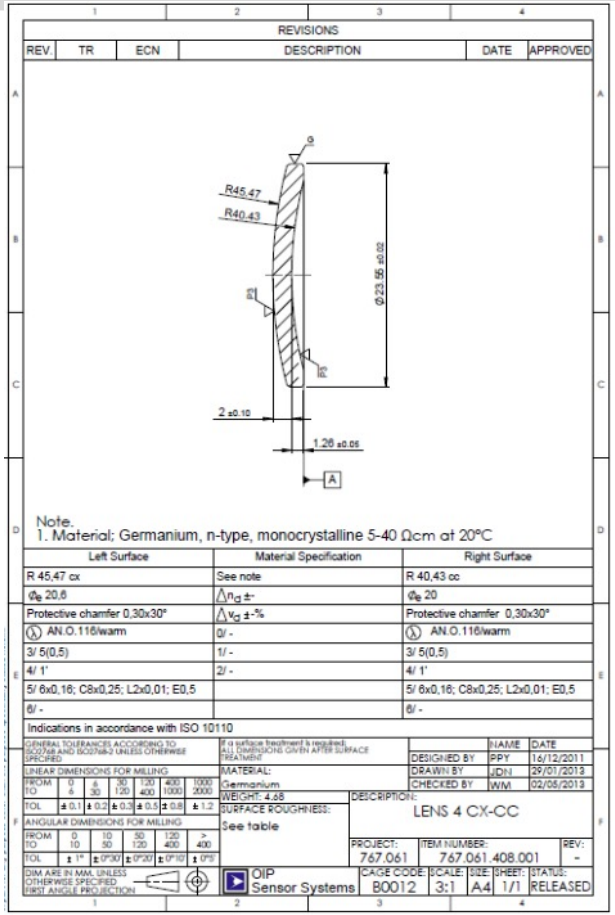


Figure 37: 2σ MTF and nominal MTF at the slit at 2.2µm

Detailed optical design

Output:

- Optical drawings
- Design report



REVISIONS

REV.	TR	ECN	DESCRIPTION	DATE	APPROVED

R45,47
R40,43
Φ23,55 ±0,02
2 ±0,10
1,26 ±0,05
A

Note.
1. Material; Germanium, n-type, monocrystalline 5-40 Ωcm at 20°C

Left Surface	Material Specification	Right Surface
R 45,47 cx	See note	R 40,43 cc
Φe 20,6	Δnd ±-	Φe 20
Protective chamfer 0,30x30°	Δνd ±-%	Protective chamfer 0,30x30°
AN.O.116/warm	0/ -	AN.O.116/warm
3/ 5(0,5)	1/ -	3/ 5(0,5)
4/ 1'	2/ -	4/ 1'
5/ 6x0,16; C8x0,25; L2x0,01; E0,5		5/ 6x0,16; C8x0,25; L2x0,01; E0,5
6/ -		6/ -

Indications in accordance with ISO 10110

GENERAL TOLERANCES ACCORDING TO ISO2768 AND ISO2768-2 UNLESS OTHERWISE SPECIFIED

LINEAR DIMENSIONS FOR MILLING

FROM	0	6	30	120	400	1000
TO	6	30	120	400	1000	2000
TOL	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ANGULAR DIMENSIONS FOR MILLING

FROM	0	10	50	120	>
TO	10	50	120	400	400
TOL	± 1°	± 0°30'	± 0°20'	± 0°10'	± 0°5'

DIM ARE IN MM, UNLESS OTHERWISE SPECIFIED
FIRST ANGLE PROJECTION

If a surface treatment is required, ALL DIMENSIONS GIVEN AFTER SURFACE TREATMENT

MATERIAL: Germanium
WEIGHT: 4.68
SURFACE ROUGHNESS: See table

	NAME	DATE
DESIGNED BY	PPY	16/12/2011
DRAWN BY	JDN	29/01/2013
CHECKED BY	WM	02/05/2013

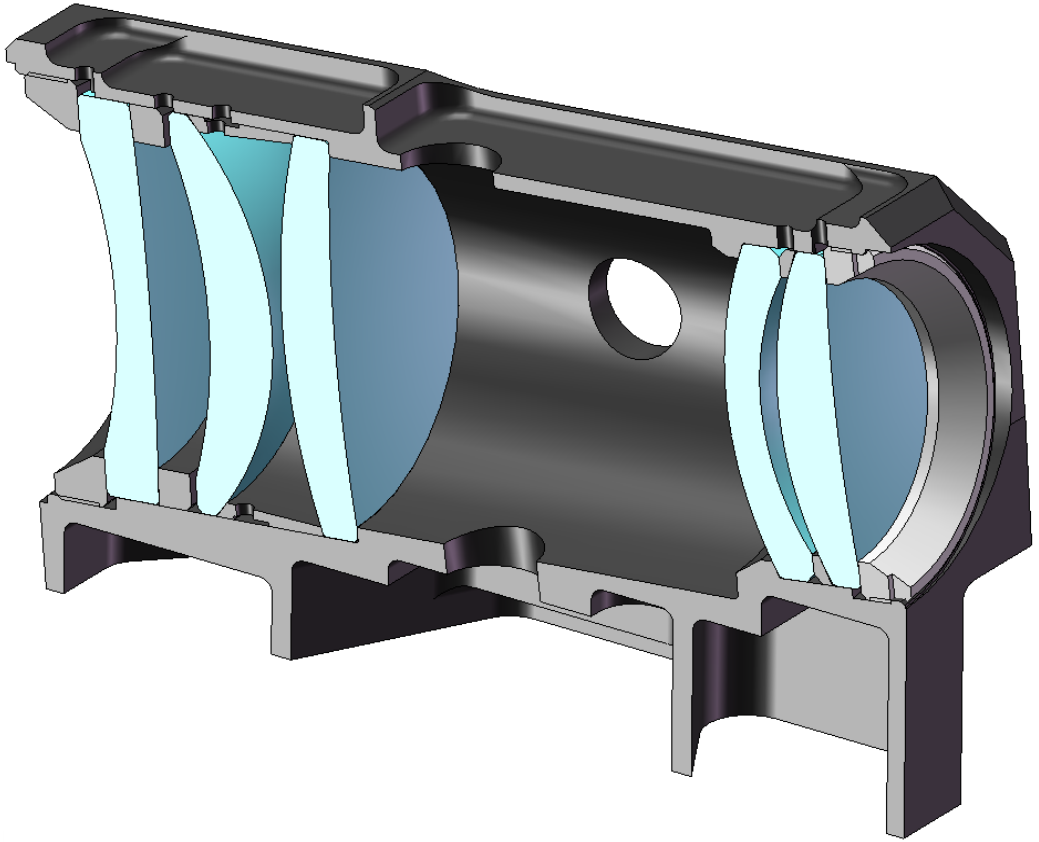
DESCRIPTION: LENS 4 CX-CC

PROJECT:	ITEM NUMBER:	REV:
767.061	767.061.408.001	-

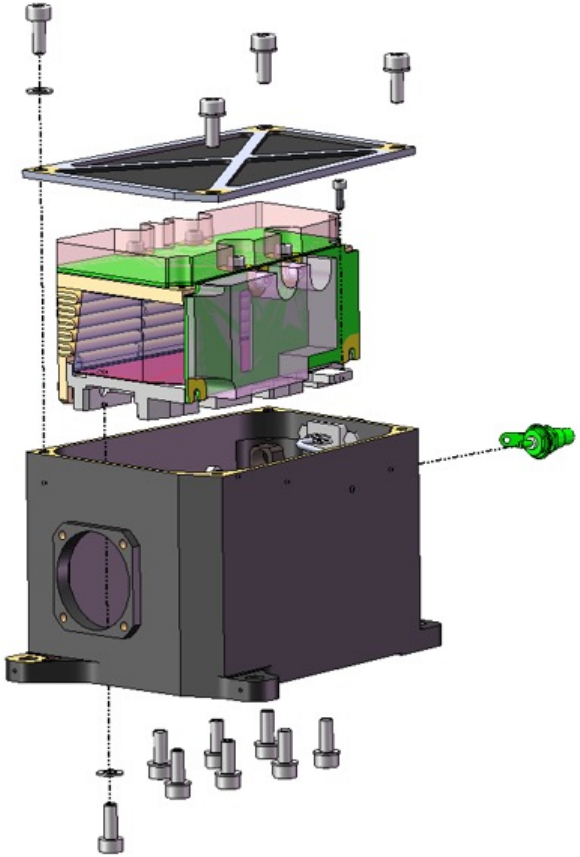
OIP Sensor Systems

CAGE CODE:	SCALE:	SIZE:	SHEET:	STATUS:
B0012	3:1	A4	1/1	RELEASED

Mechanical design – lens holders



Mechanical design – AOTF box



Mechanical design – input optics

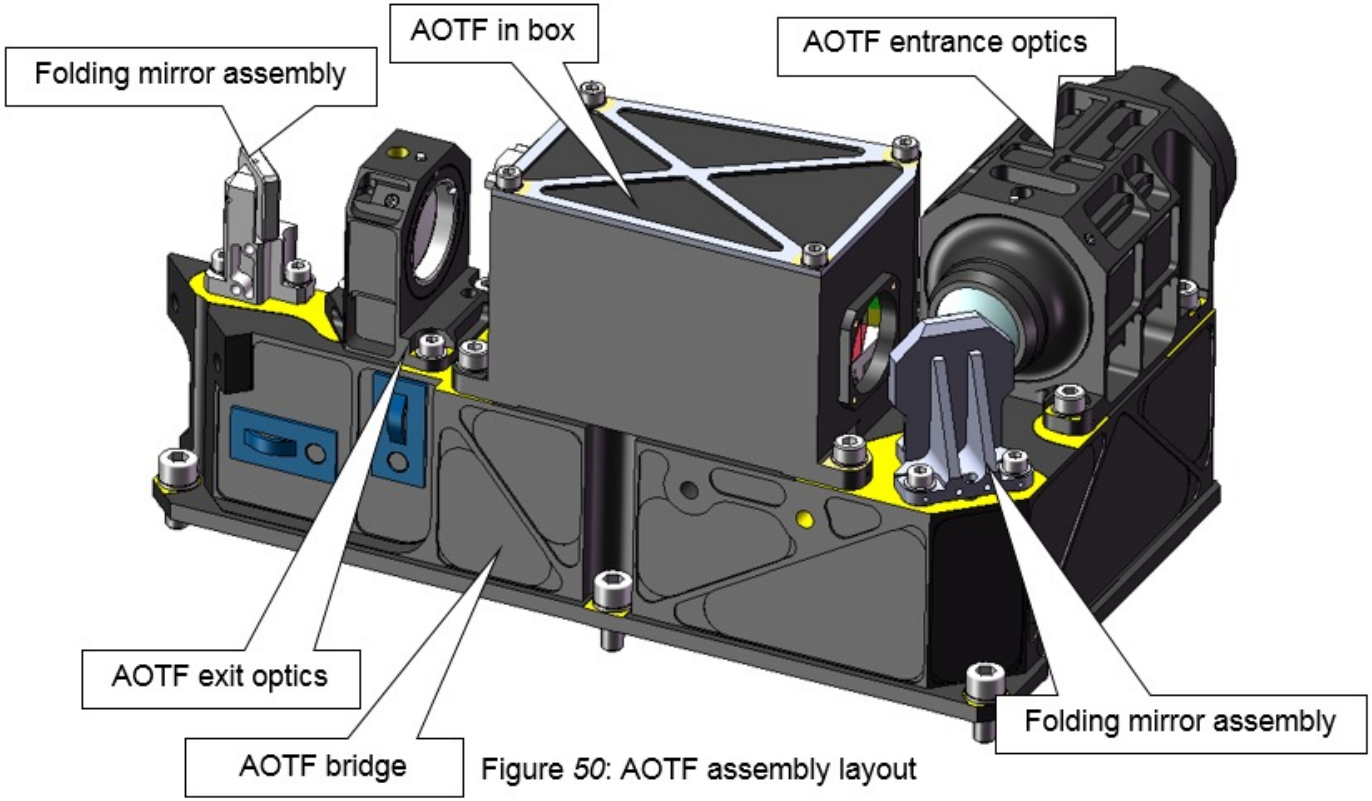
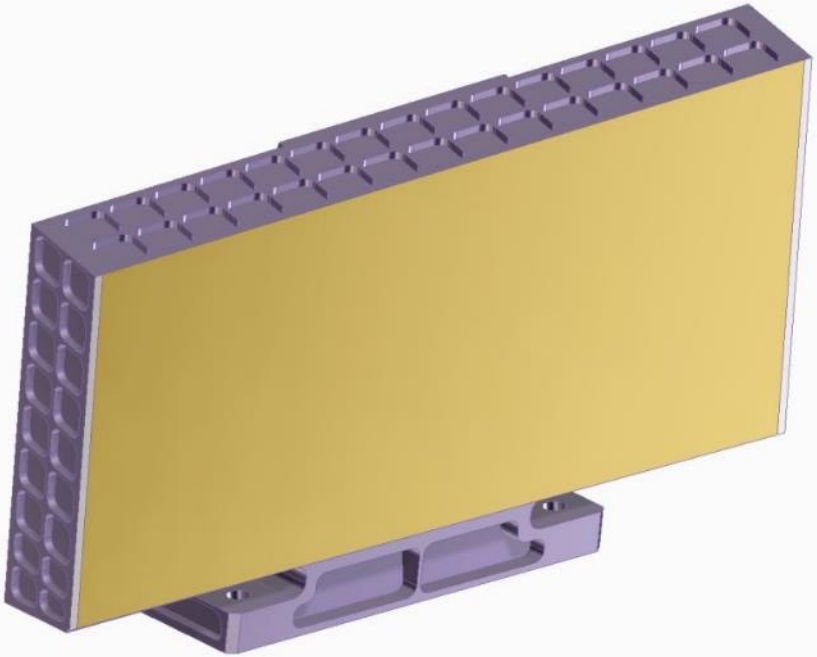
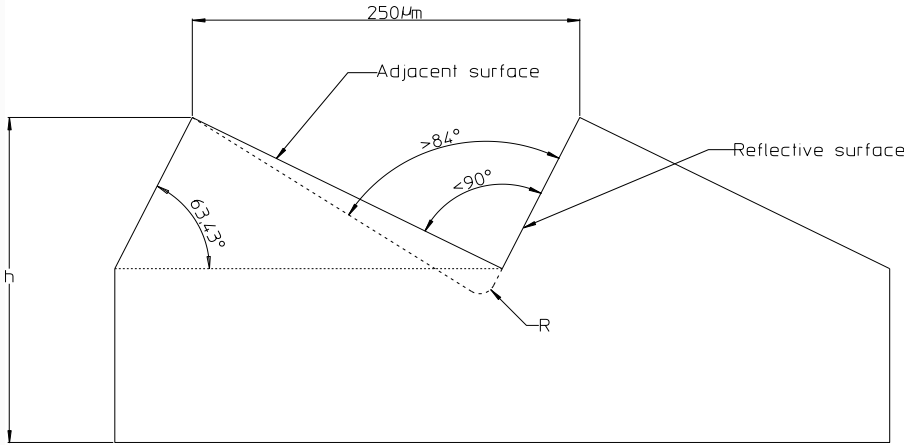


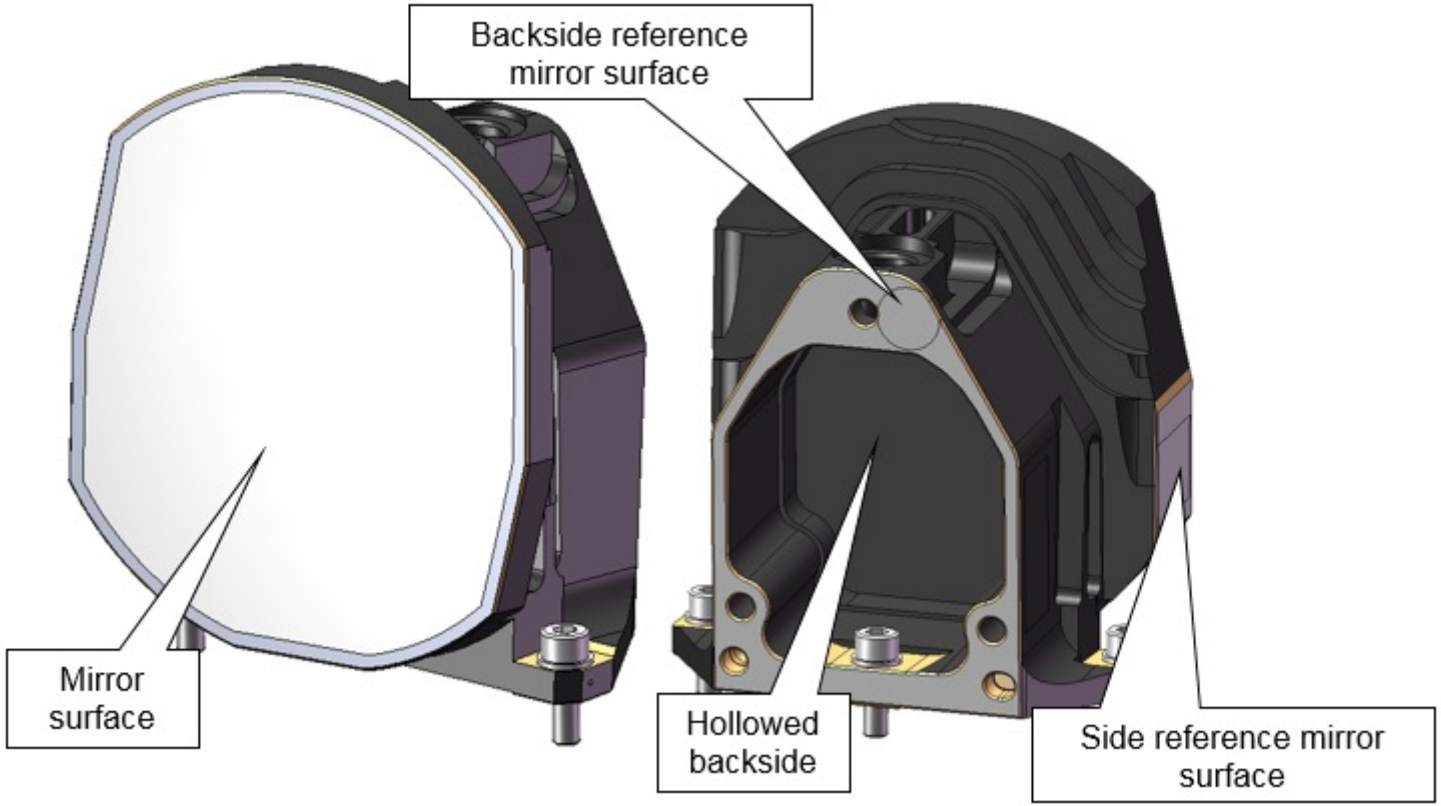
Figure *50*: AOTF assembly layout

Mechanical design – monolithic grating

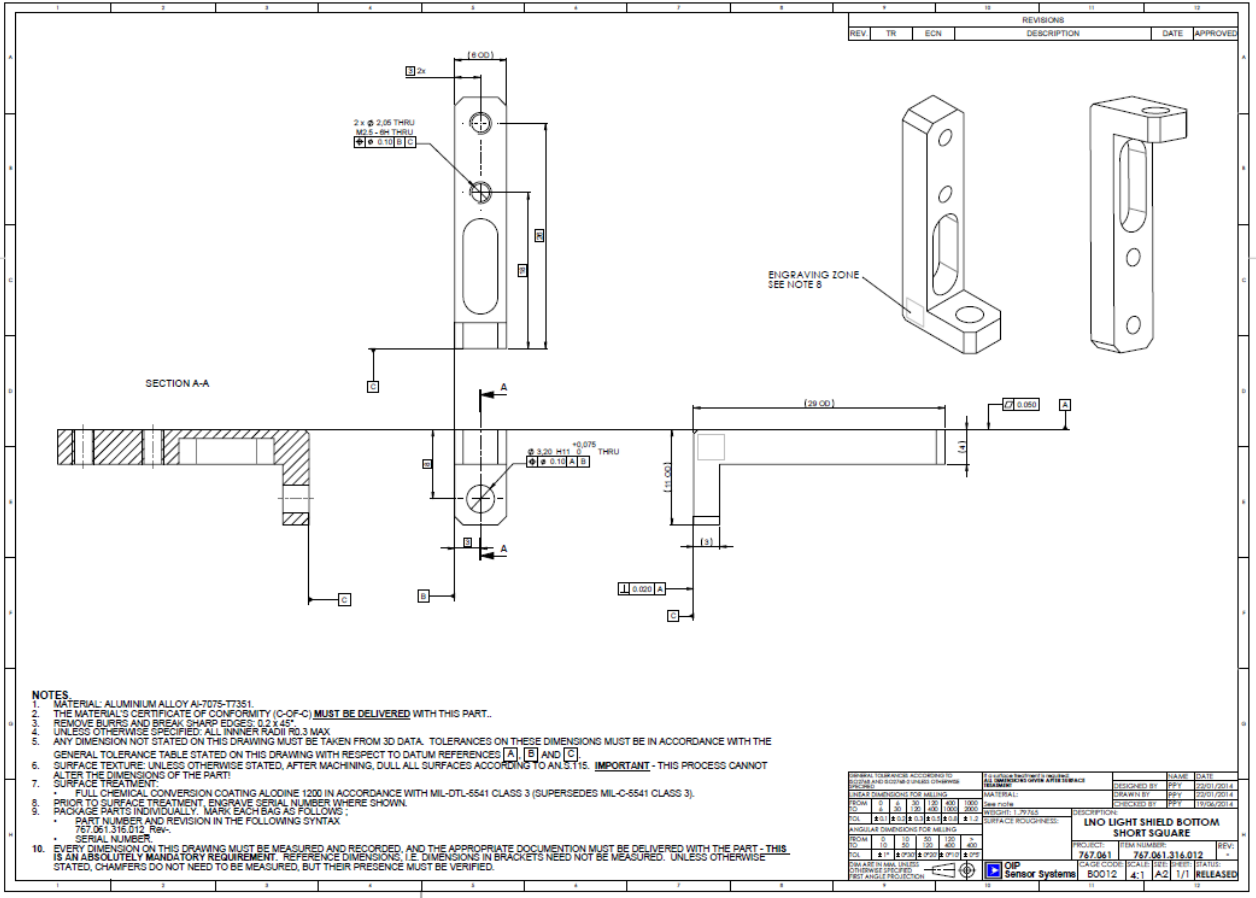




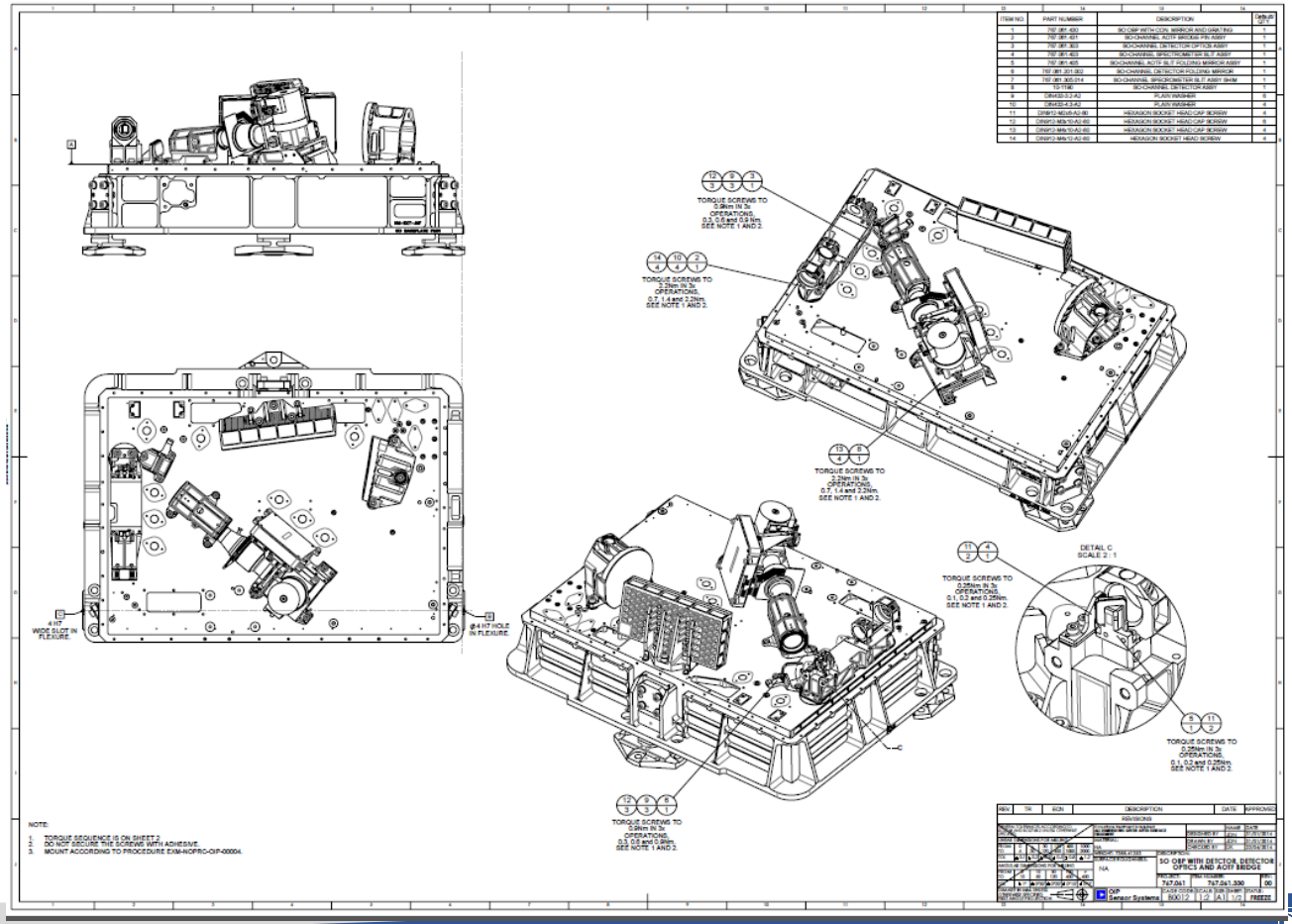
Mechanical design – monolithic mirror



Mechanical design – part drawings



Mechanical design – assembly drawings



General work

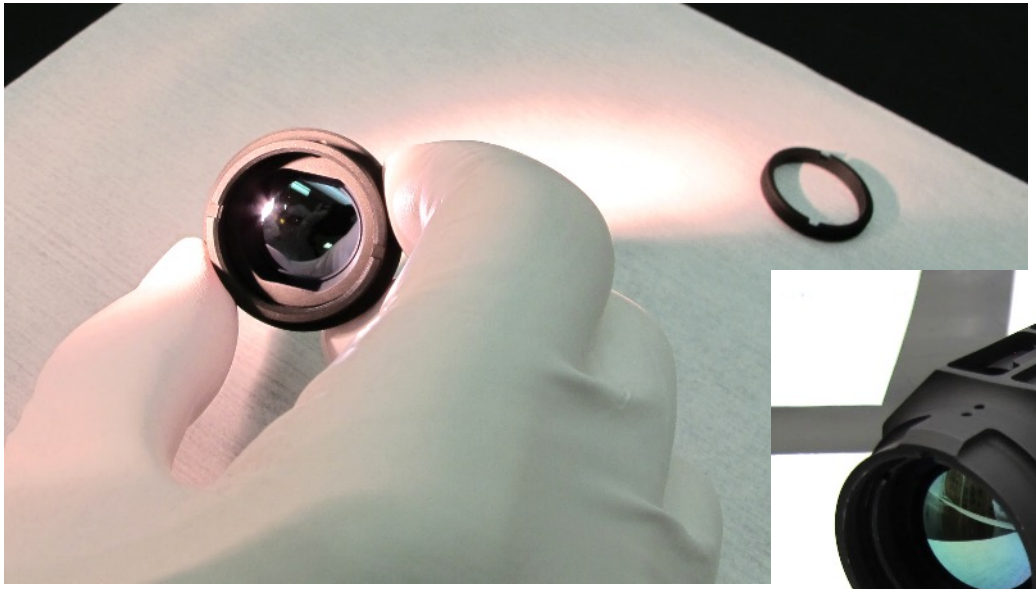
- Lots of documents
- Design is approved in design reviews

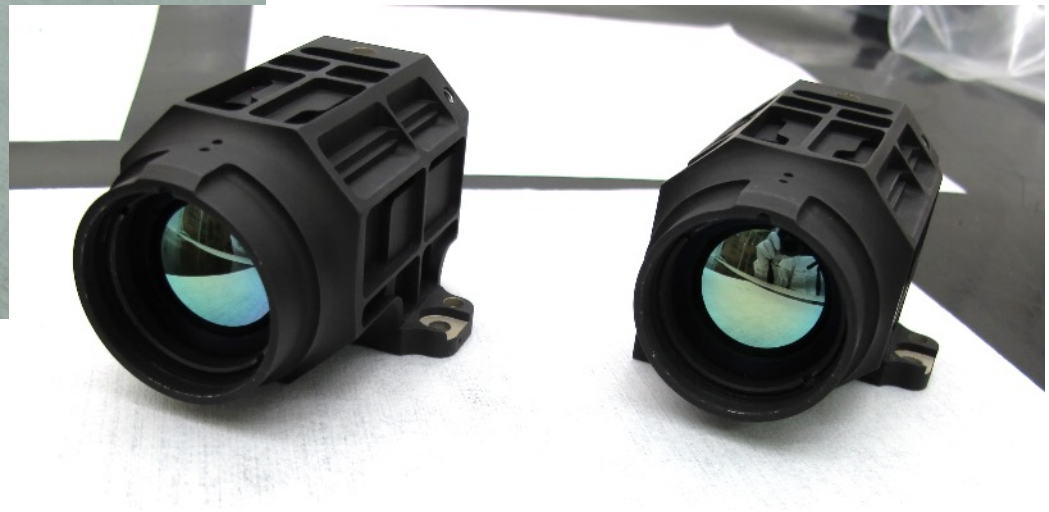
- Partners
  - UVIS channel
  - Electronic design & manufacturing
  - Radiation analysis
  - Structural & thermal analyses

General work

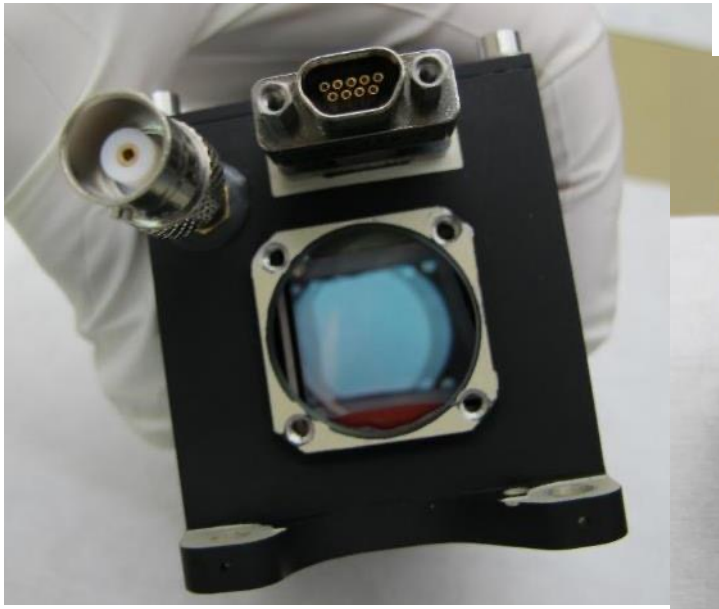
- Project management
  - Planning
  - Reporting
  - Financial
- System engineering
  - Technical coordination
  - ~2000 requirements to manage
  - Verification of all requirements: design / analyses / tests
- Product Assurance
  - Verification of workmanship, procedures, materials
  - Inspections
  - Cleanliness

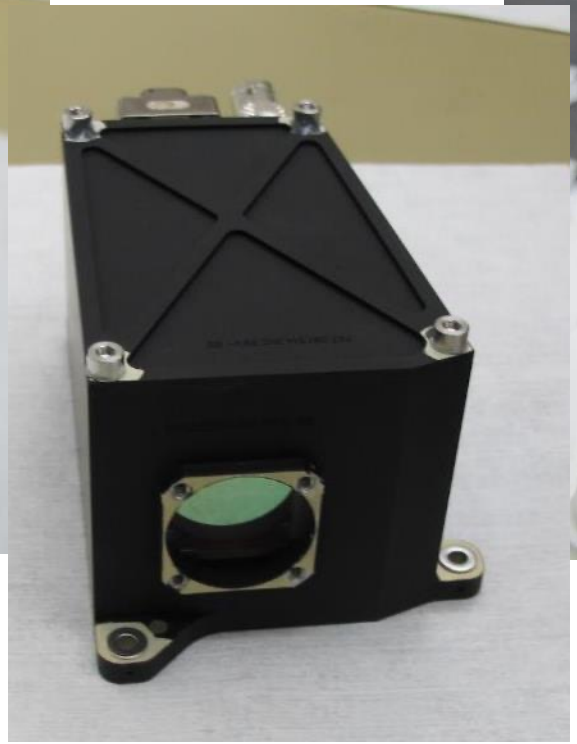
Assembly & integration: lens modules

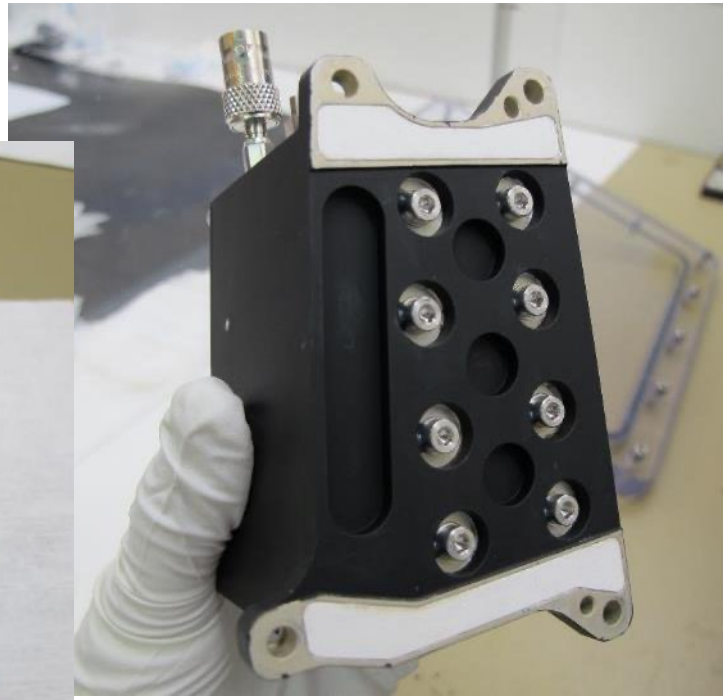




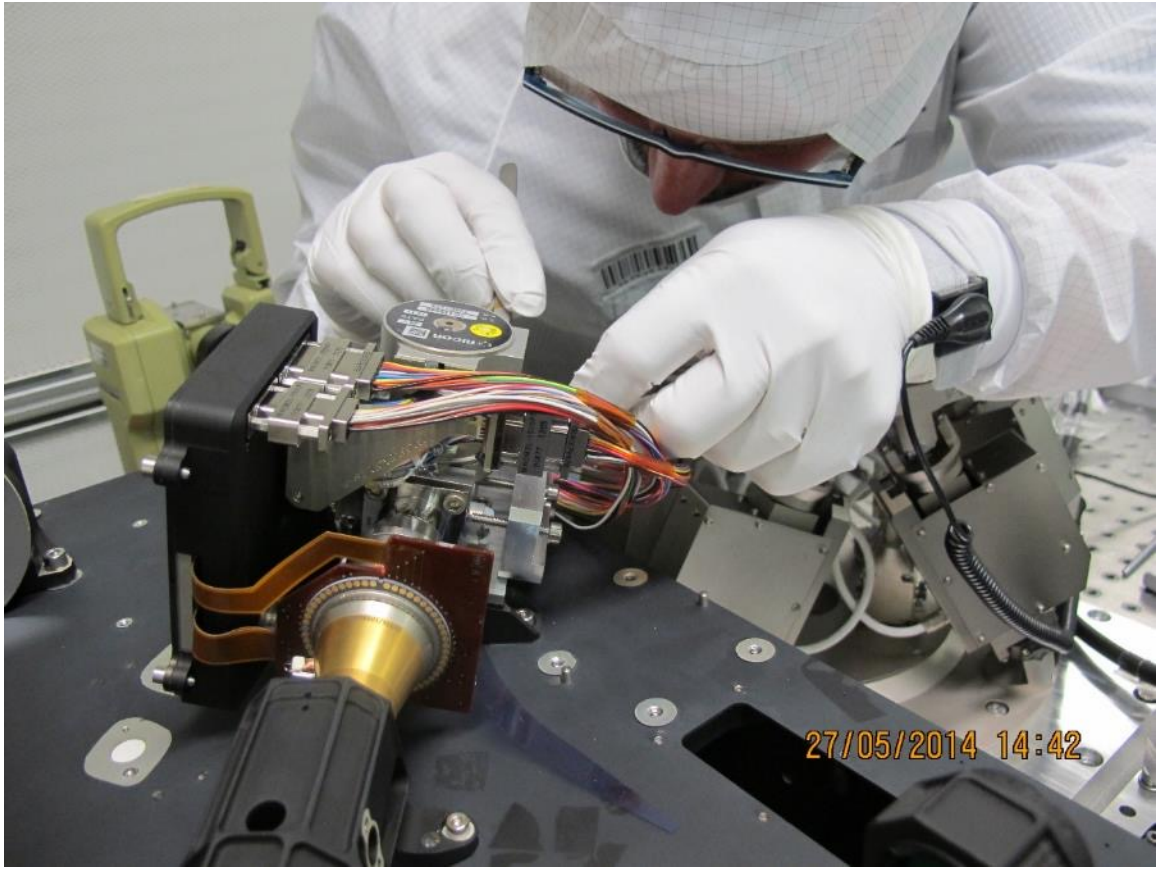
Assembly & integration: AOTF module



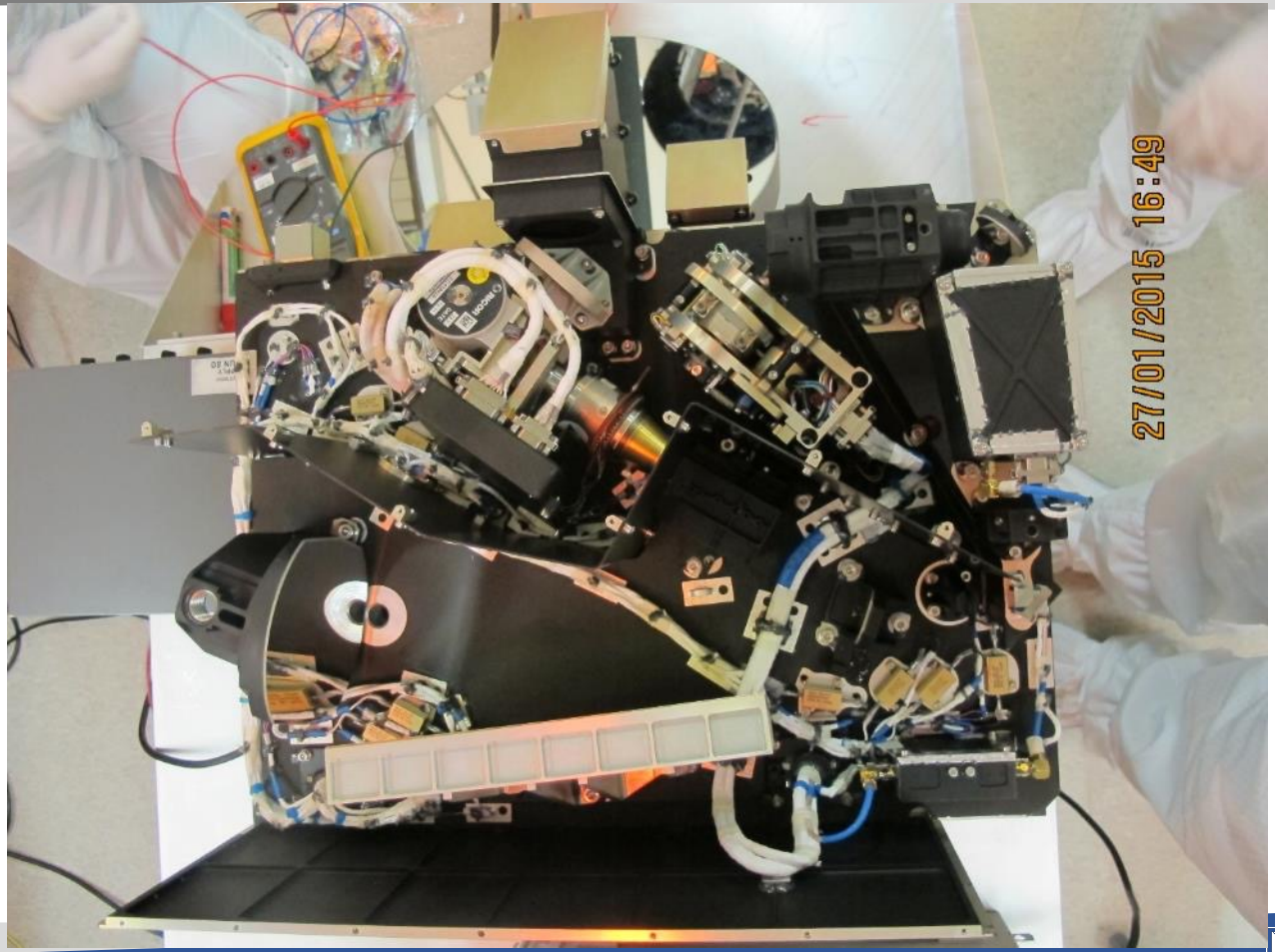




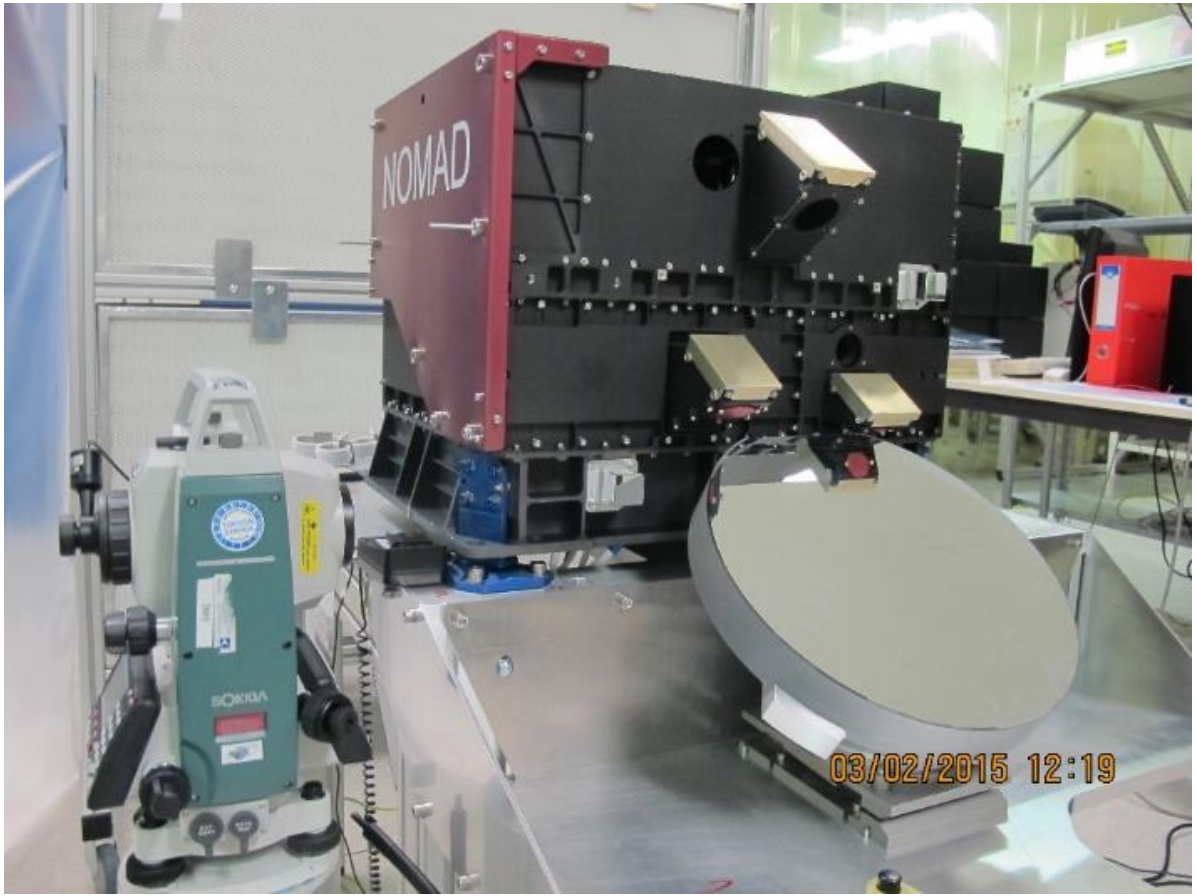
Assembly & integration – detector assembly



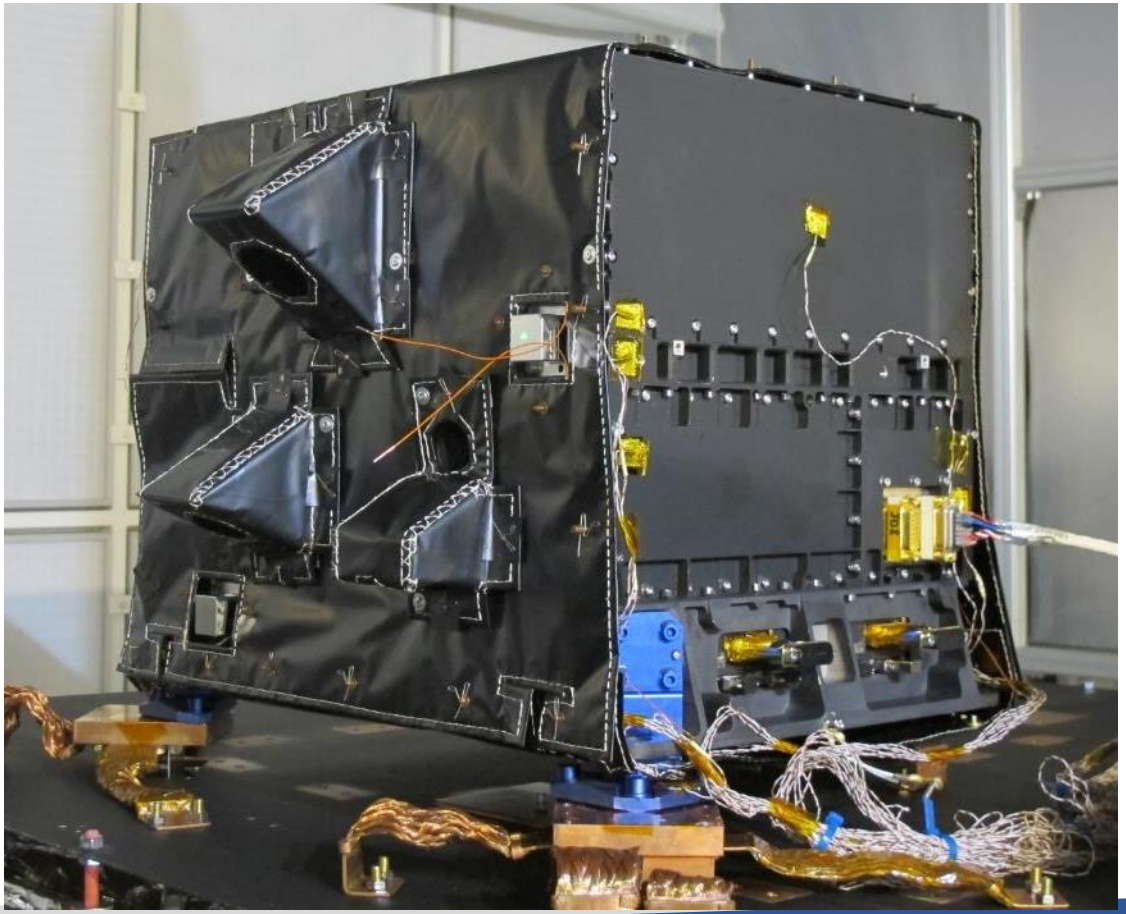
Assembly & integration: overall assembly



Assembly and alignment finished



Multi-layer insulation

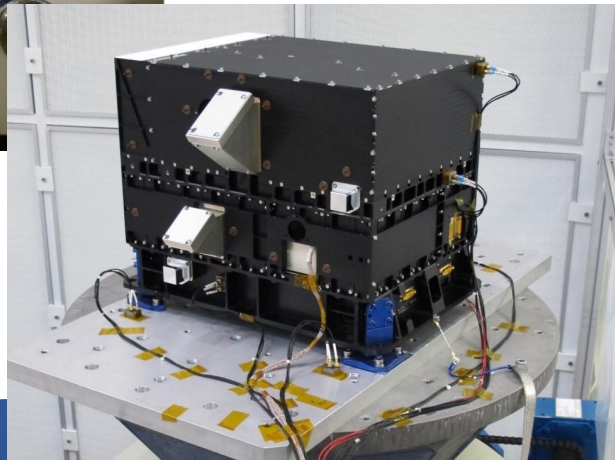


Tests

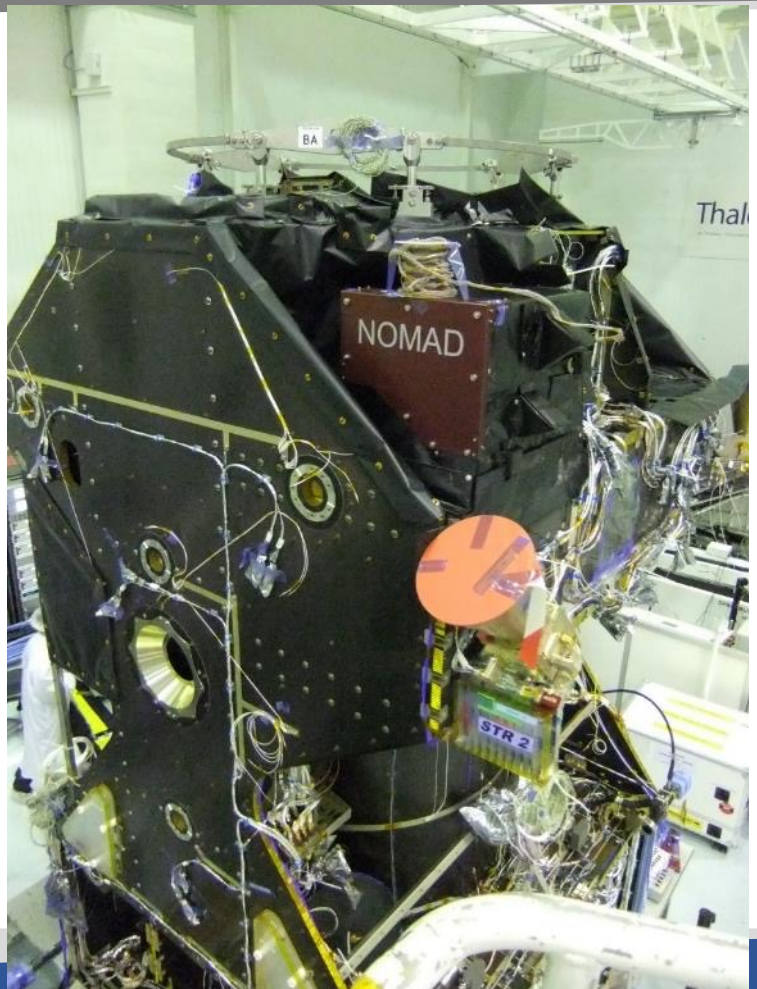
- Tests at system level
  - Thermal vacuum tests
    - Thermal cycling
    - Thermal balance
    - Scientific calibration
  - Vibration test
  - Shock test
  - Electromagnetic compatiblity tests

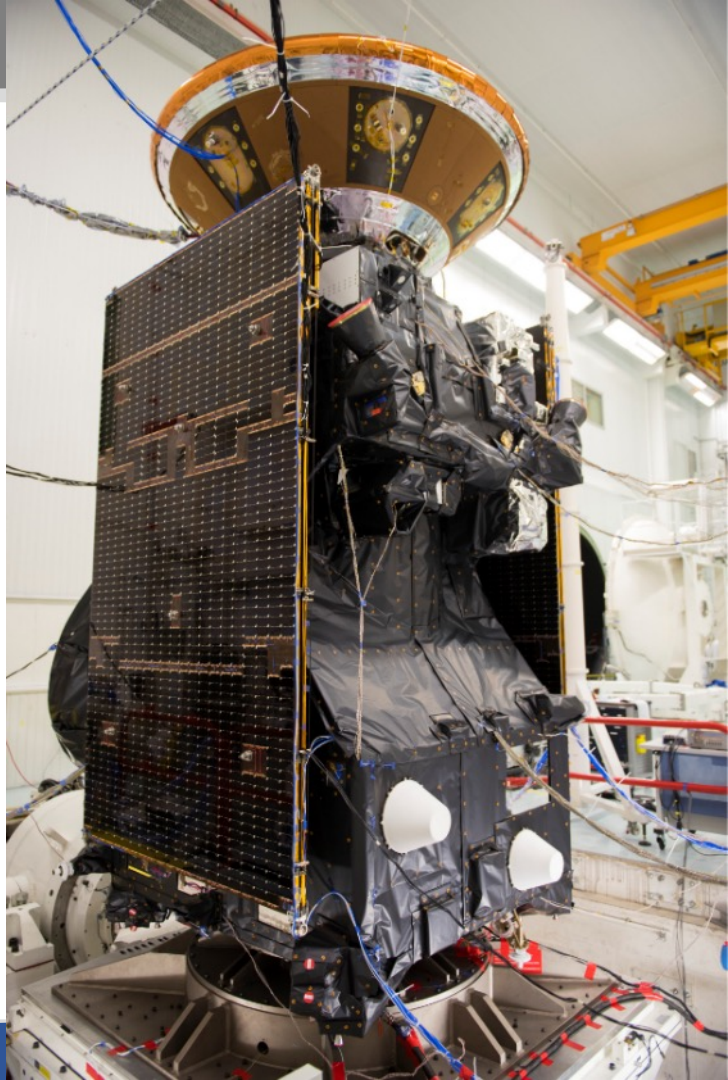
- For each test:
  - Test procedure
  - Test report

© CSL



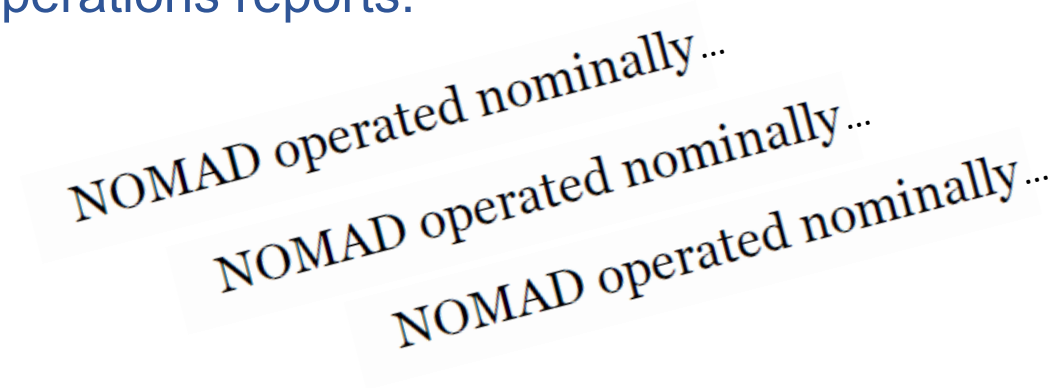
Integration in spacecraft





And today?

- Boring can be good!
- Monthly operations reports:



- Scientific papers published, more in preparation

Thank you for your attention

For more information:

Stefan Lesschaeve | stefan.lesschaeve@oip.be

OIP Sensor Systems | Westerring 21 | B-9700 Oudenaarde