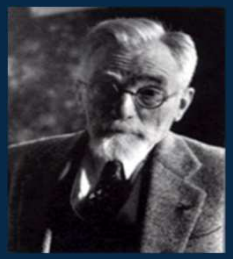
Precision Freeform Optics @ Safran Reosc

Safran Reosc : French leader in precision optics

Set-up in 1937 by a group of scientists including Henri CHRETIEN



Activity

Astronomy
Space
Energy
Industry
Defense

Key numbers

43 M€ turnover
70% export
57% eng. & PhD
Staff 172
Average 39 years

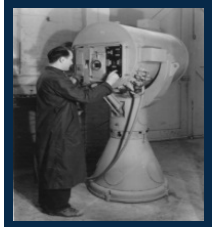
Technology

Engineering
Glass machining
Polishing & figuring
Precision testing
Thin films
Clean AIT

Location

Saint Pierre du Perray
35 km south of Paris

80 year pioneering efforts for science-defense-Industry



1 pix IR cam

Telescopes & spectrographs

coatings

Space

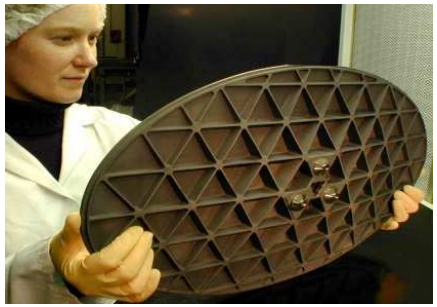
VLT

GTC

ELT

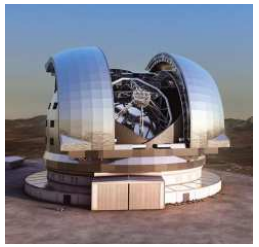
SAFRAN

Product Panorama

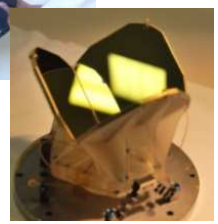



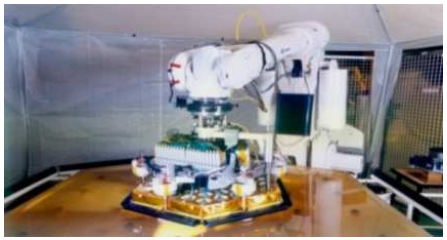

Lightweight mirrors: Glassy / SiC / Metal



Segmented Optics & the ELT

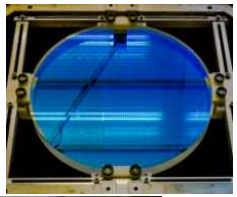




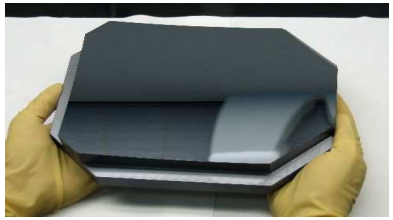
Instrumentation

Active Optics

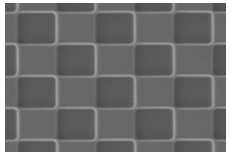
Test Equipment

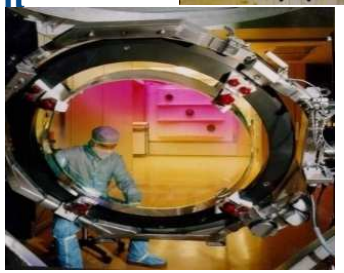



Large optics

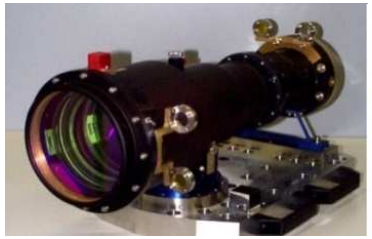



DUV et EUV optics





Thin Films




Lens Assemblies & EO payloads

SAFRAN

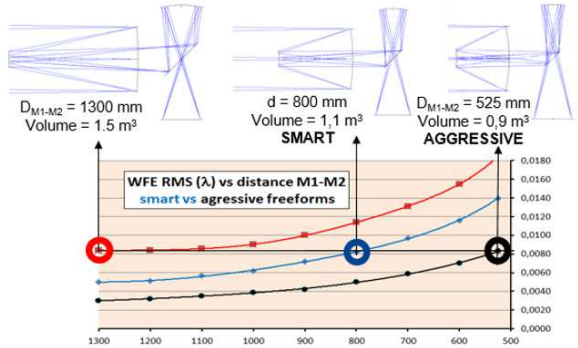
Freeform at Safran Reosc

Robotic polishing technology

Developed in the early 90's
Fully freefrom since the begining

- But demand limited to off-axis until recently

Improving design & metrology



More compact and/or better performances

SPACE : Reduction of volume, mass, inertia, platform size, launch cost ⇨ total mission cost

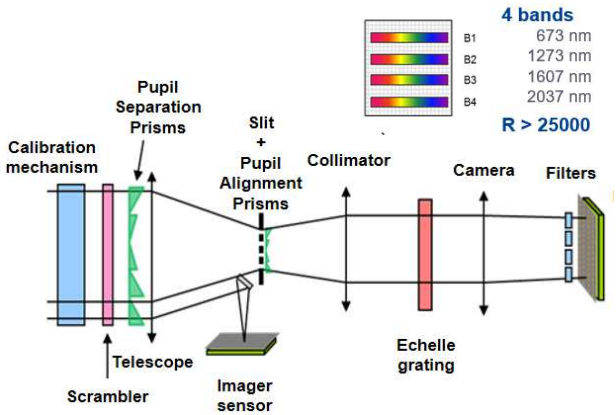
MicroCarb

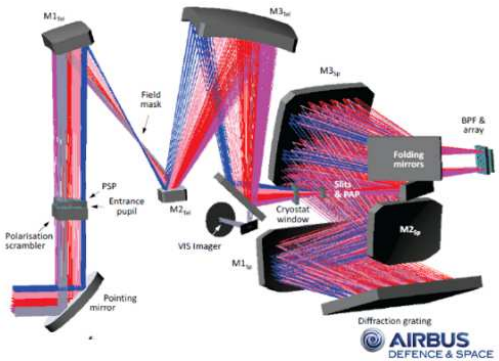
MicroCarb : The CO2 hunter

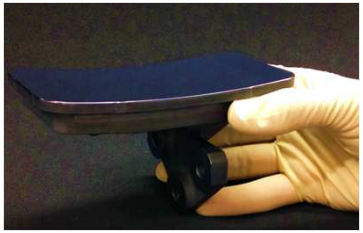
A European première decided during COP 21 in Paris

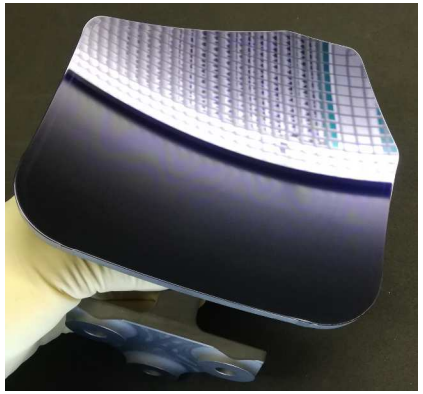
Compact, 4 bands, high-res spectrograph

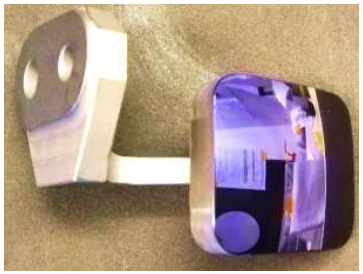
Innovative concept from Airbus with freeforms

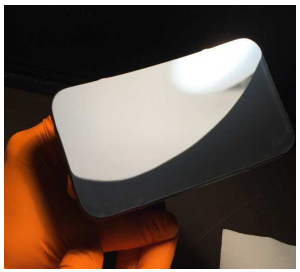


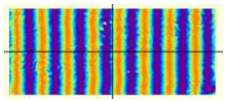












High quality SiC freeform optics required

Size 5–20 cm / Freeform 450–1300 µm PTV / Figure < 20 nm RMS

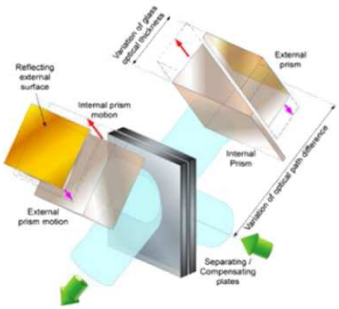
Telescope & Spectrometer optics delivered to 6,5 – 17 nm RMS residual errors

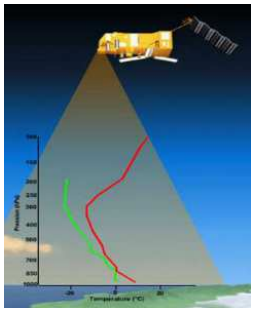
IASI – NG

IASI NG, the successor of IASI

IR sounder on-board Metop-SG

- MERTZ type FT interferometer design
- Spectral range: 3,6 to 15,5 µm
- KBr prisms made by Safran Reosc





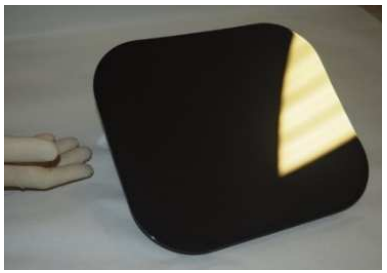
Associated optics: All-SiC TMA's

Scan **m**irrors & foldings
Afocal **T**elescope **A**ssembly (ATA)
Imager **T**elescope **A**ssembly (ITA)

ATA TELESCOPE

ITA TELESCOPE

IR quality SiC freeform optics required
Size: 7–38 cm / Freeform: 100–1500 µm PTV
Figure ≈100 nm RMS WFE



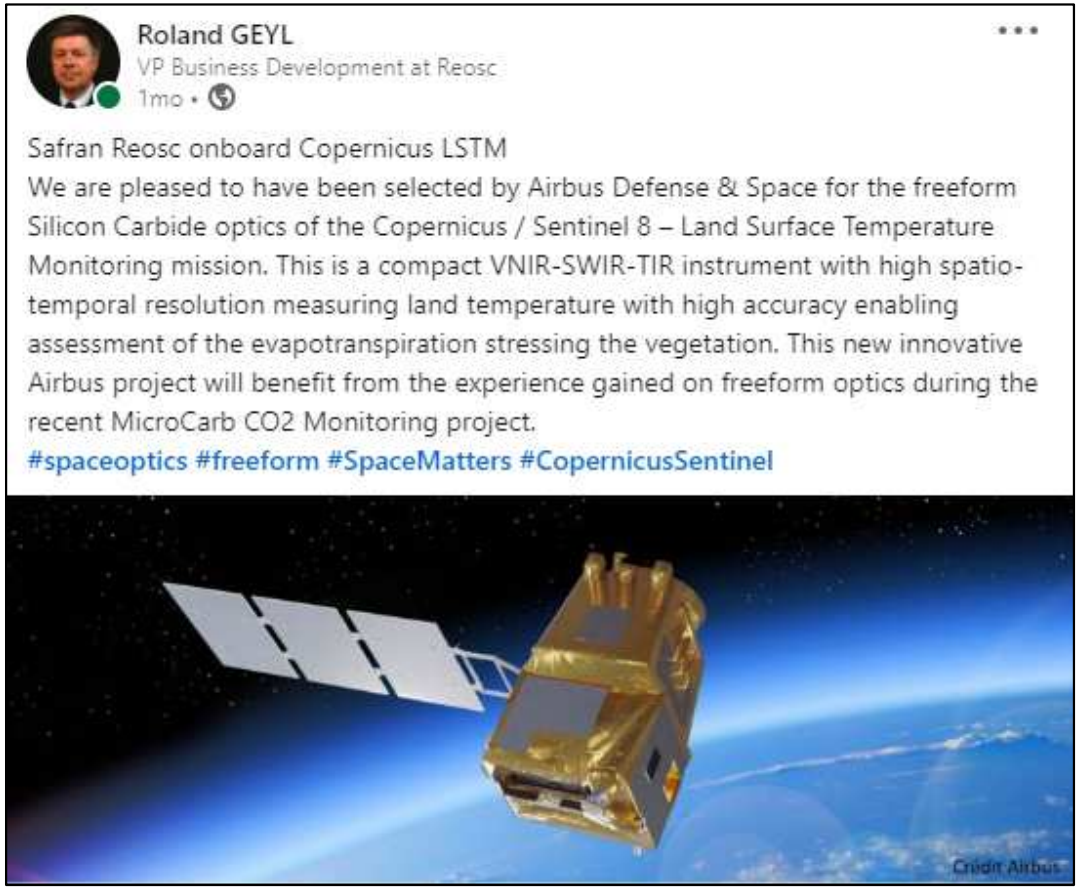
3 sets of 6 freeform optics produced in parallel to MicroCarb

Recent news: Onboard Sentinel 8 LSTM

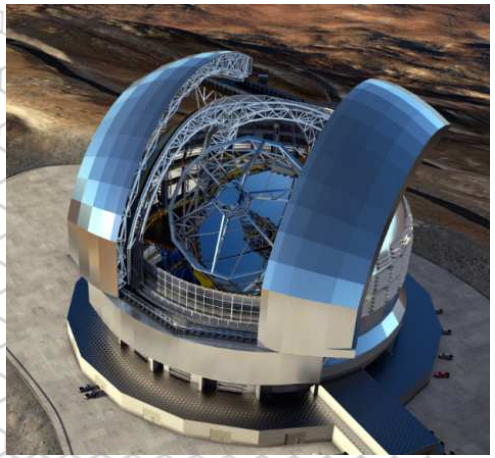
Experience gained on MicroCarb & IASI NG contributed to be selected for S8 – LSTM.

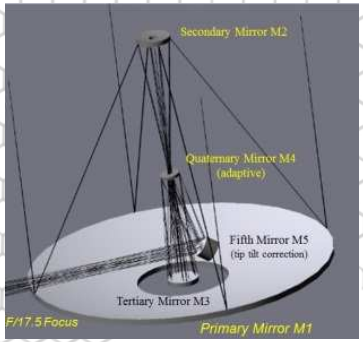
An IR imager

Design going-on at Airbus



Freeform technology for ELT M1 Segments

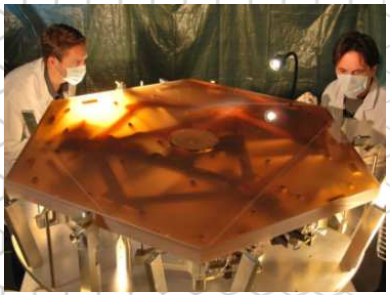




The Extremely Large Telescope

World's largest telescope by 2025 with 39-m aperture

M1	: 798 segments (+ 133 spares)
M2 & M3	: 4-m class thin meniscus
M4	: 2-mm thin petals for the M4 AO Unit
M5	: 2.5-m large fine stab mirror



M1 segment

4.0 Factory set up for M1 segments production

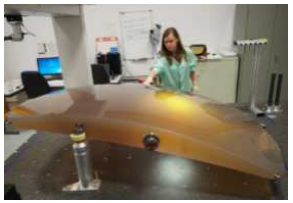
Safran industrial skill adapted to freeform optical processing and testing technologies

Production ramping up to 1 segment / day

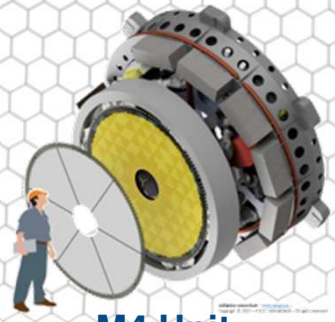
- 1st segment entered pilot line last September

M2 sector test plate

Off-Axis asph below
Freeform above



M2 Unit



M4 Unit

M5 Unit

The FO-RS Association

- **Freeform Optics – Research & Solutions**
- **Set-up in Sept 2019**
- **Academic - Industry mix**
  - Solid academic foundation
  - Heavy industrial power
  - Broad spectrum of applications
- **Lines of action - Objectives**
  - Design-Manufacturing
  - Testing-Integration
  - Leverage knowledge in common
  - Stimulate opportunities
  - Cooperate ar EU level and worldwide
- **Funding**
  - Member fees
  - Joint funding of specific projects
  - Apply to calls

Roland GEYL - President

Academics	SME's	Mid-Size	Large Groups
INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech	GAGGIONE	LYNRED BY SOFRADIR & ULIS	ESSILOR SEEING THE WORLD BETTER
LAM LABORATOIRE D'ASTROPHYSIQUE DE MARSEILLE	LIGHT TEC OPTICAL DESIGN & MEASUREMENT TOOLS	ireis	SAFRAN
ONERA THE FRENCH AEROSPACE LAB	PISEO photonics.innovation.services		
cea	SAVIMEX		
	Tematys Exploration of photonics markets		
	Winlight System		

SAFRAN

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BY TRUST