

ONERA

The French Aerospace Lab



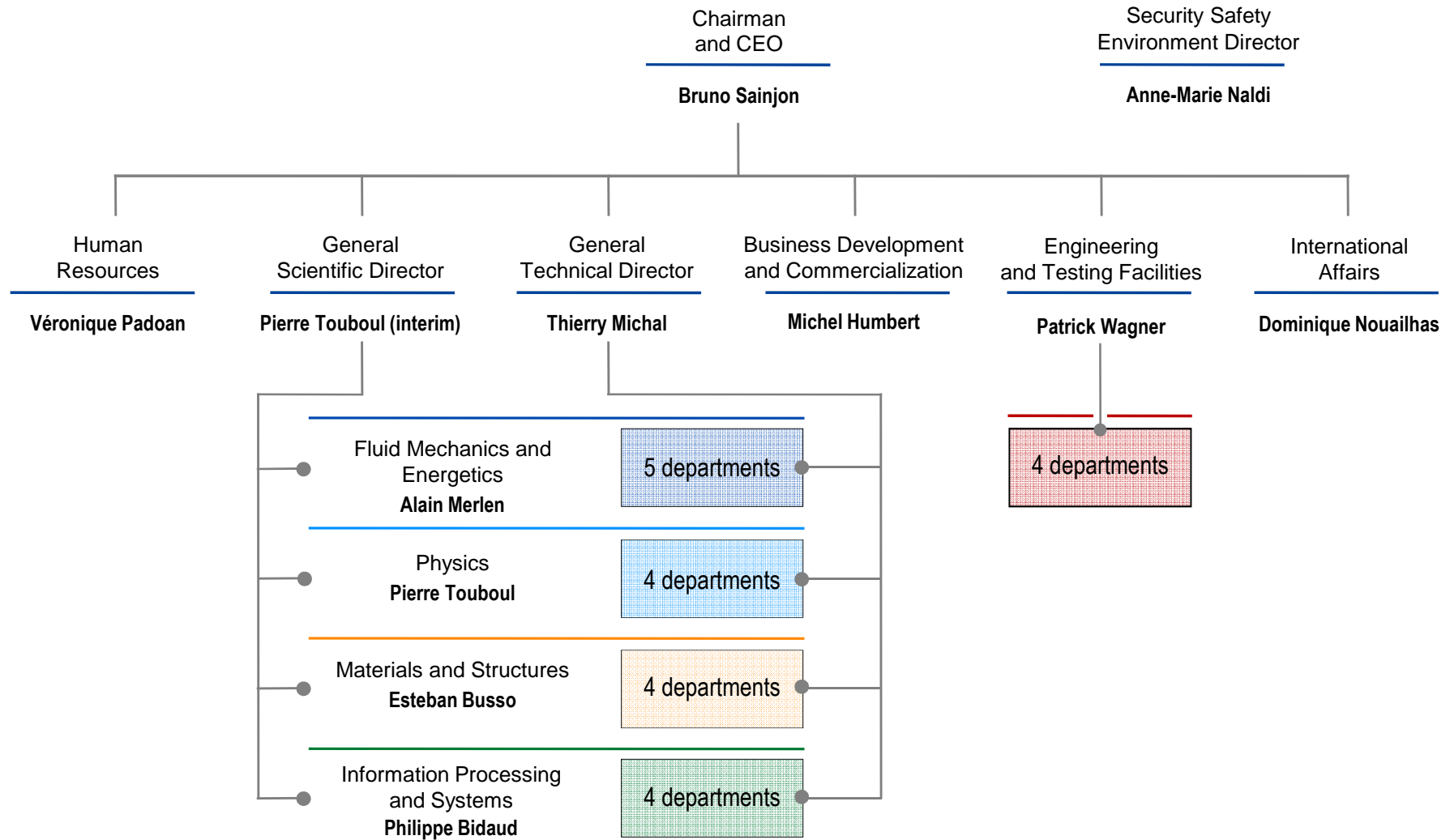
return on innovation

The French Aerospace Lab

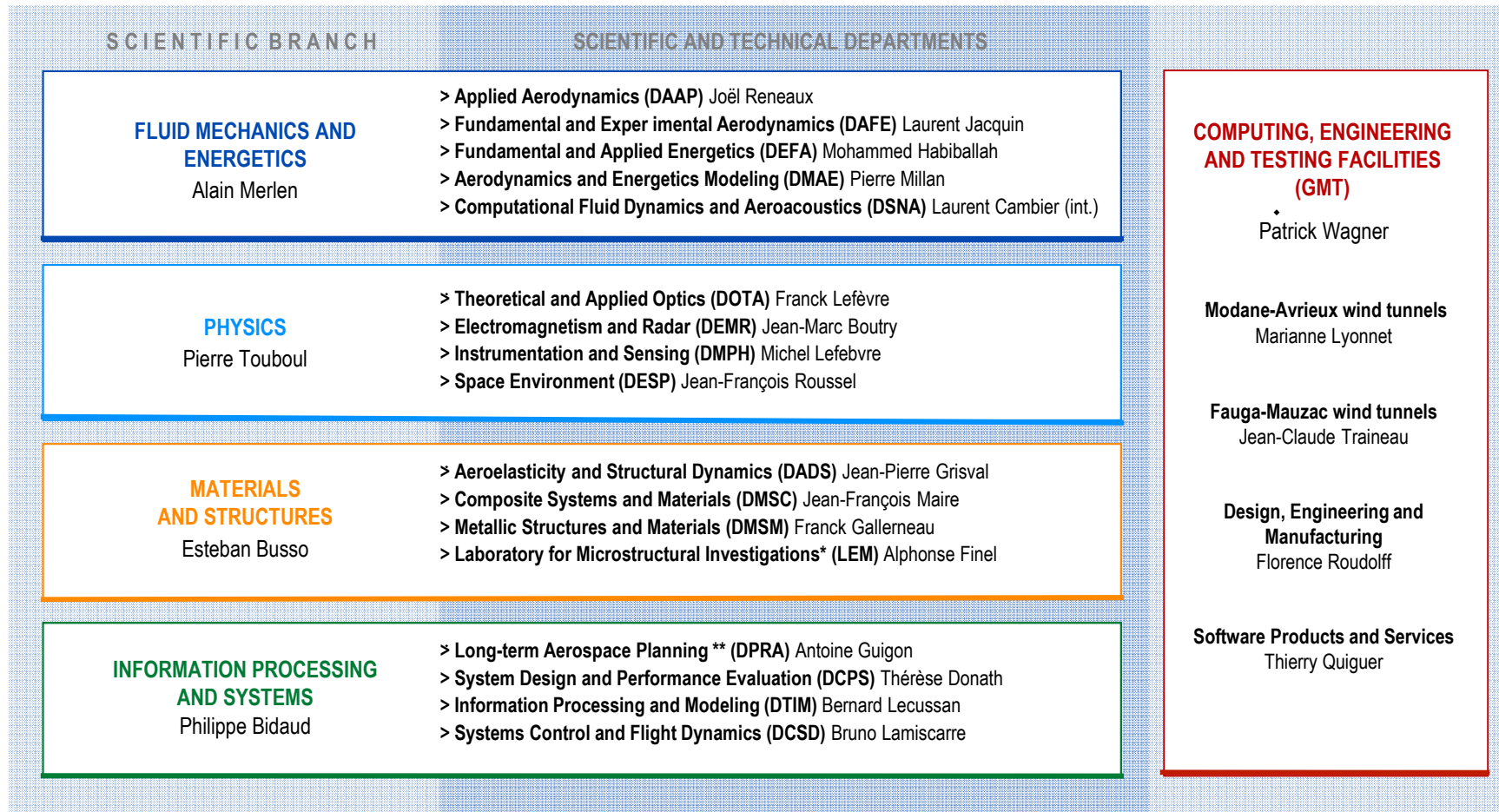
Innovation, expertise and long-term vision
for industry, French government and Europe

- A public entity created in 1946
- Reporting to the ministry of defense
- 2,018 employees
- 229 doctoral students and post-docs
- 233 million euro budget
- 53% contract-based business
- Largest fleet of wind tunnels in Europe
- “Carnot label” from Ministry of Higher Education and Research

Organization



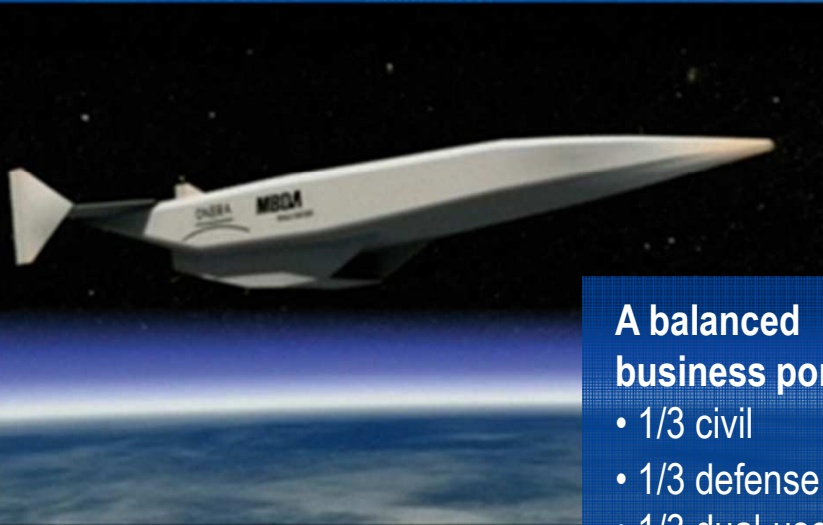
Scientific and technical organization



* A joint ONERA-CNRS unit

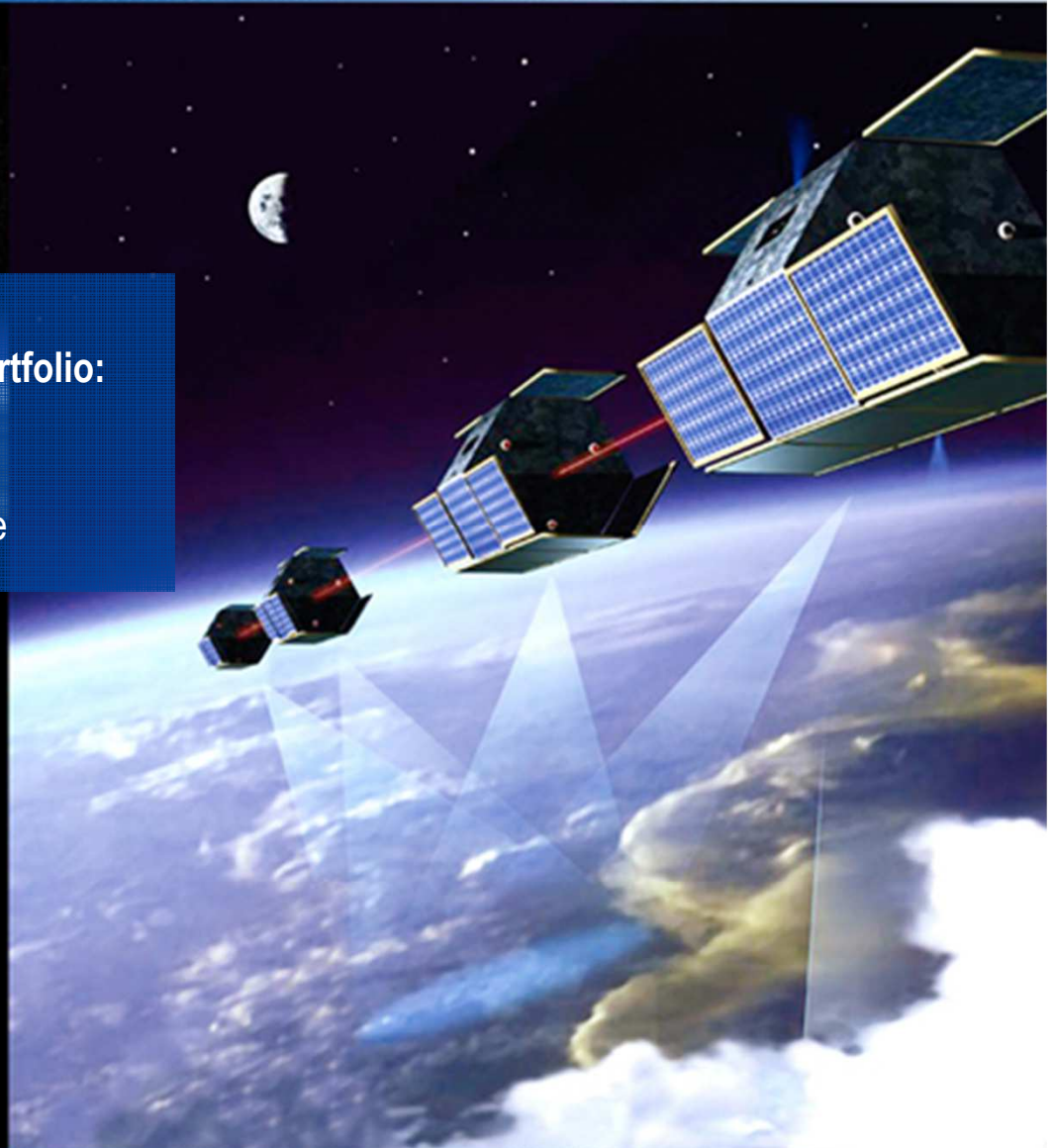
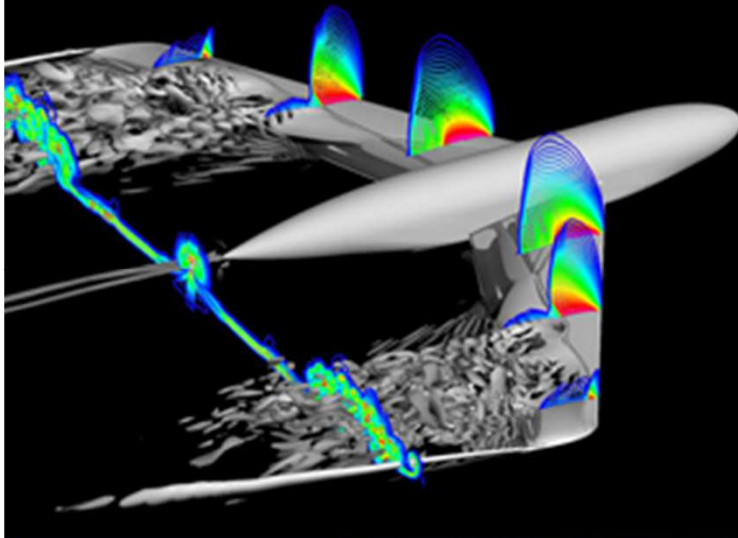
** entity working for all ONERA departments

Science driving innovation in aerospace and defense



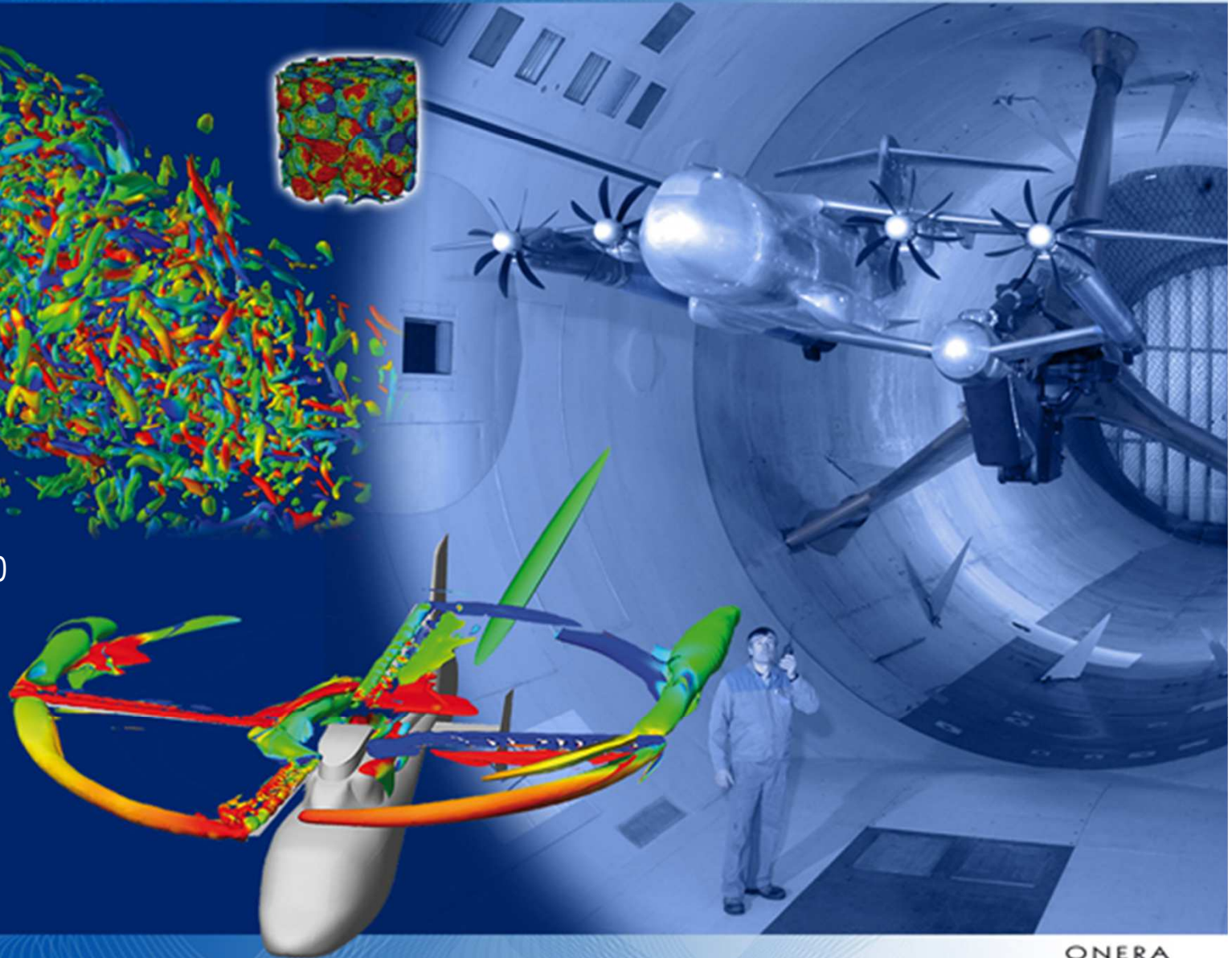
A balanced business portfolio:

- 1/3 civil
- 1/3 defense
- 1/3 dual-use



Return on innovation: advanced technology and industrial succes

- All Airbus jetliners including the A350
- Falcon 7X
- Ariane 5 & 6
- Propulsion
- Helicopters
- Space missions



Return on innovation: expanding knowledge to meet Society's challenges

Environmental protection

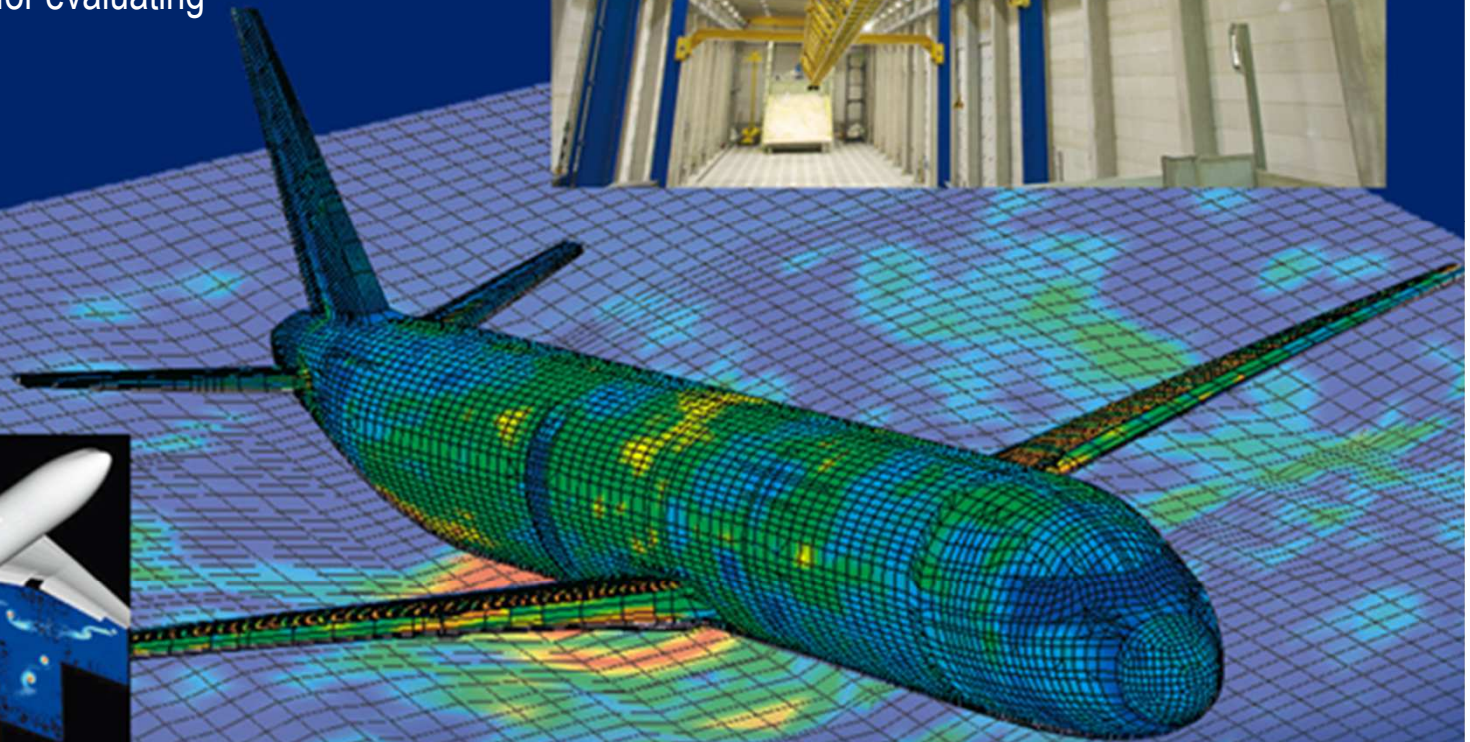
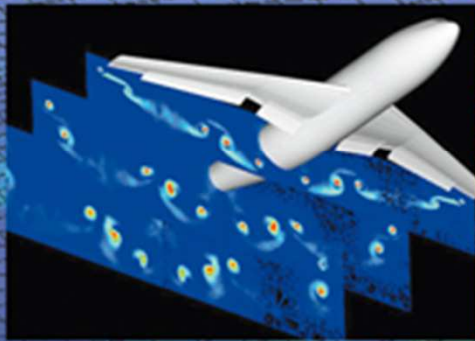
- Reduce aircraft noise
- Reduce emissions
- Alternative fuels



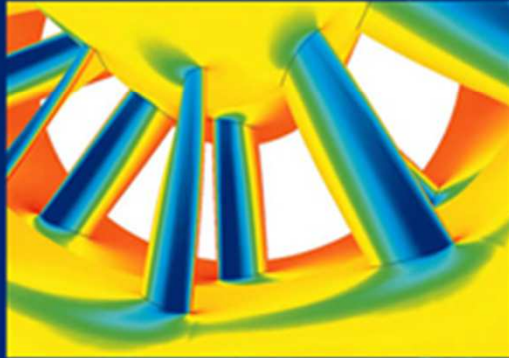
Return on innovation: expanding knowledge to meet Society's challenges

Air transport safety and traffic management

- Crashworthiness
- Wake vortices
- IFATS (European project)
- IESTA (Infrastructure for evaluating air transport systems)



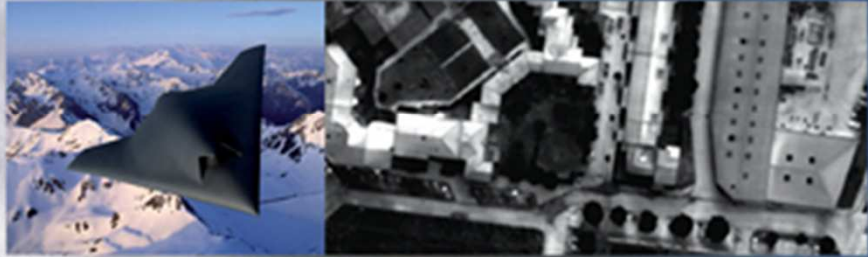
Europe's leading center of expertise in large wind tunnels



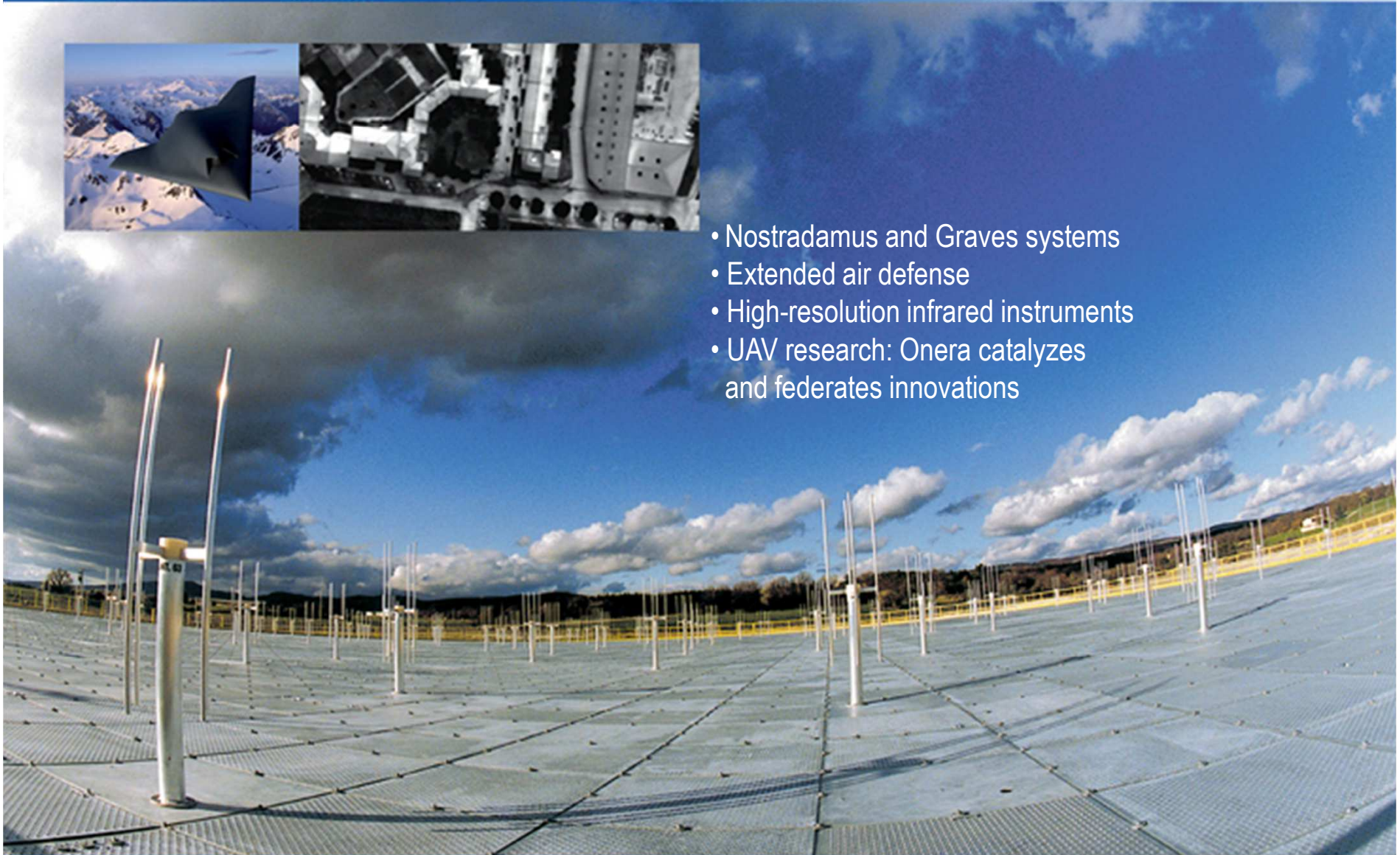
- Global clientele
- Half of the European fleet
- Key resources for Airbus and Dassault
- 50 years of working for industry
- Certified ISO 9001 seven years ago
- Speed envelope from Mach 0.1 to Mach 20
- Research/experimentation synergies and integration



Return on innovation: new defense concepts, expertise and systems

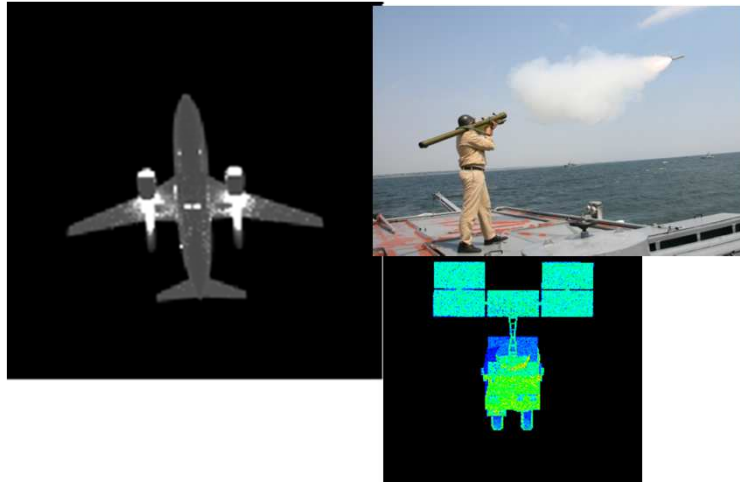


- Nostradamus and Graves systems
- Extended air defense
- High-resolution infrared instruments
- UAV research: Onera catalyzes and federates innovations



New defense concepts, expertise and systems in optronics

Stealth / protection of airborne and spaceborne platforms

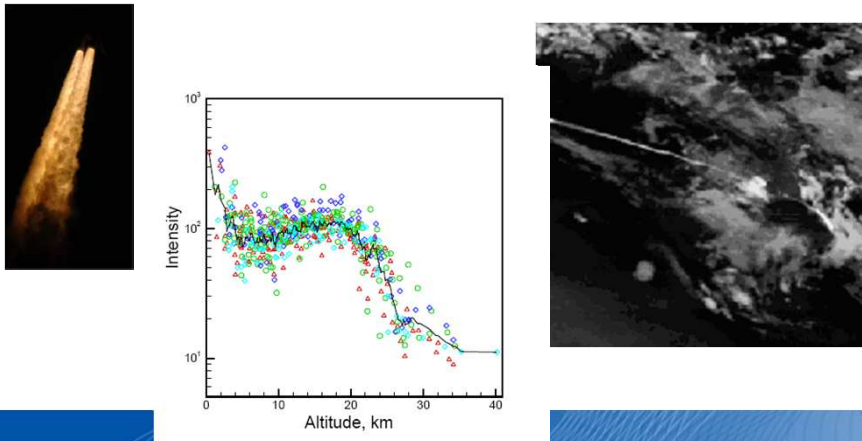


Intelligence / Situation awareness / Env.

Hyperspectral intelligence
Optro-Radar platforms
UAV

....

Ballistic Missile Early Warning

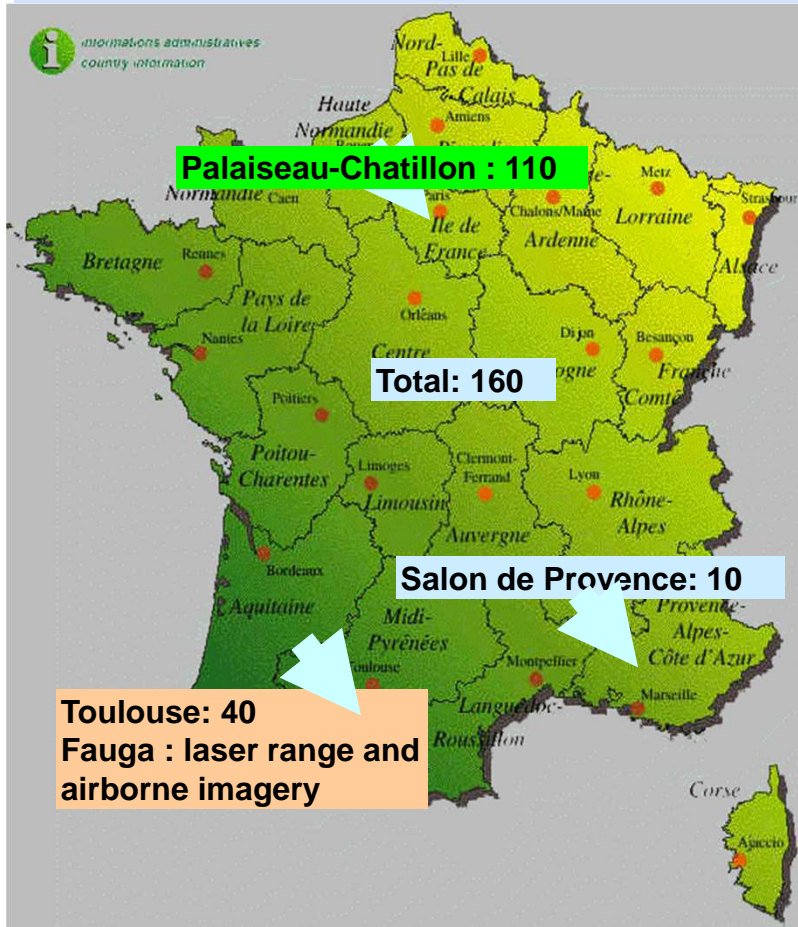


Space surveillance



Onera : Optical Technologies (OT)

DOTA on the map



Onera Web Site : <http://www.onera.fr/english.html>

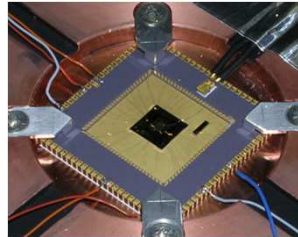
Activities (TRL 2-5)

- New Optical Technologies or Optical Application concepts
- Feasibility studies / Proof of Concept
- Laboratory instruments and Research Codes
- Airborne and Ground based measurement systems

ISO 9001
BUREAU VERITAS
Certification

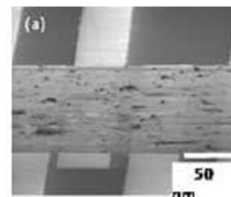
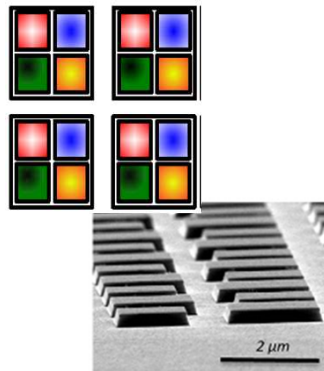
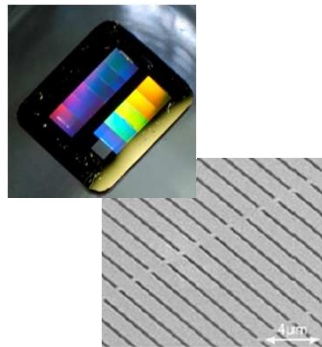


Optical Technologies : Core Technologies



IR Focal Plane Arrays characterizations
AIQUIDO Lab. (DGA reference Lab)

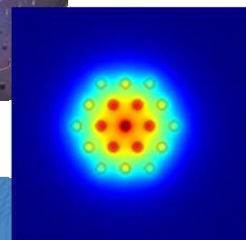
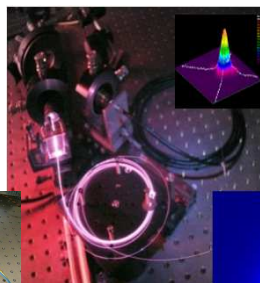
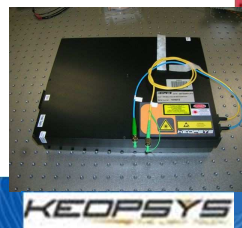
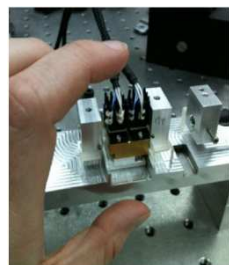
*First image and test of InAs/GaSb
superlattice (LPN-CEA-LETI-DOTA-IES)*



**Nanotechnologies for
optical components**
Plasmonic, Nanotube C

Onda Lab, LPN-LEM (UMR Onera-CNRS)

*On chip plasmonics : FPA with spectral
sorting capabilities*

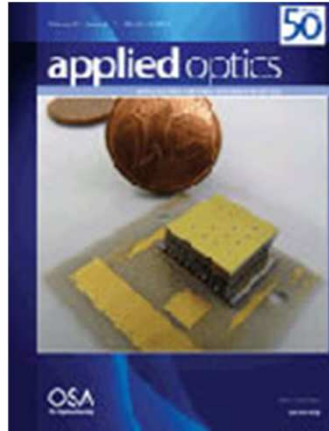
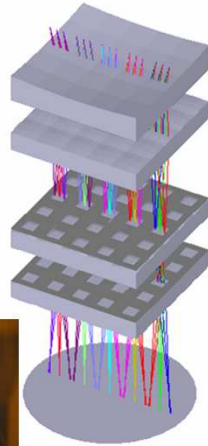


Laser sources

μ OPO, NesCOPO, Fiber laser, IR superK
SOLAIRE, & SOFIA labs

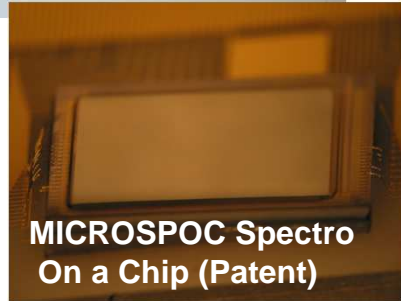
*- First doppler lidar using coherent
multiple fiber laser sources*

Optical Technologies : New imagery concepts



Integrated optics for IR micro-imagers

- imagery
- spectrometry
- zoom
- Autofocus
- Stabilisation
- Wavefront sensor

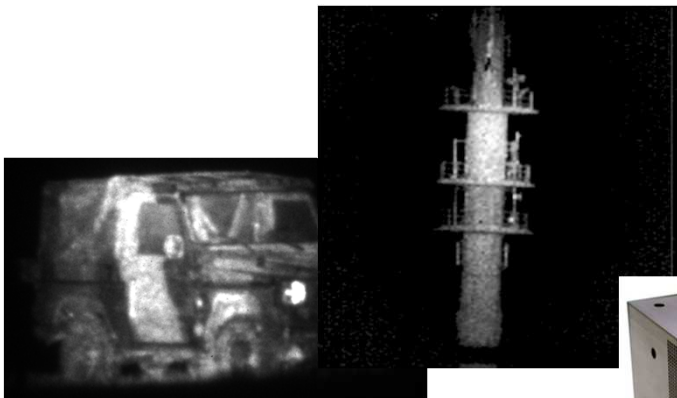


MICROSPOC Spectro
On a Chip (Patent)

3D, pseudo 3D Laser based imagery

- long range imagery
- adverse conditions / bad weather / EVS
- under foliage,
- multi-angular

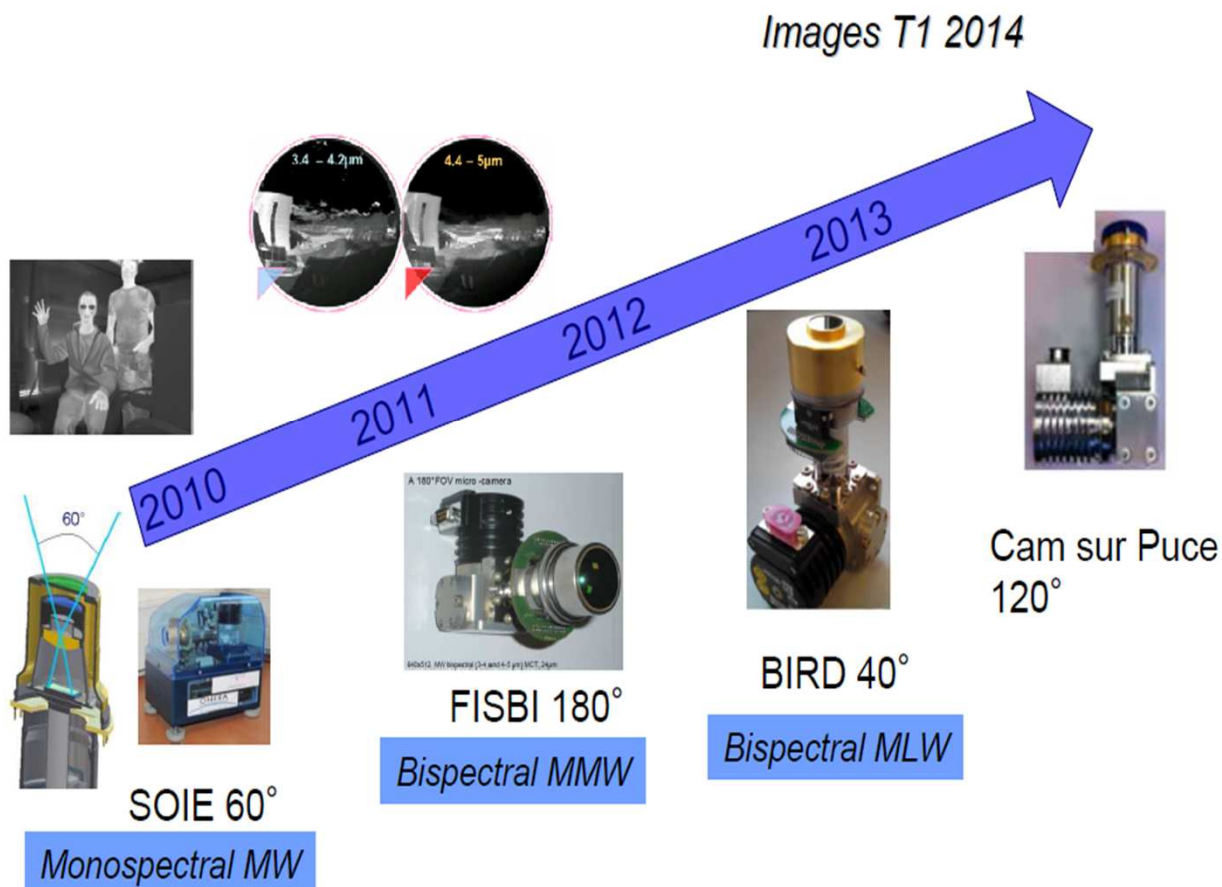
3D FPA polarimetry



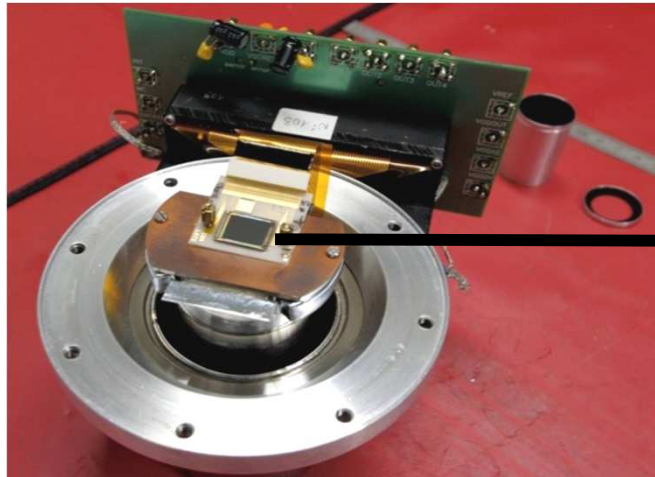
Optical Technologies : New imagery concepts



Integrated optics
for IR micro-imagers



Hardware & Payloads – Optics & Optronics hardware



MICROSPOC (ONERA patent)

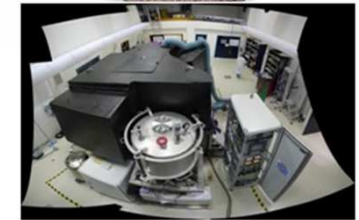
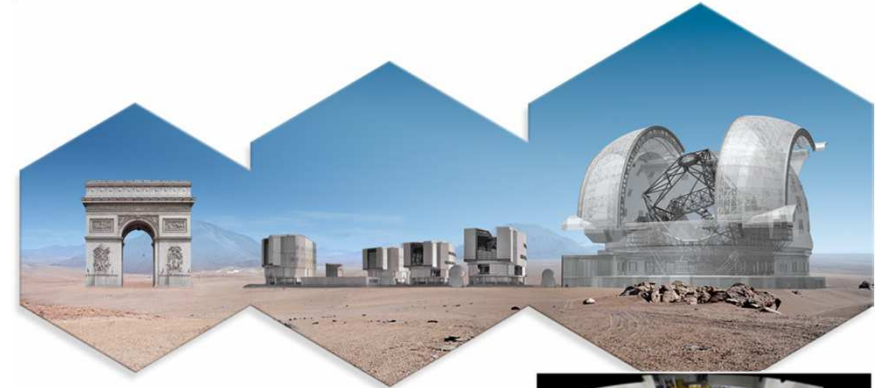
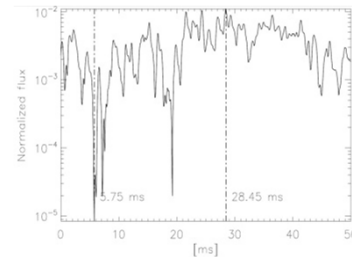
integration of a static Fourier-Transform spectrometer
onto a focal plane array
(MICRO SPECTrometer On a Chip)



Optical Technologies : New optical systems



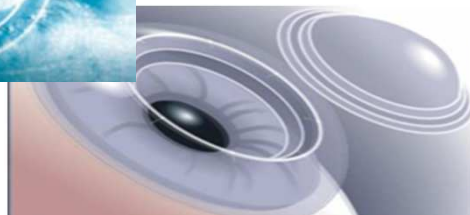
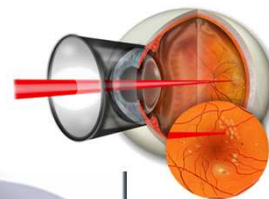
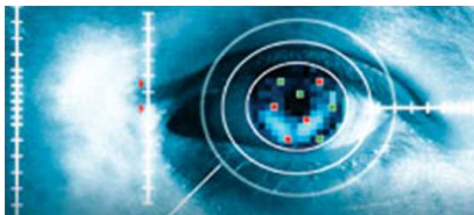
Optical links



Adaptive optics for large telescope E-ELT

SPHERE : exoplanet imaging system for the VLT (Very Large Telescope)

- onera in charge of the adaptative optic system
- first light may 5 2014



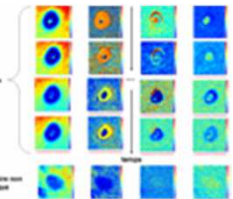
Medecine :

Ophthalmology

Eye movements and optical
analysis, 3D imagery, AO for laser
focalization

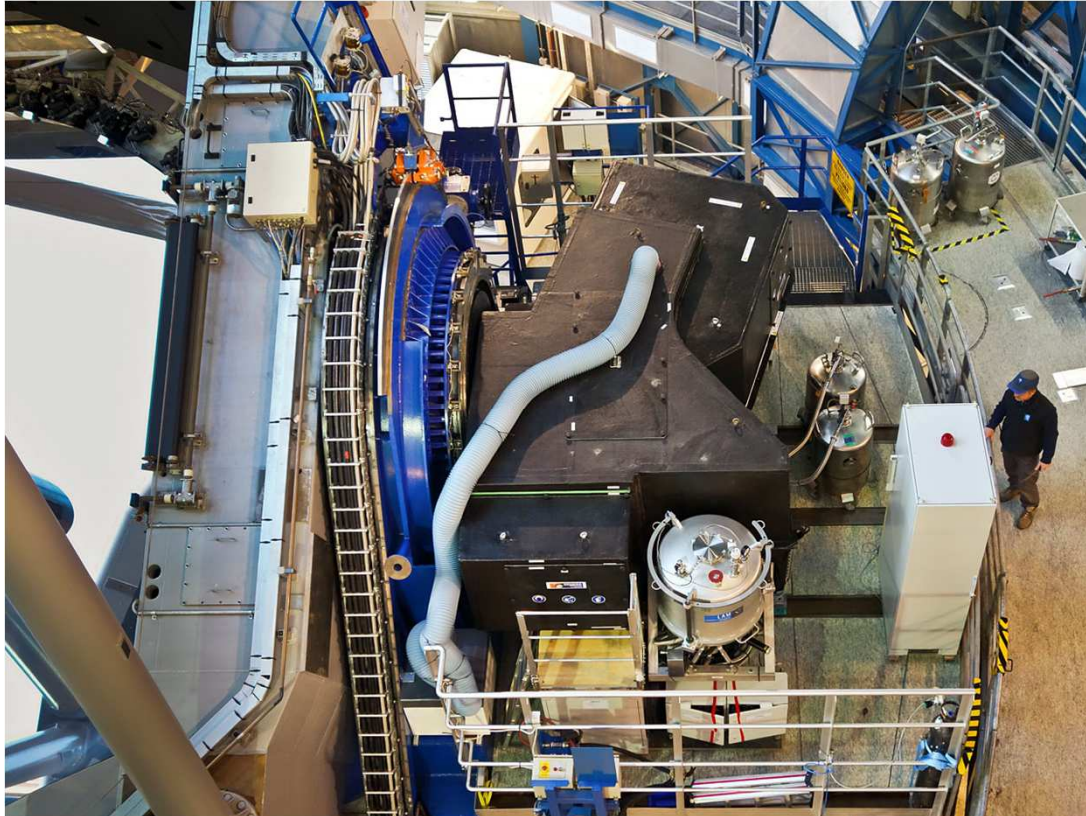
Oncology : multispectrala polarimetric

Melanoma imagery

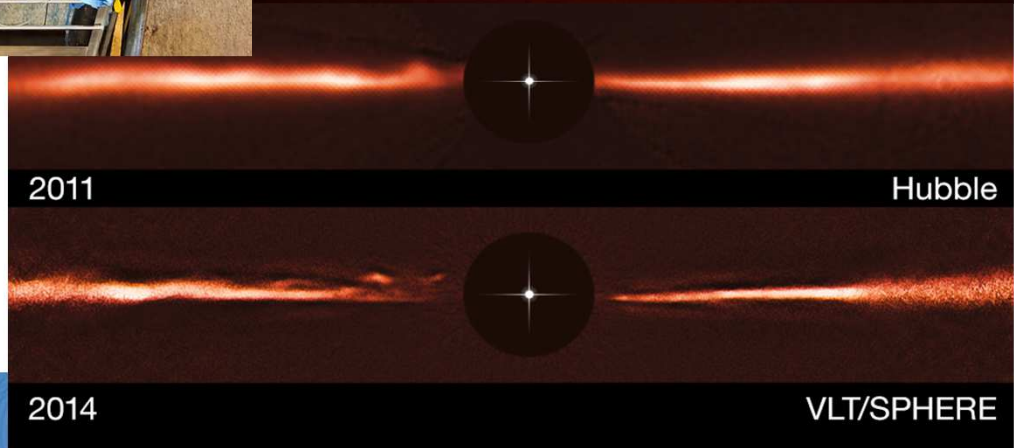
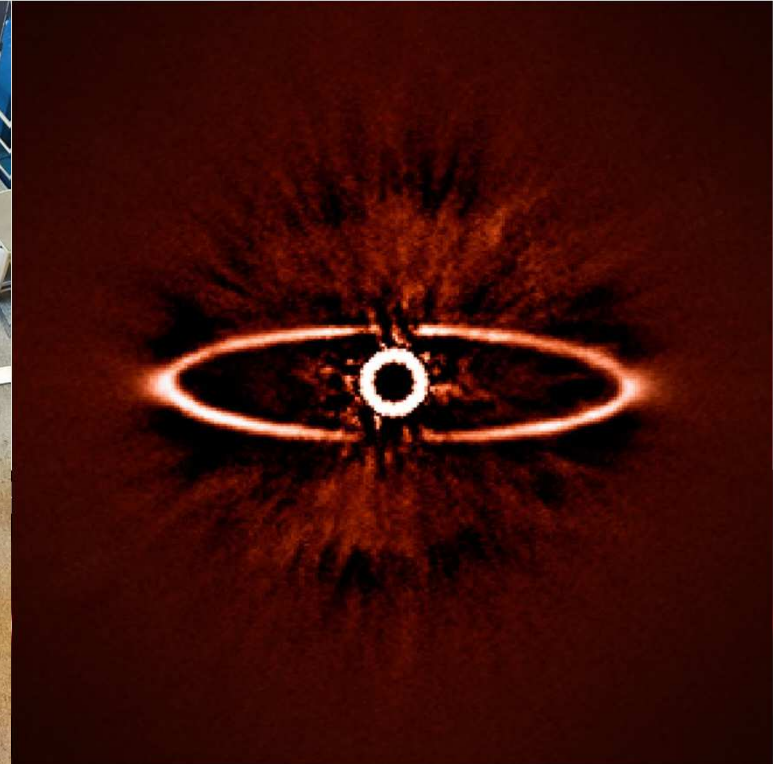


SPHERE

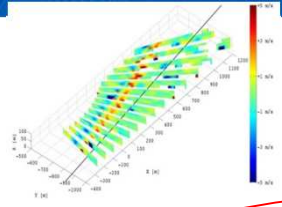
Spectro-Polarimetric High-contrast Exoplanet Research instrument



adaptive optics system on ESO's
Very Large Telescope (VLT)
at the Paranal Observatory in Chile.
8 Tons, 36 M³



Optical Technologies : Laser remote sensing



Doppler measurement lidars

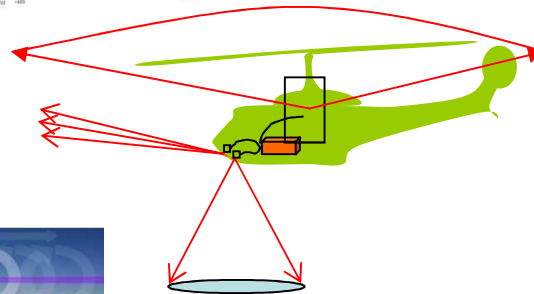
- aircraft windspeed
- wake vortex detection
- CAT detection
- atmospheric 3D windfield

Multifunctions lidar

- New Leosphere partnership on doppler lidars for airports

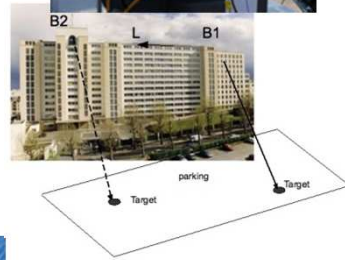
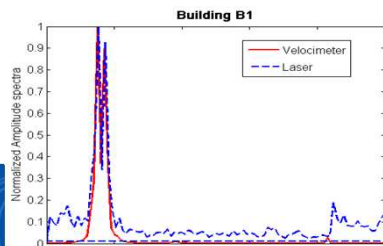
- In Flight demonstration of air data Doppler Lidar :

- airspeed, angle of sideslip, angle of attack*
- 1.5μm fiber architecture , four laser beams*



Vibrometry

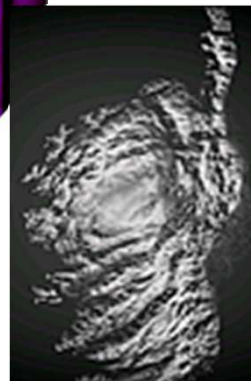
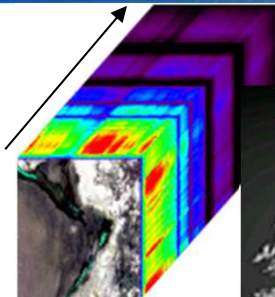
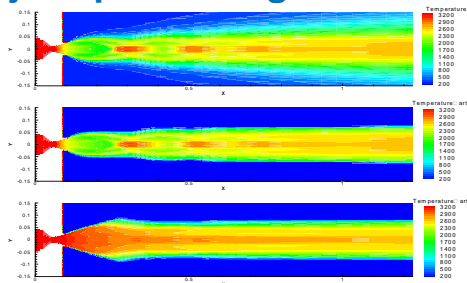
- defense-security
- structural health monitoring



Optical Technologies : Signature modelisation and Processing

ONERA is in charge of FR MOD EM&OP Environment Mitigation

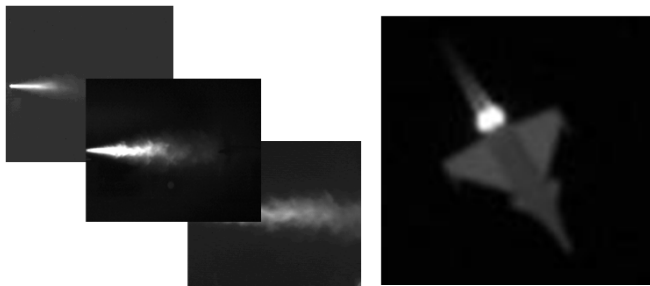
Object /plumes signatures



ATAL 64 - Trial 910 - MWIR Matisse-v2.0 image
Radiances [W/m²/sr]

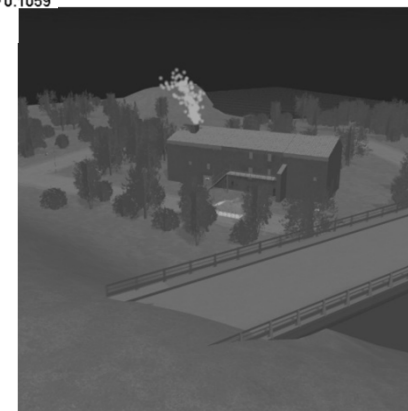


MATISSE v3,0 contract

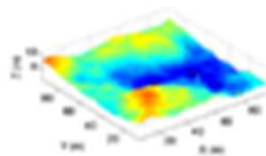
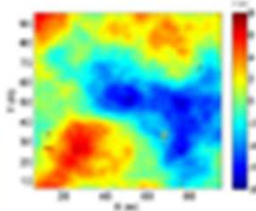
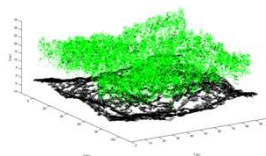


UV->IR Background and propagation codes

Improved SE-Workbenck (Oktal-SE) – MATISSE coupling
- Nightglow models and measurements

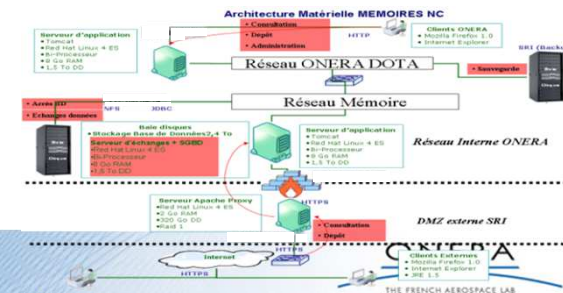


3D FW imagery



Data banks : Thermal and optical Properties, 3D models, environment description

New Mémoires databe
Delivered to several MOD
Technical centers



Optical Technologies : Airborne Research Facilities 1/2

- **Multispectral High resolution imagery** from visible to infrared
- **Hyperspectral imagery** (0,4-2,5 μm)
- **Multisensors platforms**
 - *optro-SAR : hyper, panchro, SAR (X, L, P ...)*
 - *Hyper spectral + High resolution*
- **Multisensors campaigns**
 - Hyper + 3D lidar
 - IR + Hyper



-> Strong synergy between Defense, Security, and Science applications



Onera



Onera



IGN



Onera / AJS



Onera



Airborne campaigns in 2013



THE FRENCH AEROSPACE LAB

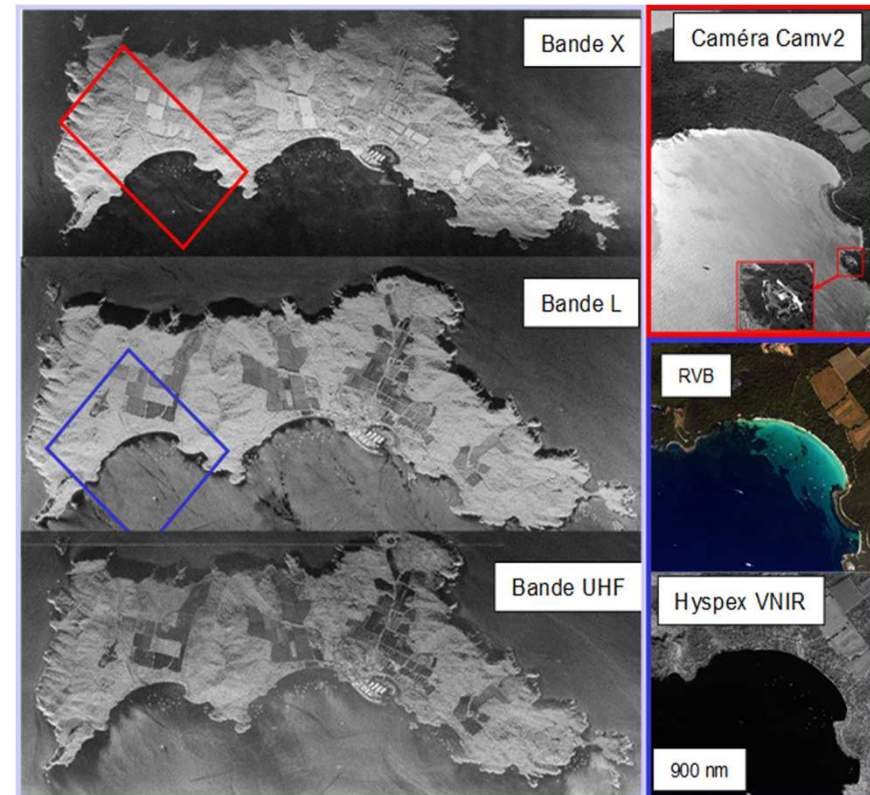
Optical Technologies : Airborne Research Facilities 2/2

New airborne facility – **SYSISPHE** First flight : September 2013

- From visible to thermal infrared (0.4 - 11.5 μm)
- High ground resolution : 50 cm all bands
- Onboard realtime processing for “target” detection
- Dual applications (civil and military).



New airborne facility – **SETHI NG** Bands P to W, interferometry, polInSAR Hyper , HR panchro



ONERA has joined European Network of Airborne Facilities for Environmental Research (EUFAR, European Integrating activity).



NEW ADVANCED OBSERVATION METHOD INTEGRATION NAOMI

5 YEARS RESEARCH PROGRAM 2014-2019
HYPERSPETRAL, RADAR, LIDAR...
on RPAV, Aircraft, Satellite...

EXPLORATION

Onshore and Offshore Hydrocarbons detection
Integrated Surface model

Safety and Environment

HC detection
Subsurface object detection
Industrial Site surveillance

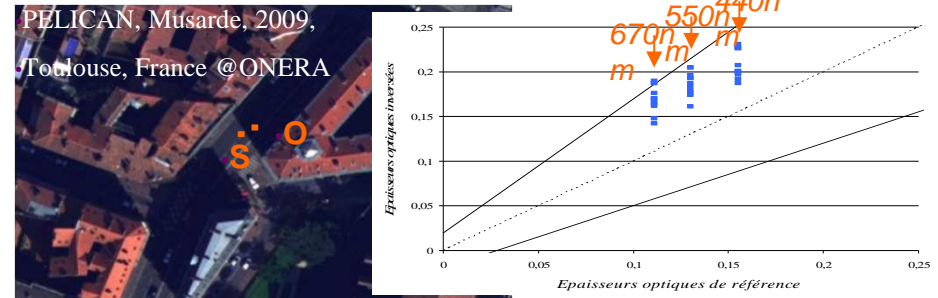


Air quality over large urban area or industrial facilities

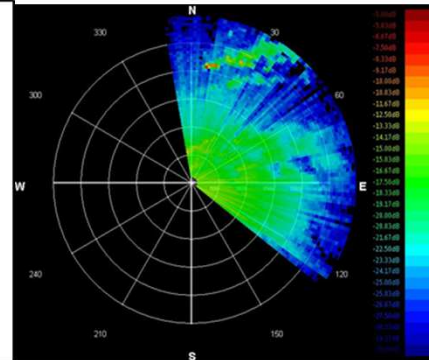
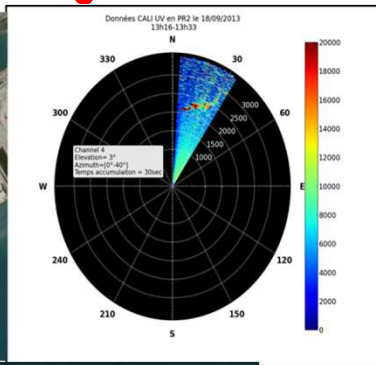
Aerosols map in urban areas

- *Multispectral or hyperspectral*

PELICAN, Musarde, 2009,
Toulouse, France @ONERA



Industrial monitoring

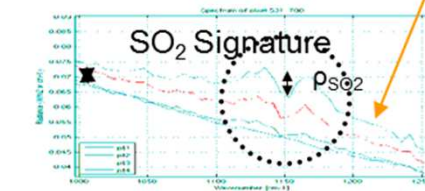
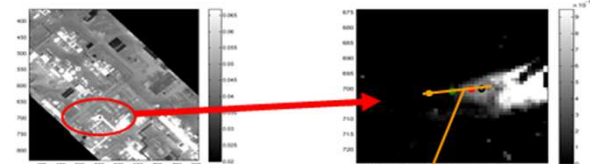


Multipsectral lidars

IR Hyperspectral imagery



VNIR6SWIR Hyperspectral
airborne imagery



SO₂ characterization over an industrial plantur site
industrial - Telens data, Onera processing

UAV WIDE-AREA SURVEILLANCE (INACHUS H2020)

UAVs carrying cameras and 3D laser scanners providing 3D laser images of collapsed buildings and 3D Digital Surface Models (DSM)



POC : nicolas.riviere@onera.fr

Thank you ...



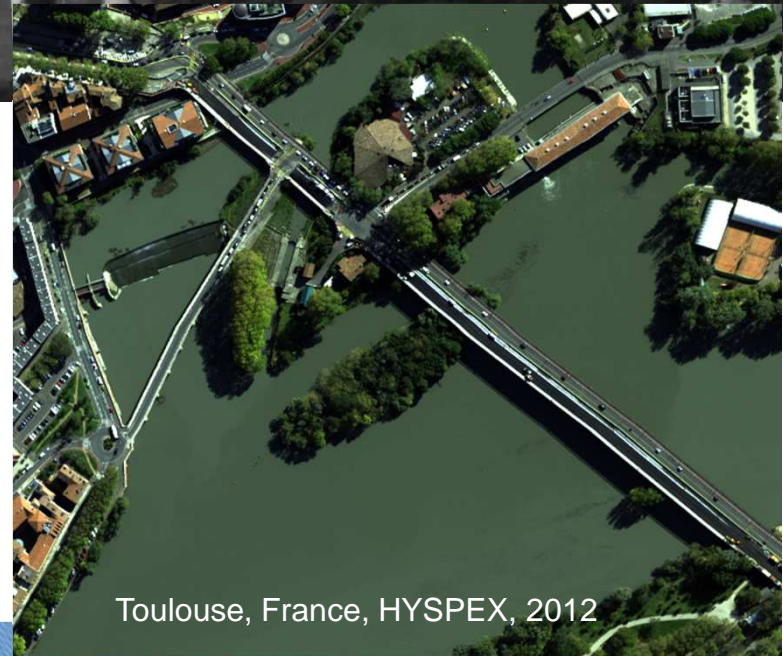
Porquerolles, France, HYSPEX on Sethi, 2013



Porquerolles Castle, France, Pan on Sethi, 2013



Fauga, France, HYSPEX, 2012



Toulouse, France, HYSPEX, 2012