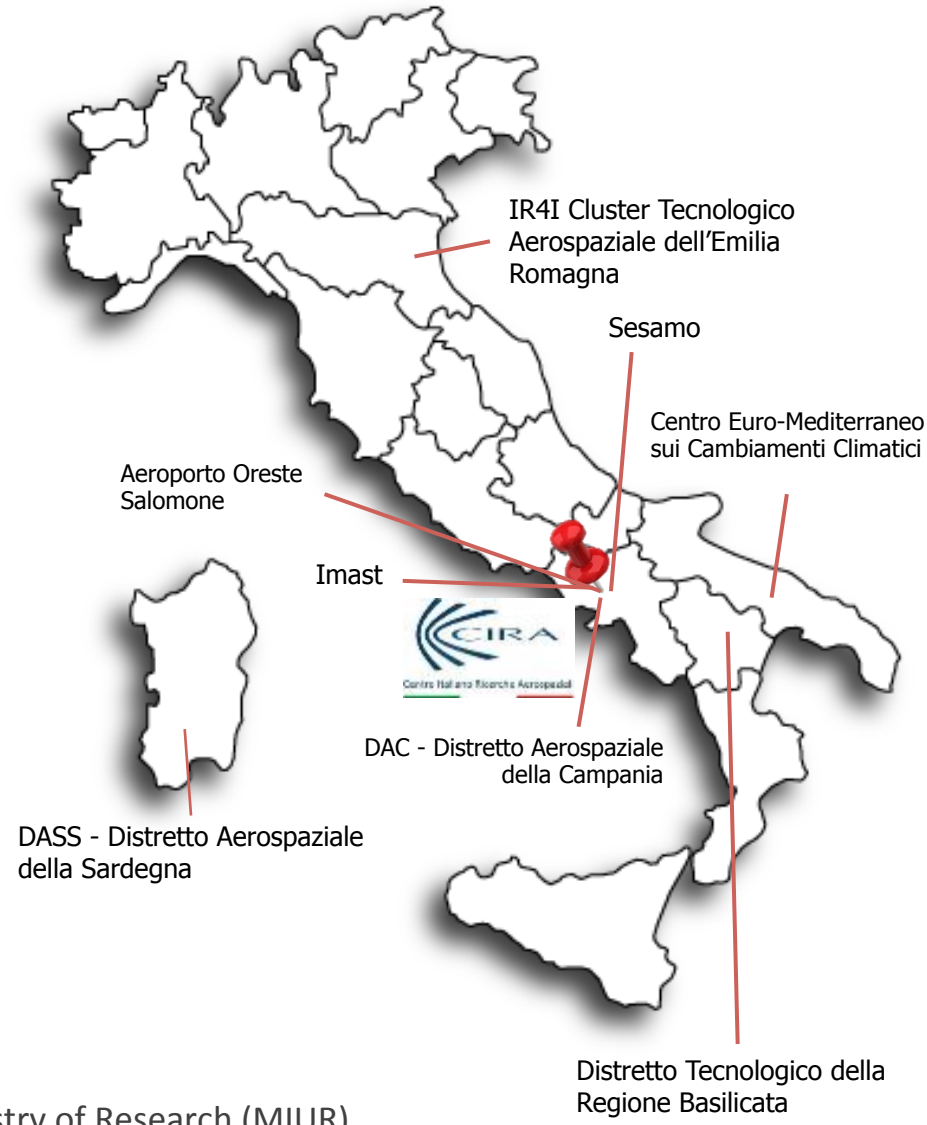
Centro Italiano Ricerche Aerospaziali

CIRA
Italian Aerospace Research Centre

- A non-profit public-private partnership among:
  - ASI (Italian Space Agency) - 47%
  - CNR (National Council for Research) - 5%
  - Campania Region - 16%
  - Italian Aerospace Industries - 32%
- 370 employees and approx. 50 university students and PhD candidates a year
- Partner of the main European research programs in the aviation and space fields

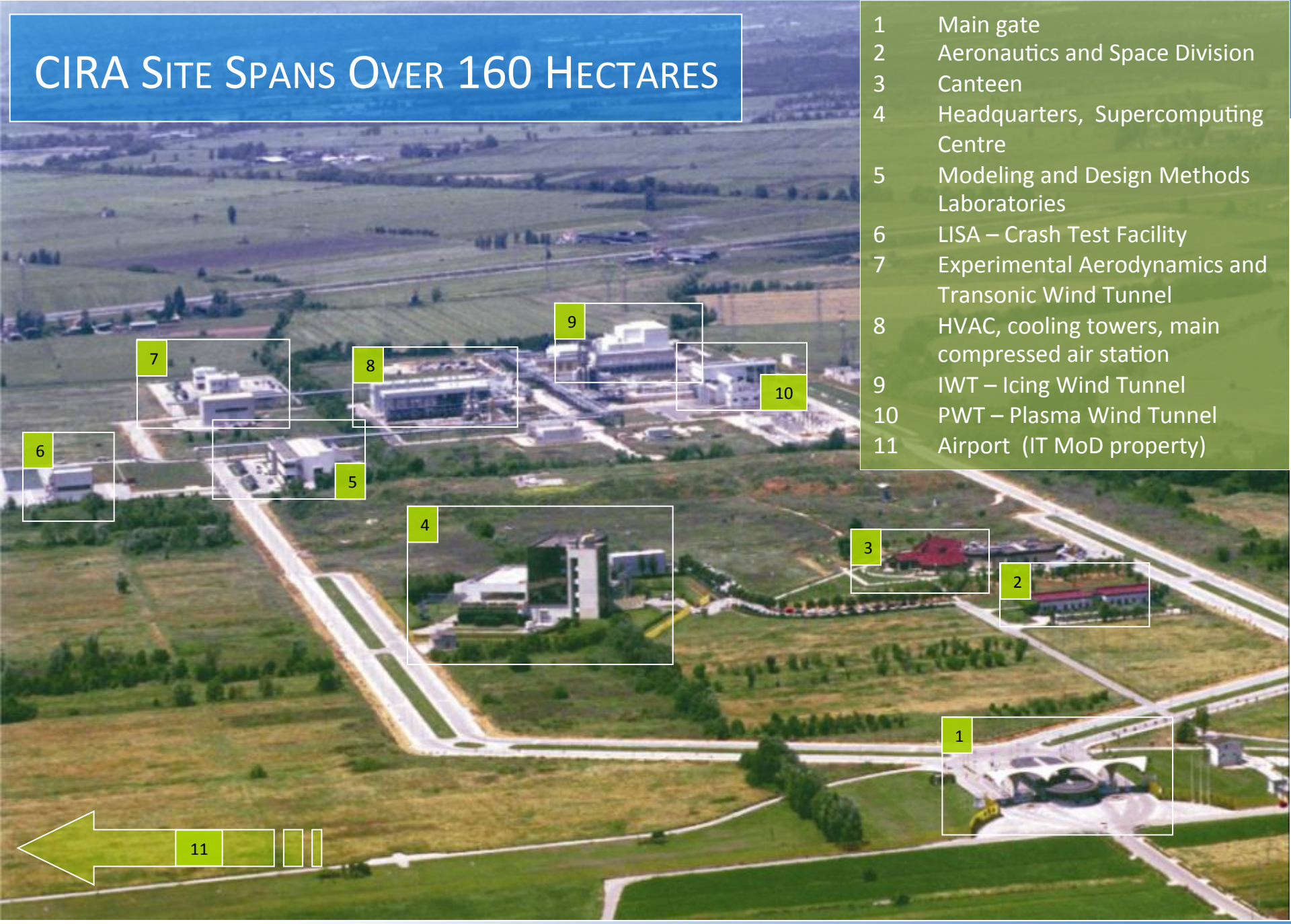


In 1989, the Italian Government entrusted CIRA the management of the Italian Aerospace Research Program (PRORA) to support the competitiveness of the Italian aerospace community by the:

- development of strategic research programs,
- development and operation of strategic testing facilities,
- enhancement of scientific competences and expertise.

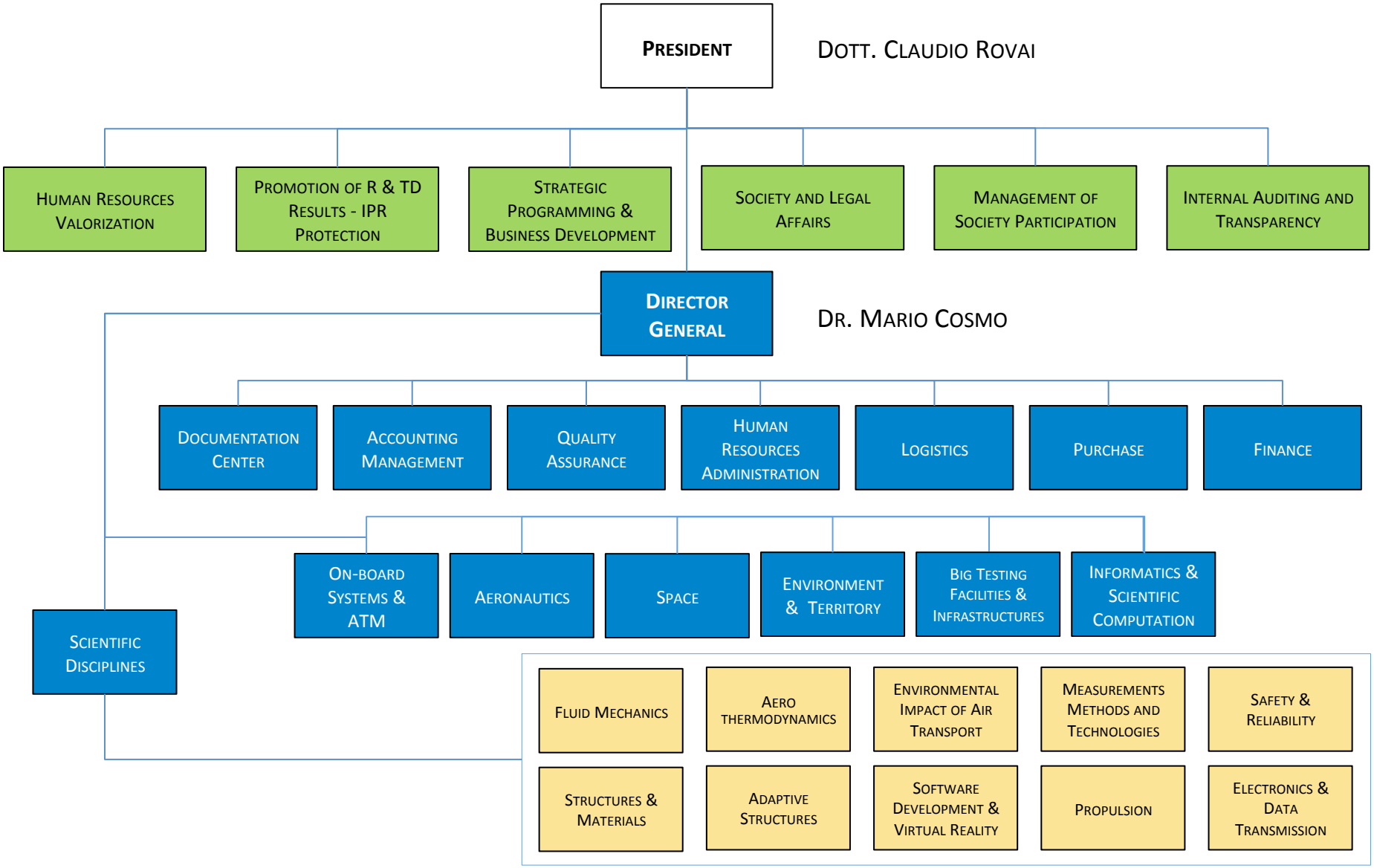
CIRA performs PRORA management under the control of Ministry of Research (MIUR).

CIRA Site Spans Over 160 Hectares



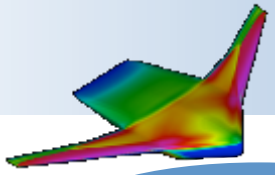
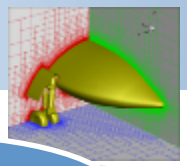
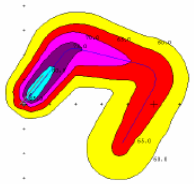
1 Main gate
2 Aeronautics and Space Division
3 Canteen
4 Headquarters, Supercomputing Centre
5 Modeling and Design Methods Laboratories
6 LISA – Crash Test Facility
7 Experimental Aerodynamics and Transonic Wind Tunnel
8 HVAC, cooling towers, main compressed air station
9 IWT – Icing Wind Tunnel
10 PWT – Plasma Wind Tunnel
11 Airport (IT MoD property)

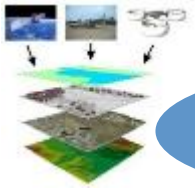
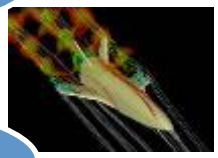
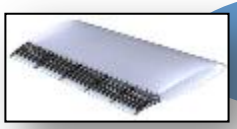
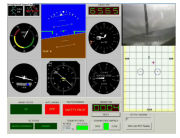
Organization Chart

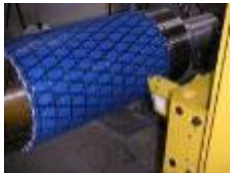


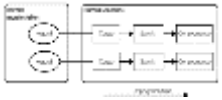
COMPETENCES

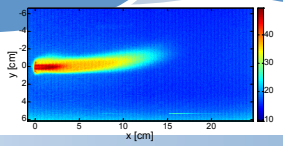
Centro Italiano Ricerche Aerospaziali

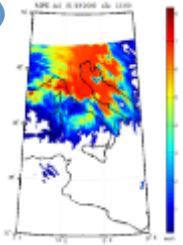













Aerodynamics

Vibroacoustics

Aeroacoustics

System Integrations

Aerothermodynamics

Earth Observation

Electronics and Communications

Knowledge

Adaptive Structures

GN&C and on Board Systems

Meteorology

Structures and Materials

Icing

RAMS

Propulsion

PWT

LISA

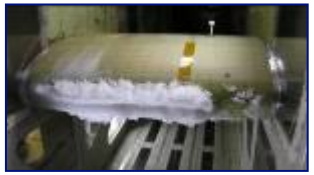
GHIBLI

Validation Demonstration

PT1

IWT

Flare



HYPROB

Space Qualification

PWT – PLASMA WIND TUNNEL SCIROCCO

- **GOAL:** IMPROVE SAFETY OF RE-ENTRY SPACE VEHICLES
- **USE:** DESIGN AND TEST THERMAL PROTECTION SYSTEMS FOR SPACE VEHICLES
- **OPERATIVE SINCE:** 2002
- **TESTING FLUID:** AIR
- **MAX SPEED:** MACH 16
- **STAGNATION TEMPERATURE:** ~ 10.000 °C
- **MAX TEST DURATIONS:** < 25 MINUTES
- **NOZZLE EXIT DIAMETER:** 2.0 M
- **NOMINAL DIMENSION OF TEST SPECIMEN:** 0.6 M
- **MAX POWER OF ARC HEATER:** 70 MW

NASA · ThalesAlenia Space · agenzia spaziale italiana · Snecma Moteurs groupe snecma · esa · NASDA National Space Development Agency of Japan · AEROSEKUR · DLR · ALI Aerospace Laboratory for Innovative components S.C.a r.l. · ISRO Indian Space Research Organisation

GHIBLI – SMALL PLASMA WIND TUNNEL

- **GOAL**: IMPROVE SAFETY OF RE-ENTRY SPACE VEHICLES
- **USE**: DESIGN AND TEST SMALL SPECIMENS OF MATERIALS TO BE USED FOR THERMAL PROTECTION SYSTEMS OF SPACE VEHICLES
- **TESTING FLUID**: AIR, (CO_2 IS UNDER DEVELOPMENT)
- **MAX SPEED**: MACH 12
- **STAGNATION TEMPERATURE**: ≅ 10000 °C
- **MAX TEST DURATIONS**: < 25 MINUTES
- **NOZZLE EXIT DIAMETER** : 150 MM
- **NOMINAL DIMENSION OF TEST SPECIMEN**: 80 MM
- **MAX POWER OF ARC HEATER**: 2 MW

IWT – ICING WIND TUNNEL

- **Goal**: Simulate the flight conditions requested for ice certification
- **Use**: Test ice protection systems and ice accretion effects on flight safety
- **Operational:** Since 2003
- **Test Sections:** 3 solid/slotted walls test sections and one Open Jet configuration

TEST SECTION	Dimension [m]	Max Speed (Mach)	Temperature [°C]	Altitude [m]
MAIN	2.25 x 2.35	0.41	-32 < Ts < +40	0 ÷ 7000
SECONDARY	1.15 x 2.35	0.7	-40 < Ts < +40	0 ÷ 7000
ADDITIONAL	3.60 x 2.35	0.25	-32 < Ts < +40	0 ÷ 7000
OPEN-JET	2.25 x 2.35	0.34	-32 < Ts < +40	0 ÷ 7000

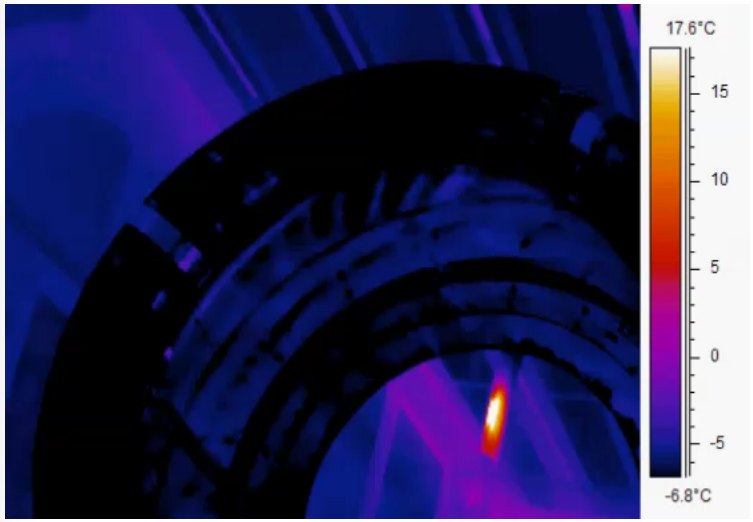
- **Unique for:** operating range and advanced instrumentation

IWT – ICING WIND TUNNEL

- **Max test duration**: 4 hours
- **Cloud conditions assessment:** According to international standard (SAE ARP 5905)

Ice accretion test

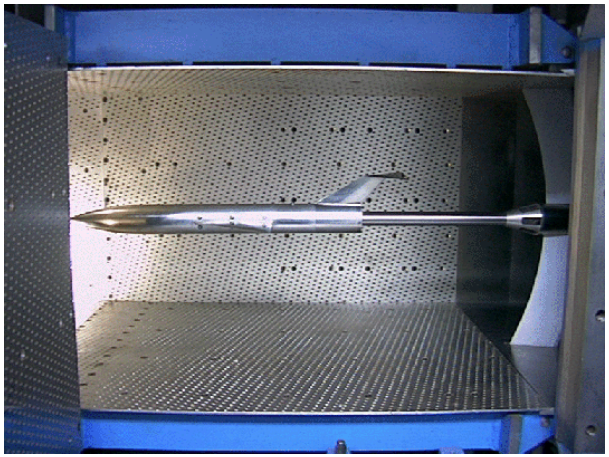
Bleed air IPS efficiency test



LISA – AEROSPACE STRUCTURES IMPACT LABORATORY

- **Goal**: Improve passenger/freight safety in case of crash on ground/sea.
- **Use**: Design and test aerospace structures and safety devices wrt crash worthiness
- **Operational:** Since 2003

- **Impact trajectory:** Between 5 and 90 degrees wrt horizon
- **Max vertical speed**: 20 m/s
- **Impact surfaces**: Water, concrete, grass
- **Calibration and procedures:** According to national standard defined by ENAC



PT-1 TRANSONIC WIND TUNNEL

- **GOAL**: AERODYNAMICS EXPERIMENTS ON SCALED MODELS IN SUBSONIC, TRANSONIC AND SUPERSONIC FLIGHT
- **USE:** AERODYNAMICS AND AEROACOUSTICS CHARACTERISATION OF 2D MODELS, AIRCRAFT CONFIGURATIONS AND SLIM BODIES SUCH AS MISSILES AND LAUNCHERS
- **OPERATIONAL** SINCE 2000
- **MAX SPEED**: MACH 1.4
- **MAX TEST DURATION:** CONTINUOUS UP TO MACH=0.4; INTERMITTENT FROM MACH=0.4 TO MACH=1.4 (MAX SINGLE TEST DURATION 3 MINUTES)
- **2 TEST SECTIONS**: 0.45 X 0.35 M^2, SOLID AND POROUS WALLS
- **CALIBRATION** ACCORDING TO INTERNATIONAL STANDARDS

SPACE QUALIFICATION LABORATORY

STANDARD ESA, ECSS-E-10-03C, MIL-STD-810G

QUALIFICATION CAPABILITIES FOR:

- PHYSICAL PROPERTIES MEASUREMENTS
- ACCELERATION TEST
- PYRO-SHOCK TEST
- COMBINED VIBRATION, HUMIDITY, TEMPERATURE AND ALTITUDE TEST
- ENVIRONMENTAL STRESS SCREENING
- THERMAL SHOCK TEST, THERMAL VACUUM TEST

Combined Chamber: Temperature, Humidity, Altitude,Vibration

Static Inertial Acceleration Tests

Thermal Vacuum Chamber

Thermal Shock Chamber

Pyroshock Test Facility

CURRENT HPC SYSTEMS

Architecture: Dell Cluster multinode multiprocessor, 38 Nodes, 608 cores

Aggregated Peak Performance: 18 TFLOPS

Processors: Intel Xeon+ GPU:6 Nvidia M2090

Oper. System: Linux RedHat Enterprise Server 6 + xCat

ONGOING HPC UPDATING (PUBLIC BID IN PROGRESS, AVAILABILITY: 2Q2016 AND 2Q2017)

Target Architecture: Cluster multi-node multiprocessor+ GPUs, 3000-4000 cores

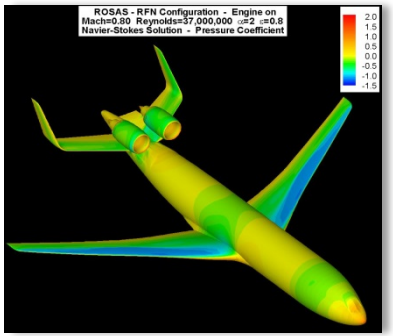
Target Aggregated Peak Performance: 300 TFLOPS (50 TFLOPS 2Q2016 + 250 TFLOPS 2Q2017)

+

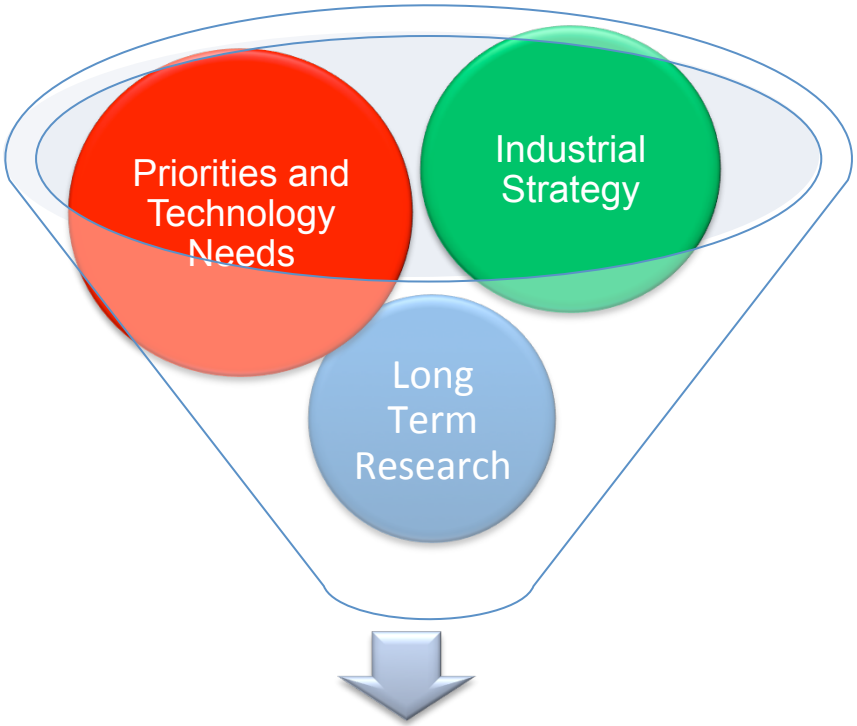
Use of HPC Cloud Computing Resources for Peak Computational workload

MAIN CIRA HPC APPLICATIONS (MOSTLY IN-HOUSE SW CODES)

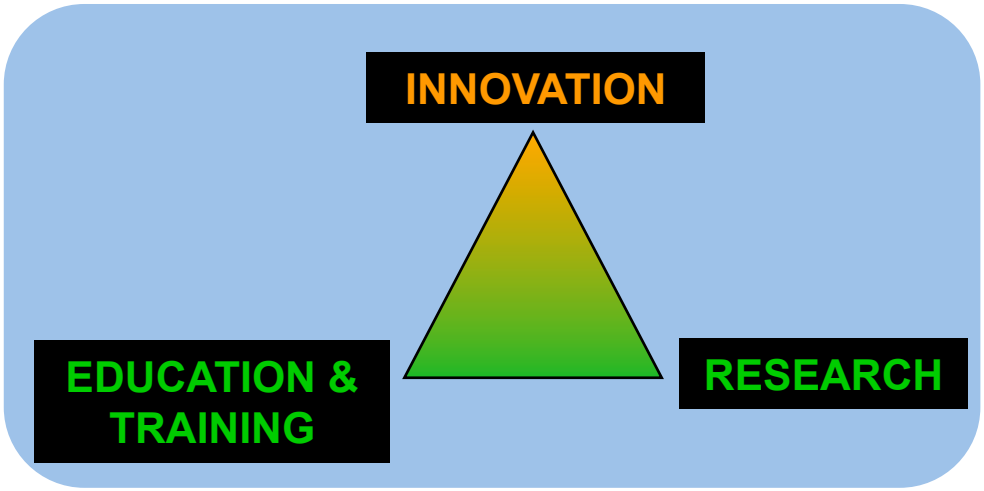
-Aerodynamic Design
-Large Eddy Simulation
-Thermo-Structural Analysis
-Unsteady and Steady CFD
-Aeroacoustics Simulations
-Meteo Applications



From Needs to Strategic Planning



Strategic Plannig 2015-2017

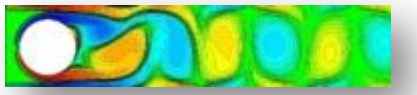


TECHNOLOGY DEVELOPMENT AND INTEGRATION

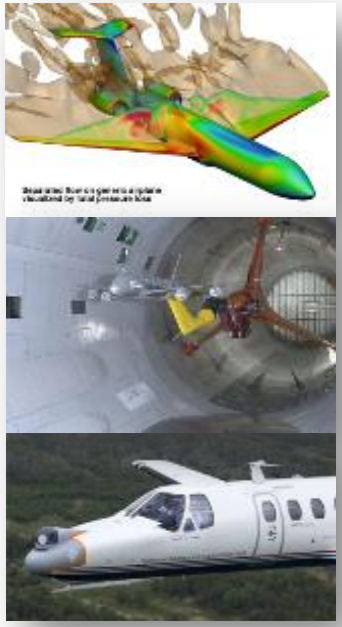
PRODUCTION AND COMMERCIALISATION

RESEARCH

TRANSFER TO INDUSTRY



Università



Spin-off

Start-up

Aziende

EREA

ESRE

On March 10, **ESRE** the Association of the European Space Research Establishments was formally established as an international non-profit organization according to Belgian Law (AISBL).

ESRE gathers the leading space research centers of CIRA (Italy), DLR (Germany), INTA (Spain), NLR (Netherlands) and ONERA (France).

The leading national space research centers in Europe decided to strengthen their cooperation and to propose common R&TD actions in order to advance cutting edge science and innovative technologies for the support of the competitiveness of the European space sector and to provide contributions to the solution of the grand societal challenges.

ESRE identified the areas "**collaborative small satellite constellations**", "**future launching systems**", "**cost-efficient satellite subsystem technologies**", "**satellite-based greenhouse gases monitoring**", and "**Remote Sensing for Environmental Protection**" as particularly promising for next-generation research and technology development.

PLANNING FOR 2015-2017

Strategic R&TD developments

- RPAS and Autonomous UAS
- Fixed Wing Aircraft
- Rotary Wing and Tilt-Rotor Aircraft
- Access to Space, Satellites and Space Exploration Systems
- Space and Aviation Propulsion
- On Board Systems for aircraft and space vehicles, ATM
- Reliability, Availability, Maintainability, Sustainability - Safety and Security of Air Transport Systems and Critical Infrastructures
- Aerospace Methodologies and Technologies applied to monitor the Environment and Territory

Low TRL R&T projects

Testing Facilities, Laboratories and Infrastructures: envelope enlargement; new developments.