



Università degli Studi  
di Napoli Federico II



25 May 2011

# BRIEF OVERVIEW OF THE DEPARTMENT OF AEROSPACE ENGINEERING EWADE International Workshop

*Research and technology in Aircraft Design - The Role of Italian Industry*

Department of Aerospace Engineering  
Facoltà' di Ingegneria  
Polo delle Scienze e delle Tecnologie  
Universita' degli Studi di Napoli "Federico II"

The University of Naples “Federico II”, the oldest and biggest of the five Universities in Naples, was founded in 1215.

One of the oldest “lay” University in the world.

The third biggest University in Italy (90 000 students).

The Engineering Faculty has about 13 000 students with almost all engineering branches and graduated about 1000 engineers each year.

Bologna convention

- Laurea, after 3 years

- Laurea Magistrale after 2 more years

- Ph.D. Course (generally 3 years)



Gabinetto di Costruzioni Aeronautiche  
Founded in 1926 by  
Gen. Prof. Umberto NOBILE,  
polar explorer



Aerodynamics Institute

Gasdynamics Institute

Aircraft Design Institute

Science and Space  
Engineering Department  
"Luigi G. Napolitano"

Aircraft Design Department

Department of  
Aerospace Engineering  
(01 January 2007)

**12**

Full Professors

**14**

Associate Professors

**10**

Assistant Professors

Ph.D. Students

Research Assistants

**11**

Technicians

**8**

Administration

**All Aerospace Disciplines Are Covered**

**Fluidodynamics**

**Navigation &  
Control**

**Structures**

**Acoustics &  
Vibrations**

**Flight  
Dynamics**

**Statistics**

**Microgravity**

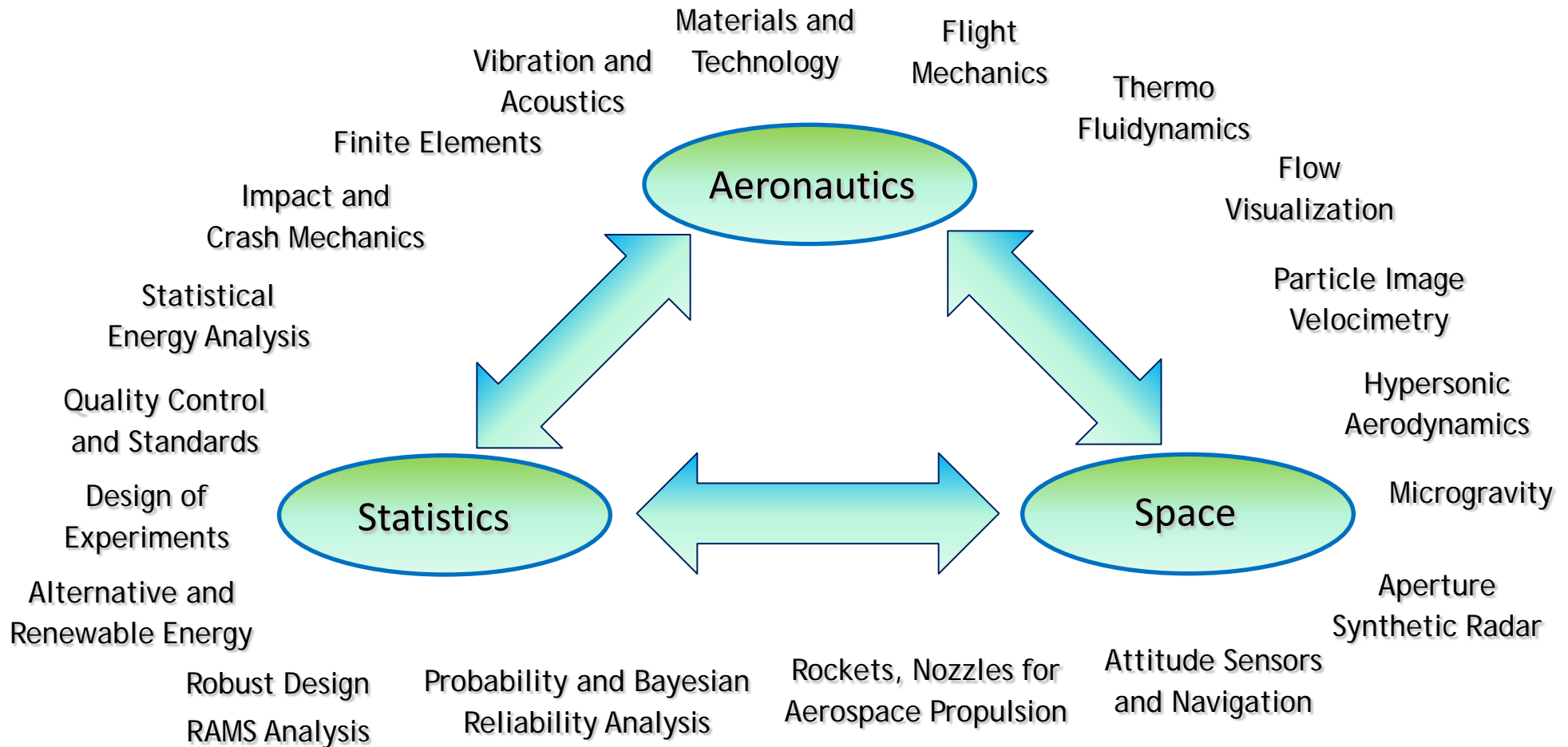
**Experimental  
Aerodynamics**

**Aerospace  
Propulsion**

**Aerospace  
Systems**

**Advanced  
Materials**

**Remote  
Sensing**





High Wing Airplane



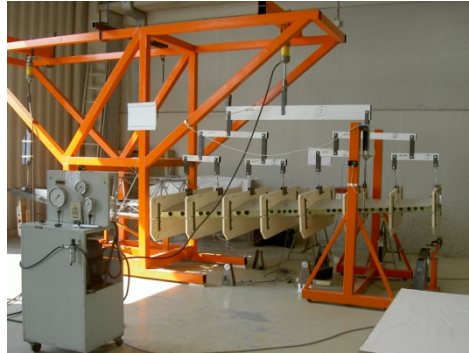
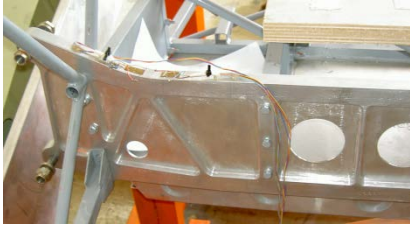
Very Light Twin Engine Airplane



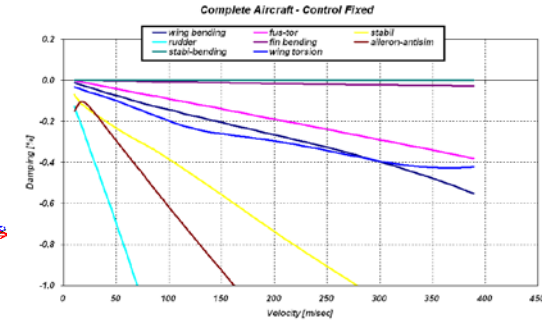
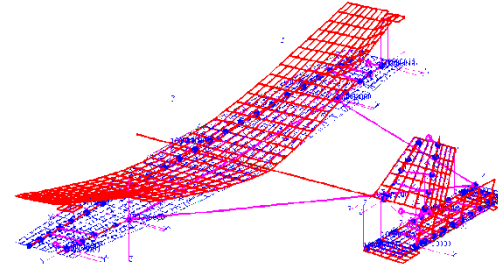
Low Wing Airplane



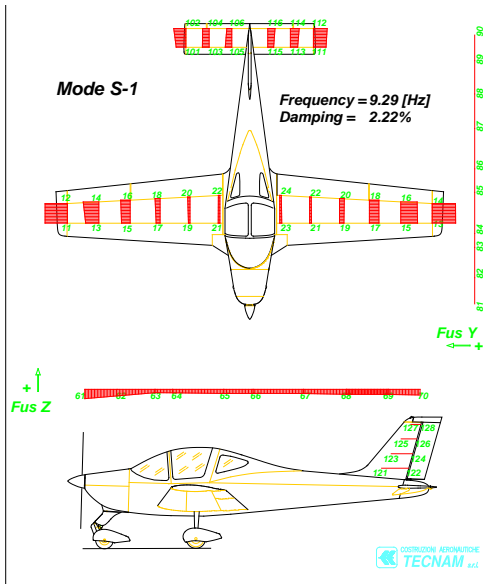
## Static testing



## Aeroelastic Calculations



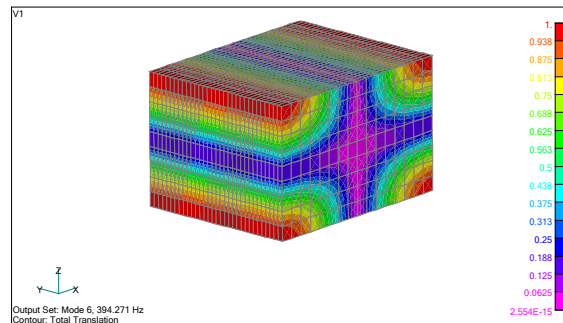
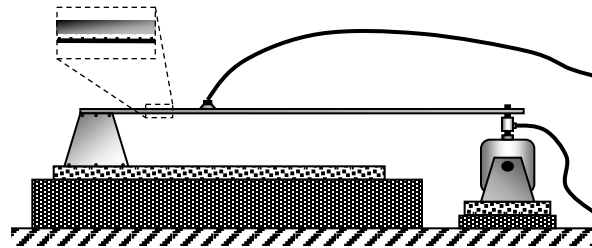
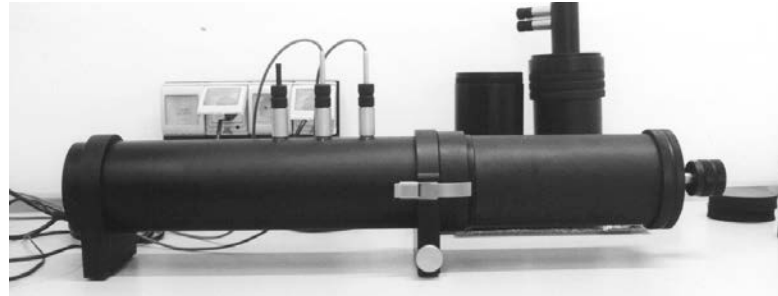
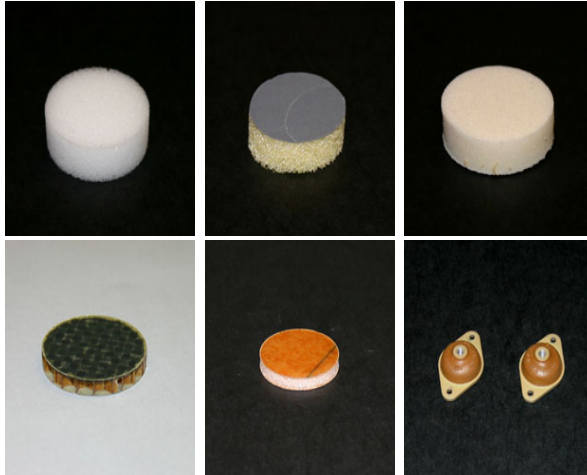
## Ground Vibration Testing



## Wind Tunnel Testing



## Damping and Acoustic Material Characterisation



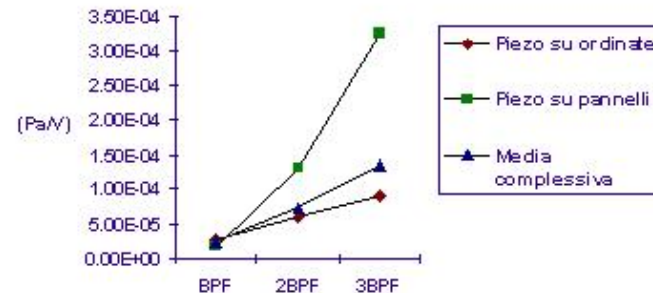


## Fuselage mock-up - Alenia ATR 42 turboprop aircraft

### Test set-up and results



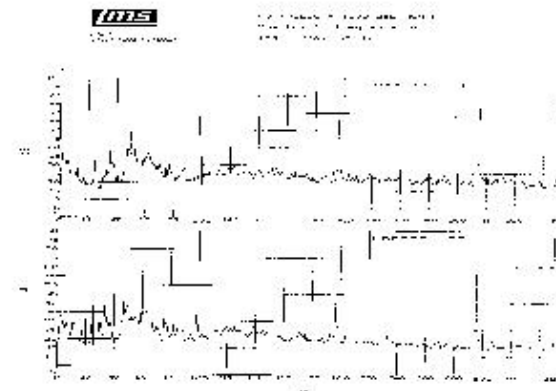
INTERNAL VIEW: PIEZO LOCATION



*24 actuators/ 32 microphones system configuration*

*Over 10 dB overall attenuation*

*Less than 900 gr. of added weight for seat: this parameter is 2 Kg for loudspeakers and 6 Kg for shakers*

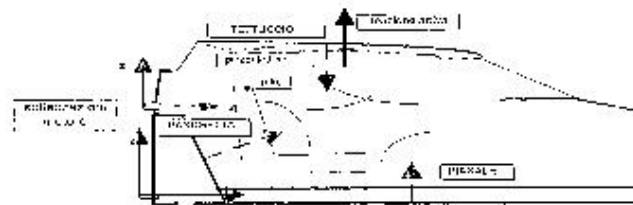


CONTROL EFFECTED NOISE SPECTRA

## High speed gt car - Ferrari F-50 (in collaboration with Alenia)



FERRARI F50 SCHEMA ECOTTAZIONI DINAMICHE  
controllo attivo con "haffle" sotto il tettuccio



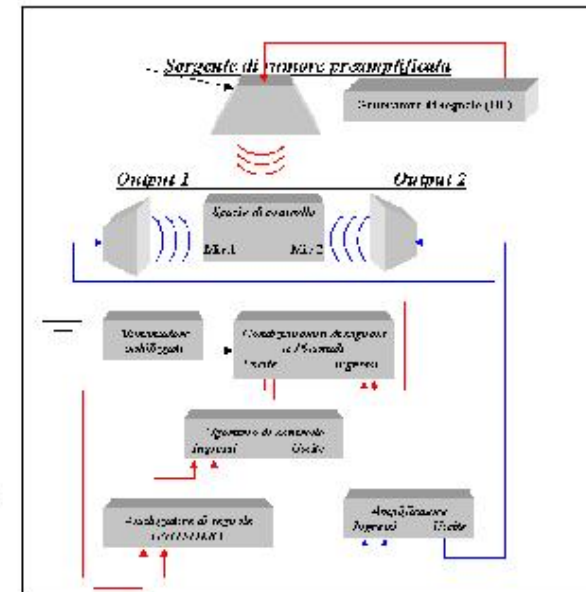
### FERRARI F-50

High internal noise levels due to the composite car body structure and structural architecture

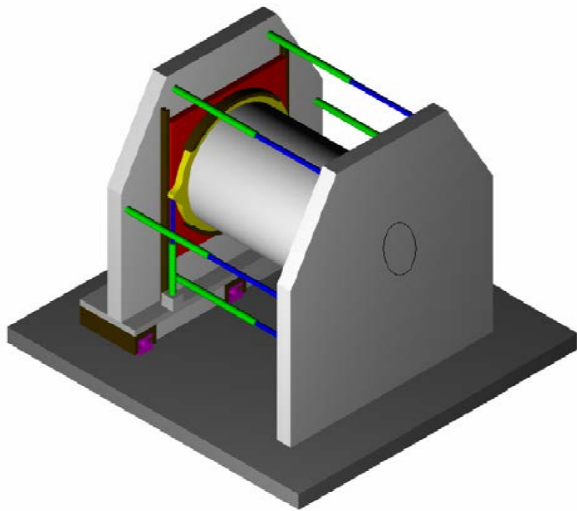
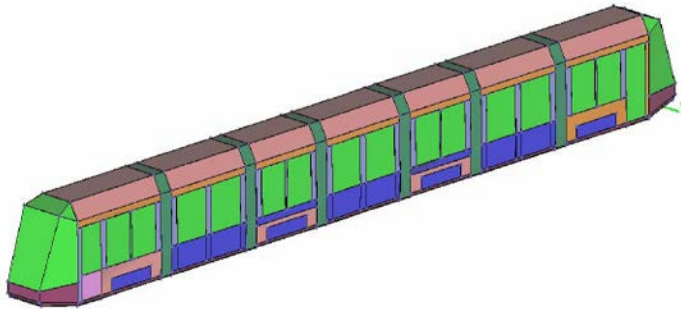
Investigation to use advanced loudspeakers to realise a sort of self adapting active seat



SPEAKING PANELS MOUNTED  
UNDER THE CEILING

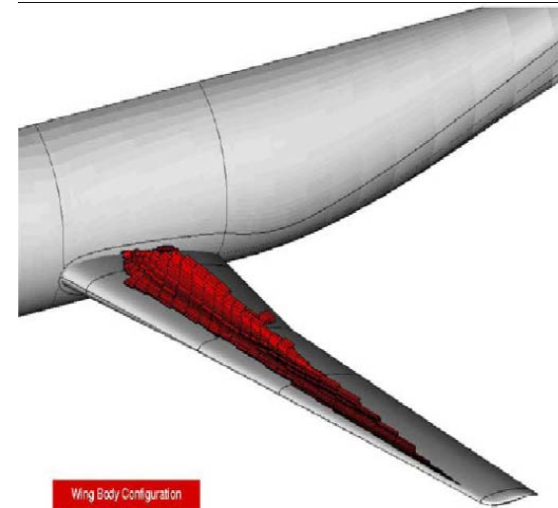


## Statistical Energy Analysis

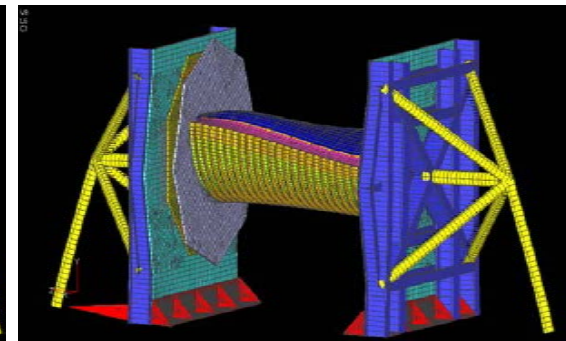
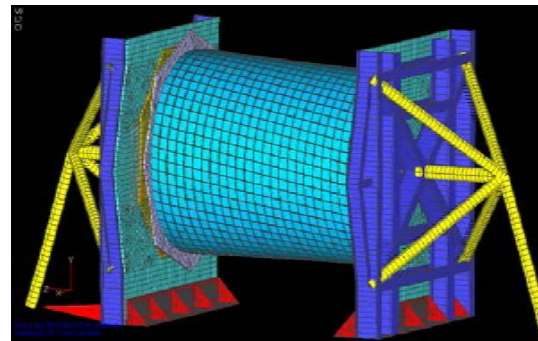


## Multi Axial Testing Equipment

## CFD (RANS) Simulation

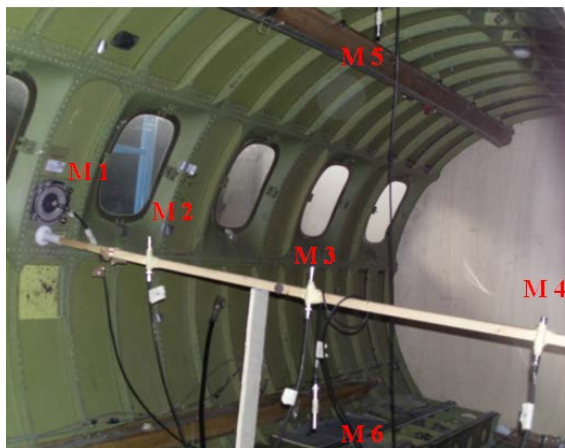


Wing Body Configuration  
 $M=0.75$  -  $Re=4.3 \text{ Mil}$  -  $C_x=0.5$   
 Wave layer - 4 drag counts





## Acoustic tests, increasing soundproofing treatment installation



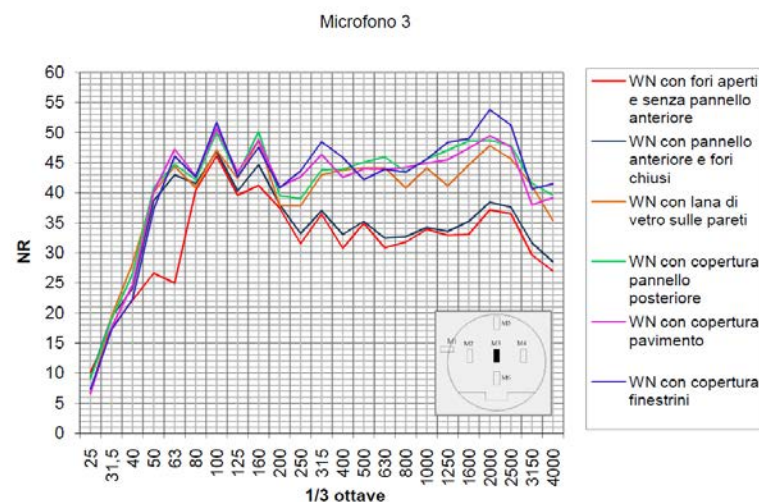
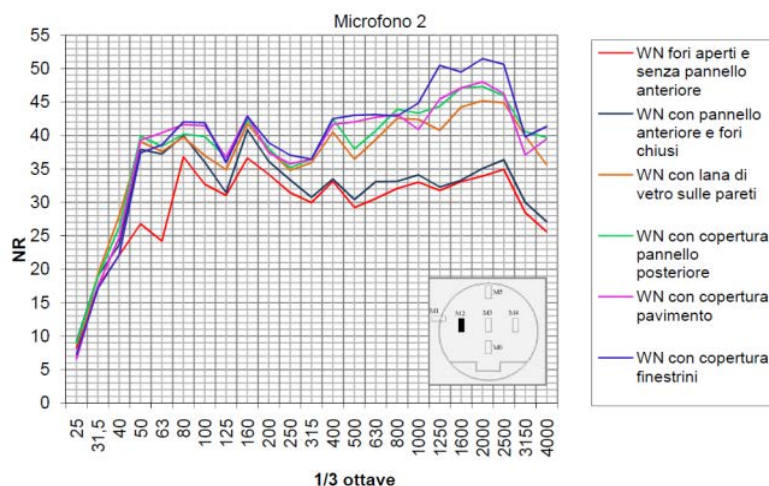
Green fuselage



"Typical" coverage



Floor and windows covered




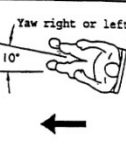
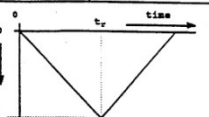
T. Polito, F. Marulo, A. Sollo, M. Aversano, G. Pagnozzi, Proceedings of ISMA 2010

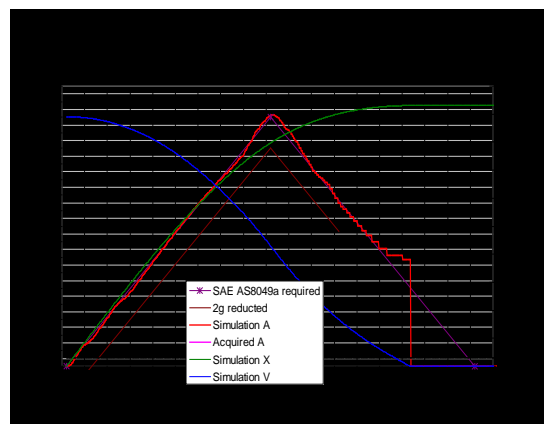
## FAA/EASA Requirements

TSO/JTSO C127a & AC

SAE AS 8049

FAR 25.562

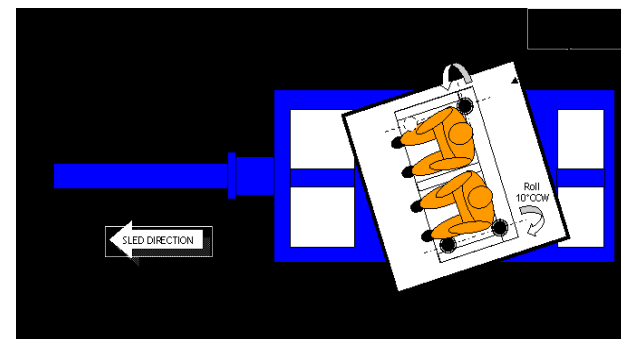
Illustration shows a forward facing seat	TEST 1	TEST 2
		
Inertial load shown by arrow		
Min V m/s (ft/s)	10.67 (35)	13.41 (44)
Max. t <sub>r</sub> s	0.08	0.09
Min. G	14	16
Deform floor:		
Degrees roll	0	10
Degrees pitch	0	10
Test Pulse simulating Aircraft Floor Deceleration - Time History:		
tru Rise time		
V = Impact Velocity		
G = Deceleration measured on test fixture or sled near the seat position.		



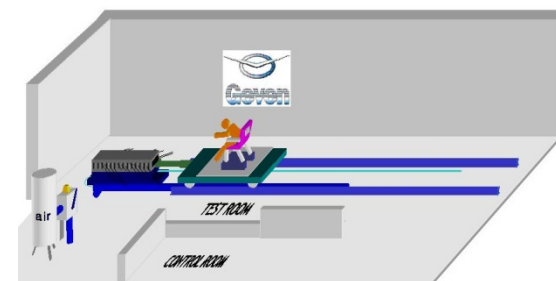
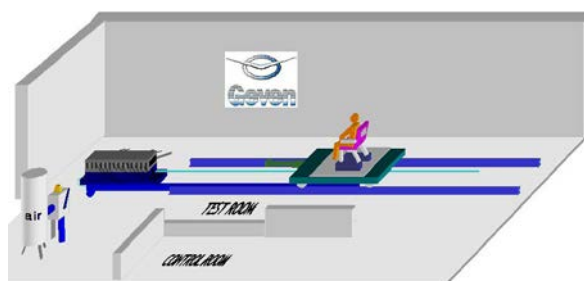
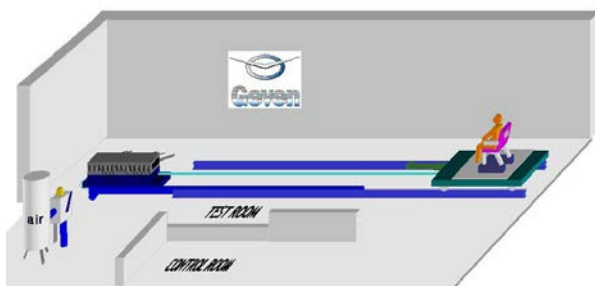
## Dynamic Lab

Dynamic Qualification Tests

Test Setup

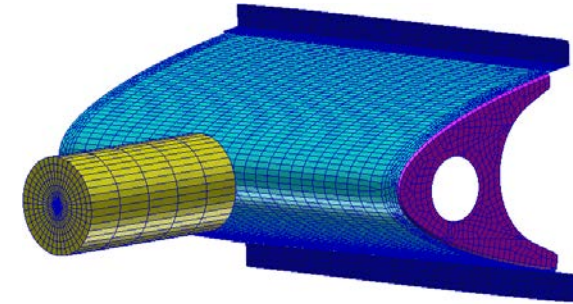
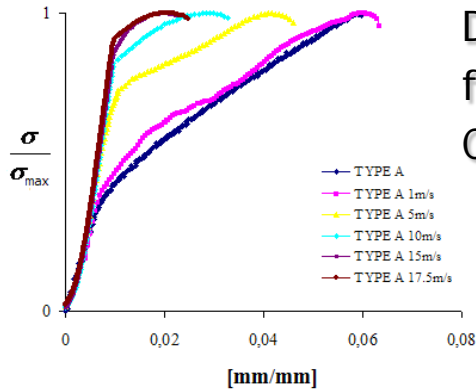


## Aircraft Seat Sled Test with Geven

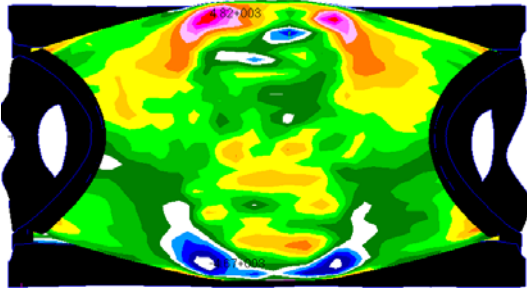
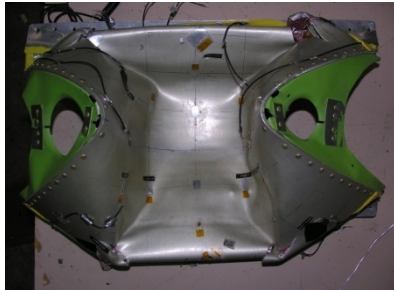




## Numerical Experimental Comparison on Leading Edge



Experimental Setup and Numerical Model for simulation



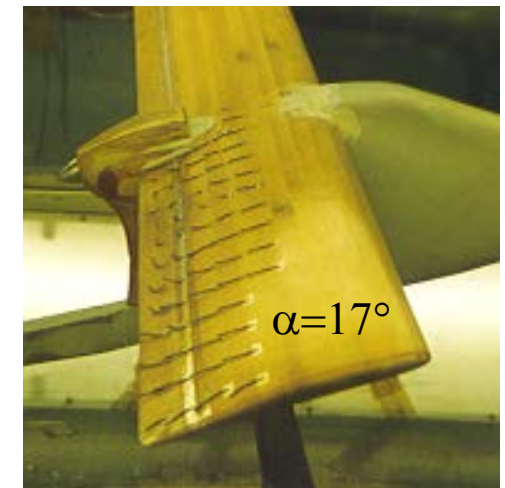
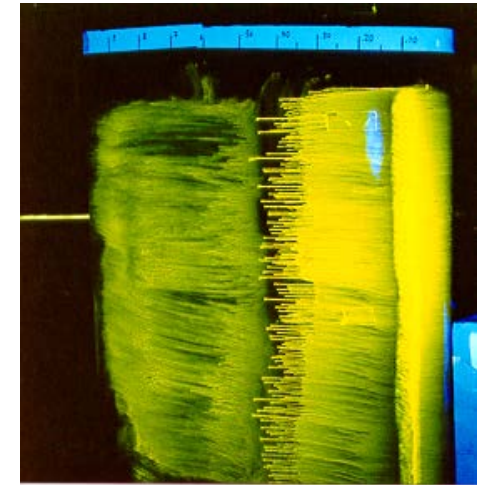
	Num	Exp	Error
Max deflection skin [mm]	320	305	5%
Max load impact [daN]	1915	2050	4%
Duration [ms]	33	34	3%
Truss deflection [mm]	225	235	4%
Rib distance after impact [mm]	220	230	4%

## 2-D and 3-D Model Testing



## Automatic Data Acquisition System

## Flow Visualization

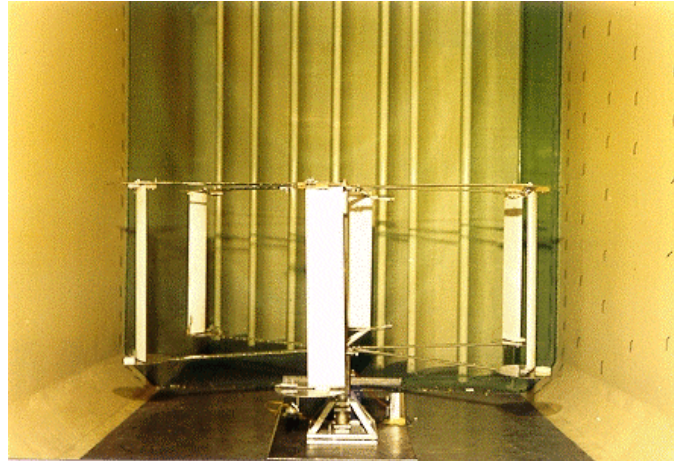




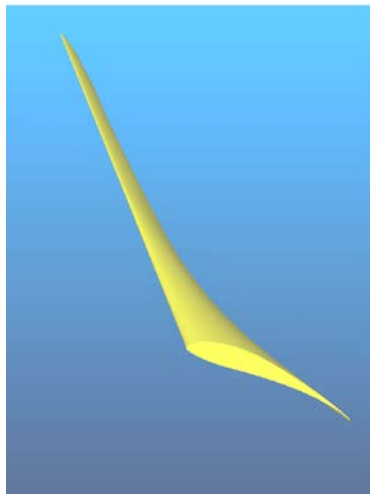
Horizontal Axis Turbine



Vertical Axis Turbine



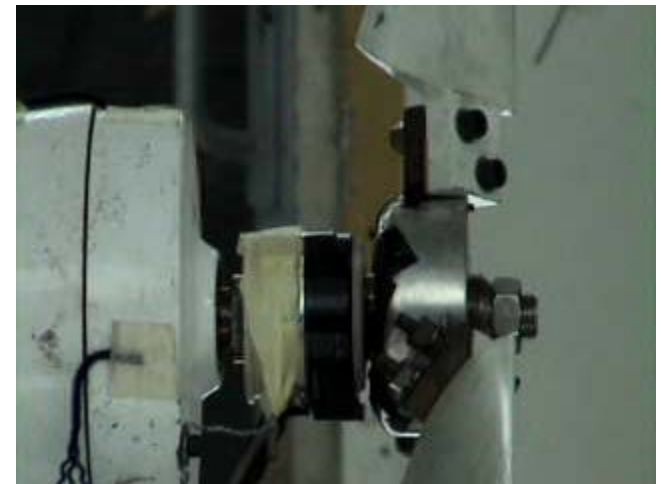
Real Installation



Design

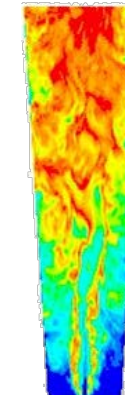
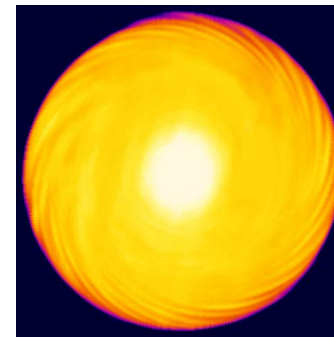
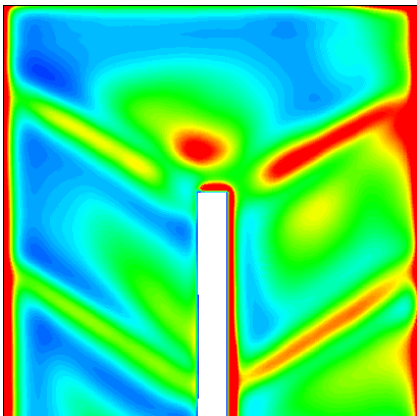
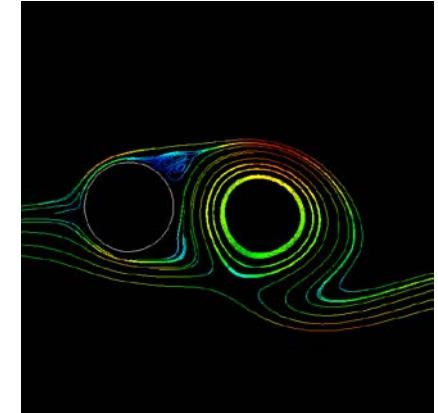
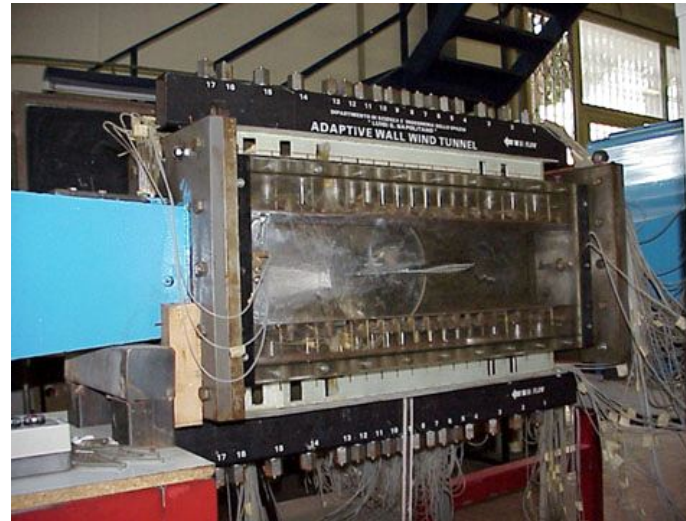
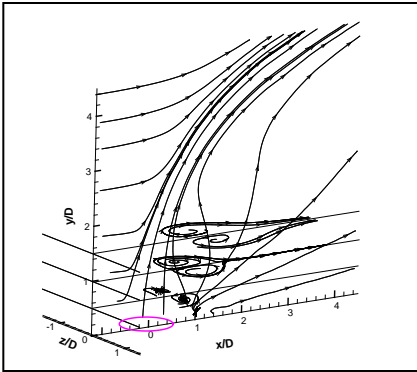


Aerodynamic Testing

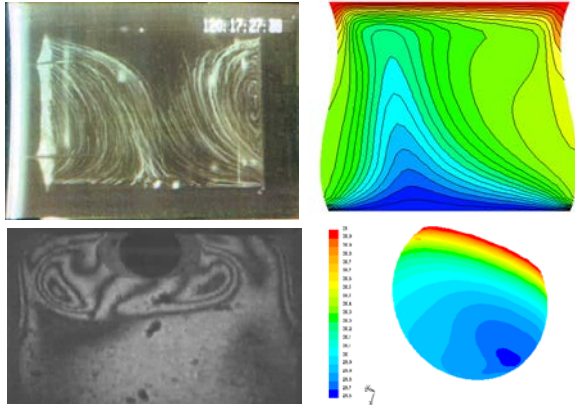


Performance Testing

## ThermoFluidynamics - Heat Transfer - Particle Image Velocimetry







Marangoni instability effect (numerical and experimental correlation)



Texus launcher



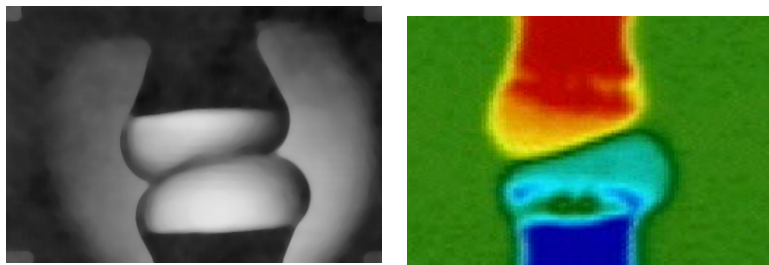
Parabolic flights



International Space Station

Numerical simulation and experimental testing of complex multiphase flows, with temperature gradients and different concentrations.

Definition of experiments onboard the International Space Station (ESA collaboration)



Non-coalescence of two drops at different temperature (CCD and thermographical pictures)

Collaboration with:





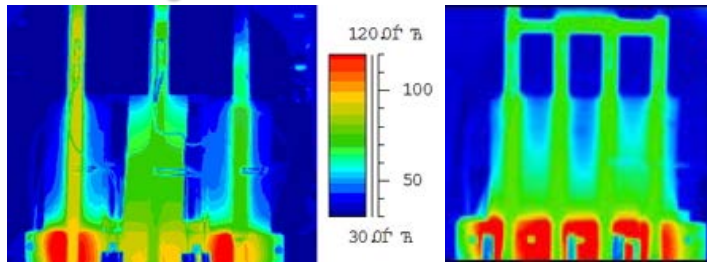


Kapton flexible radiators with "self rewetting" fluids



Testing chamber for parabolic flights

Thermophysical properties measurements  
"Self-rewetting" fluids and nanofluids for heat exchanger



Thermographical pictures

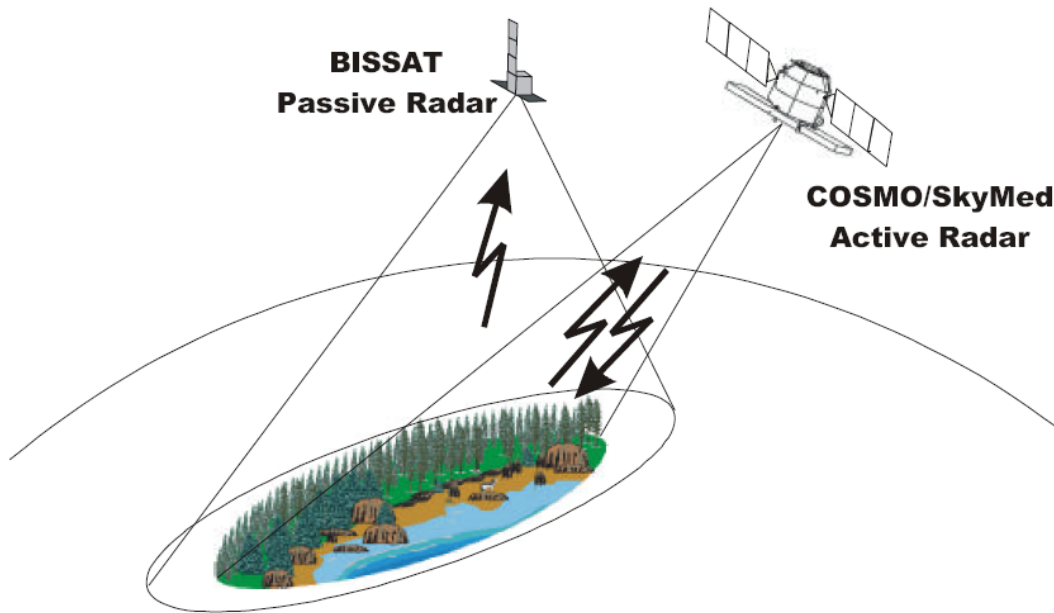
High efficiency heat pipes development (Joint patent - Japanese Patent office, n. 2007002436).  
Development of an experiment onboard the ASI microsatellite MIOsat

Collaboration with:



Bistatic interferometric space mission of a Synthetic Aperture Radar operating in conjunction with the Italian Mission COSMO-SkyMed

Main objectives: High resolution remote sensing for topographical applications, velocity measurements, multi-angle observations to improve selectivity and classification.

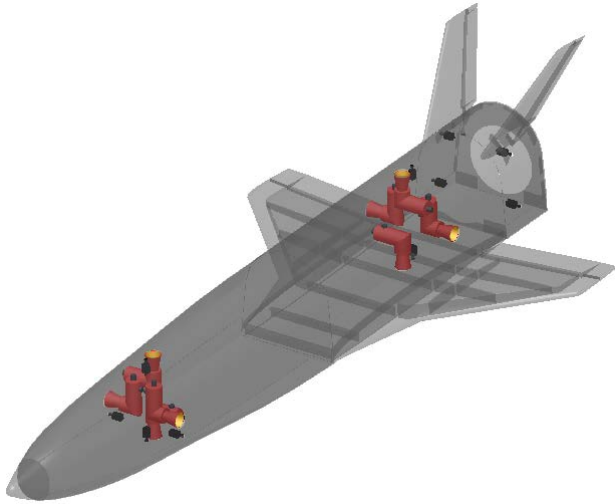


Mission approved by ASI

Thales Alenia Space prime contractor

Operated under the scientific supervision and responsibility of DIAS

## Bistatic SAR for Earth observation



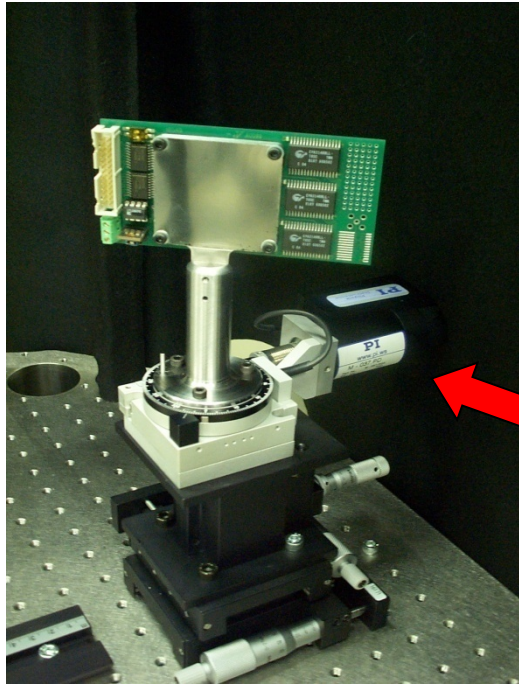
Development of GN&C algorithms for unmanned space vehicles:

Collaborations with CIRA for the **USV (Unmanned Space Vehicle)** project



Development of GN&C algorithms for measurement and control of satellites flying in formation:

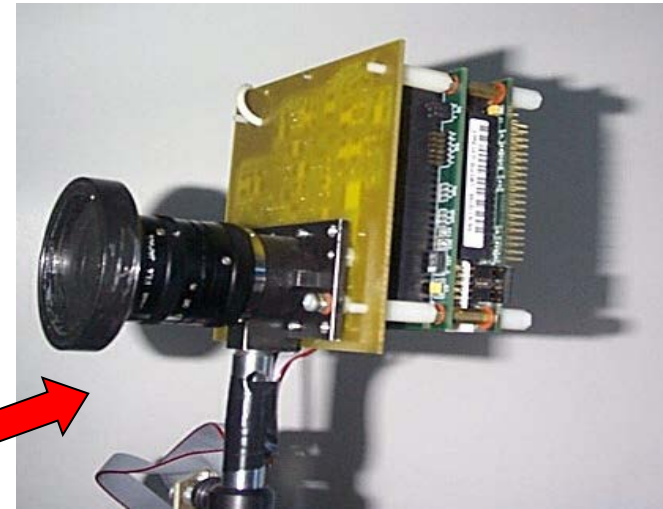
ASI projects, jointly developed with Thales Alenia Space Italy in the framework of the bistatic mission **SABRINA**



Solar sensor CMOS (Micro Electro-Mechanical System)

The solar sensor has been selected as demonstration payload onboard the first ASI microsatellite (MIOSAT)

Development of prototypes of solar and stellar sensors



Stellar sensor MOS



INS-GPS System (Micro Electro-Mechanical System for the inertial-satellite integrated navigation)





Pressure instability measurement and analysis inside the combustion chamber

Performance measurements of propellants including aluminum nanoparticles



***Combustion simulation for Ram/scram jets***

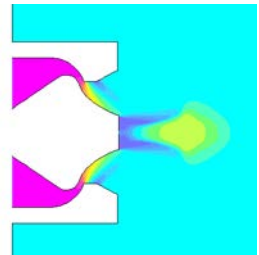
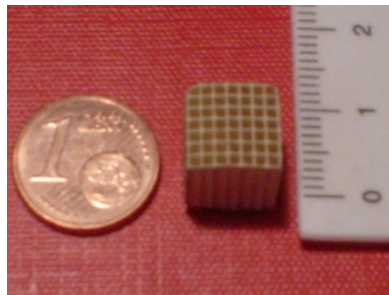


Hybrid propellant rocket

Max thrust up to 2000 N


Combustion chamber pressure up to 30 atm


***Green Propellants for OMS and RCS applications***



***Non-conventional supersonic nozzles***






 English version
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 Job opportunities
 Contatti

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Aeronautica
 Spazio
 TIBS

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### News

**14 Ottobre 2008** CALENDARIO DEGLI ESAMI DEL MESE DI OTTOBRE 2008  
 Le date relative alle sessioni d'esame del mese di ottobre 2008 per i Corsi tenuti dai Proff. L. Lecce e G. Renzulli sono disponibili nelle ...  
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**13 Ottobre 2008** CORSI DI FORMAZIONE SULLA TERMOGRAFIA



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