SPACE INFRASTRUCTURES ON GROUND

NETVAL ANNUAL CONERENCE 2023

MONOPOLI

18-20 SETTEMBRE

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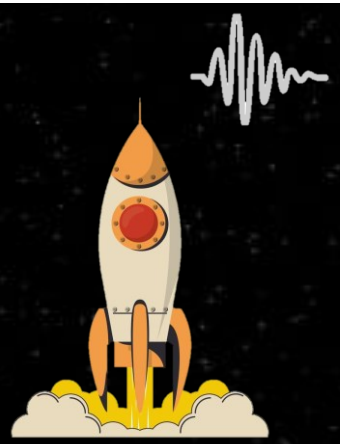
CIRA -INFRASTRUCTURES DIRECTOR



During the initial phases of a launch, high velocity gases are ejected from engine nozzles and reflected from the ground, creating turbulence in the surrounding air and inducing a vibratory response of the rocket structure.
Acoustic energy is the primary source of vibration input to a space launch vehicle. Acoustic vibration occurs over a broad frequency range **(30 Hz to 10000 Hz)**. **Overall Acoustic Sound Pressure Level ≥ 140 dB.**

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During flight, the spacecraft is subjected to static and dynamic loads.
Such excitations may be of aerodynamic origin (e.g., wind, gusts, or buffeting at transonic velocity) or due to the propulsion systems.

Moreover pyrotechnic shock is associated with the firing of an explosive device, usually for the purpose of initiating or performing a mechanical action

(**e.g.,** stage separation, fairing opening **2.000 g @1000 Hz)**

Last update 11 August 2023
36.500 space debris objects greater than 10 cm
1.000.000 space debris objects from greater than 1 cm to 10 cm
130 million space debris objects from greater than 1 mm to 1 cm

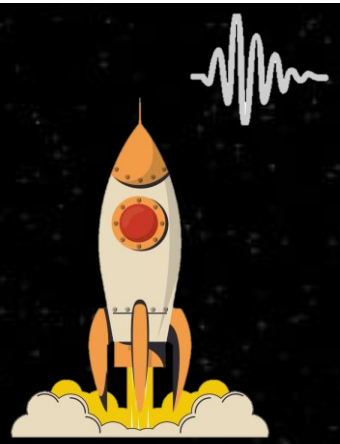
Spacecraft receive thermal energy from internal and external sources when they flight around the Earth

- solar radiation (direct and reflected)
- infrared radiation emitted by the Earth

This results for example in extreme temperatures from **-120 ° C to + 150 ° C.**

Spacecrafts have to withstand extreme aerothermodynamics heating when they re- enter the atmosphere.

Depending on the aerodynamic shapes and re-entry conditions temperature higher than 1300° C – 1700° C are experienced by external surfaces



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QUALIFICATION BEFORE FLIGHT

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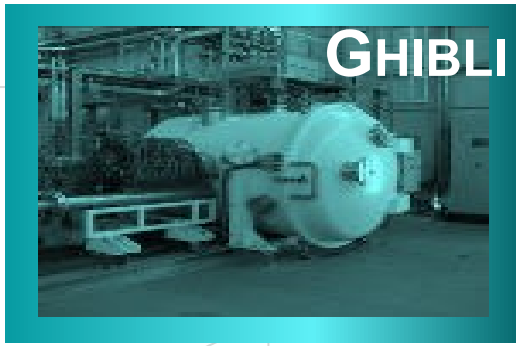
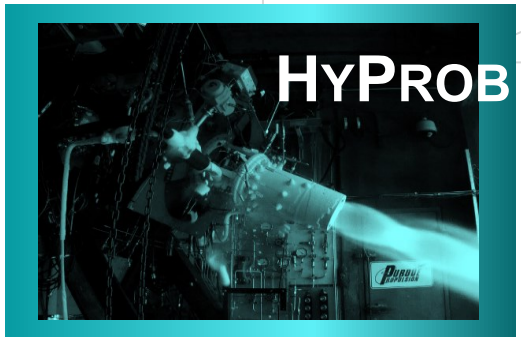
Main Research and Qualification Infrastructures

FEEL INTEGRATE EXPERIMENT

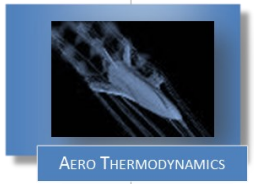


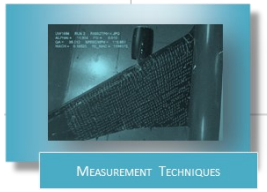


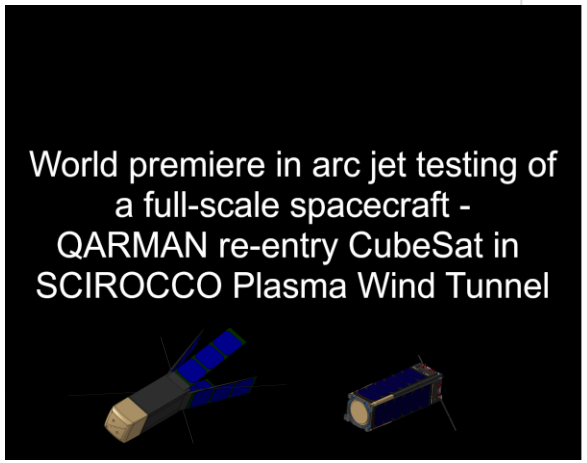
NEXT IS COMING…

PWT – Plasma Wind Tunnel


Structures & Materials


Aero Thermodynamics


Measurement Techniques

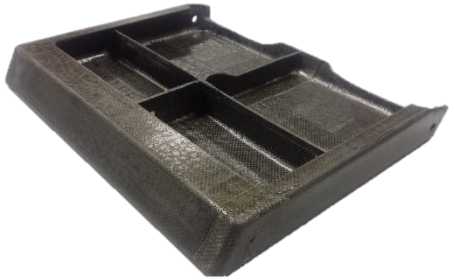


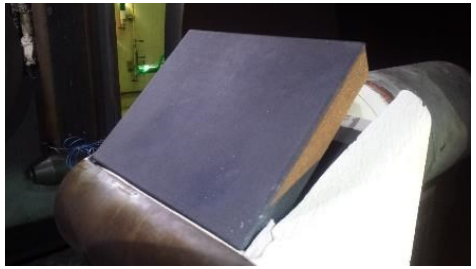
Goal: Improve safety of re-entry space vehicles

Use: Design and test thermal protection systems for space vehicles

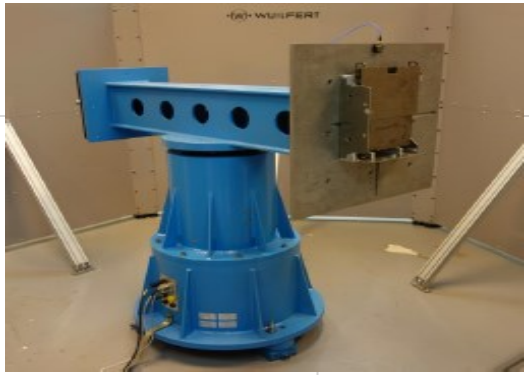
- Operative since: 2002
- Testing fluid: AIR
- Max speed: up to Mach 12
- Stagnation temperature: ~ 10.000 ° C
- Max test durations: < 25 minutes
- Nozzle exit diameter: 2.0 m
- Nominal dimension of test specimen: 0.6 m
- Max power of arc heater: 70 MW

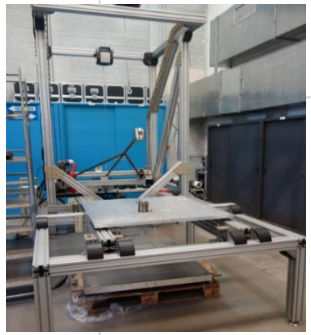
SCIROCCO TESTING OF A BFA DEMONSTRATOR (400MMX300MM) – 600S – 1200DEGC

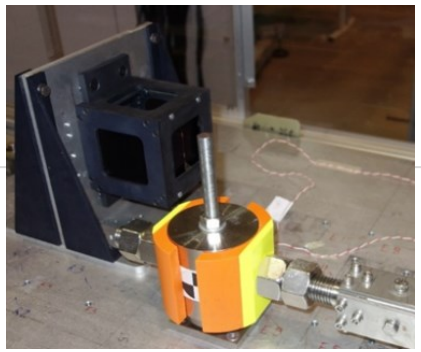




Test & Qualify



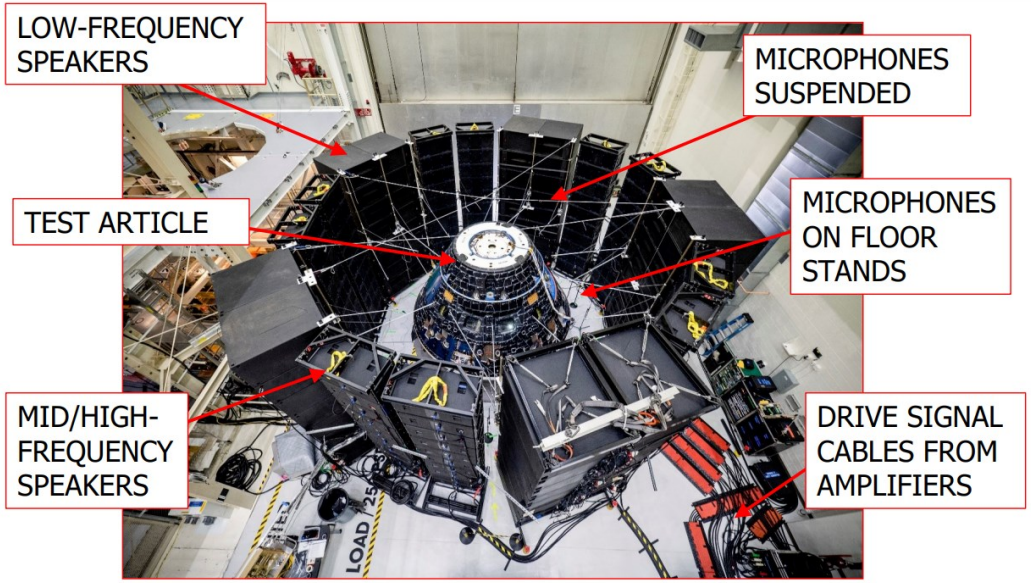




Standard ESA, ECSS-E-10-03C, MIL-STD-810G

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
- Platform for measurement
- Vibration Table
- Mechanical Shock Test facility

TEST & QUALIFY

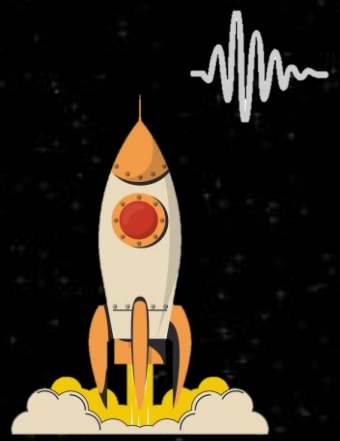


Courtesy of MSI-DFAT

THE INNOVATIVE DFAN SYSTEM ALLOWS SPACE STRUCTURES TO BE QUALIFIED FOR ACOUSTIC LOADS AT LAUNCH BY SUBJECTING THEM TO ACOUSTIC WAVES GENERATED IN A DIRECT FIELD BY LOUDSPEAKER ARRAYS POSITIONED AROUND THE TEST ARTICLE, IN ORDER TO EXACTLY REPLICATE THE OPERATIONAL ACOUSTIC SPECTRUM

DIRECT FIELD ACOUSTIC NOISE

Courtesy of MSI-DFAT



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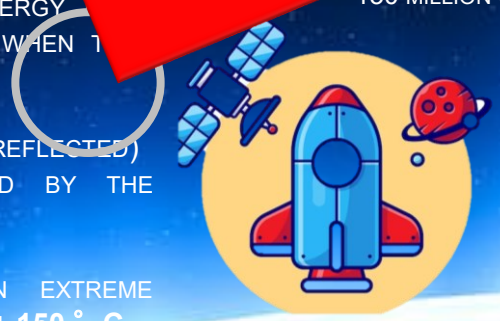

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IXV (Exhibition in Caserta Royal Palace, June-July 2015)