

A 300 ZERO-G

Parabolic Flights with A300 ZERO-G

Aircraft Capabilities and Opportunities

CSA – April 2010



NOVSPACE Table of Contents



- European Parabolic Flight Program overview
Introduction of NOVSPACE and Program Overview
- Overview of A300 ZERO-G
History, Aircraft Capabilities – Cabin, technical available means
- Parabolic Flights with A300 ZERO-G
Schedule, flight profiles, Parabolic Flights for What?
- Available Services
Partial-G, hyper-G, GMO, vertebrates
- Access to European Parabolic Flights for Canadian Scientific Community





NOVSPACE Introduction of NOVSPACE (1/2)

French company founded in 1986, for improvement of space technology transfer

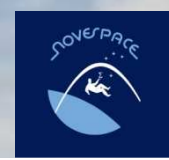
Main activity :

Other activities :

Parabolic Flight for Research

Observation Missions for Space Agencies

Flight Test for Aeronautic Industry



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Introduction of NOVSPACE (2/2)



Shareholders

- Public :
- French Space Agency (CNES): 59,39%
 - OSEO : 4,06% (French governmental agency for innovation)
- Private :
- Pool of Banks : 36,53%

Location

Paris (headquarters) and Bordeaux-Mérignac (A300 ZERO-G base)



A 300 ZERO-G

NOVSPACE Program Overview



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Overview of A300 ZERO-G – History (1/2)

A300 S:N 003, first flight in 1973

Prototype Aircraft Life:

- Used by Airbus as prototype for certification and development
- Used by systems and engine manufacturers for development





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Overview of A300 ZERO-G – History (2/2)

Bought by NOVSPACE in 1996 and modified by Sabena Technics

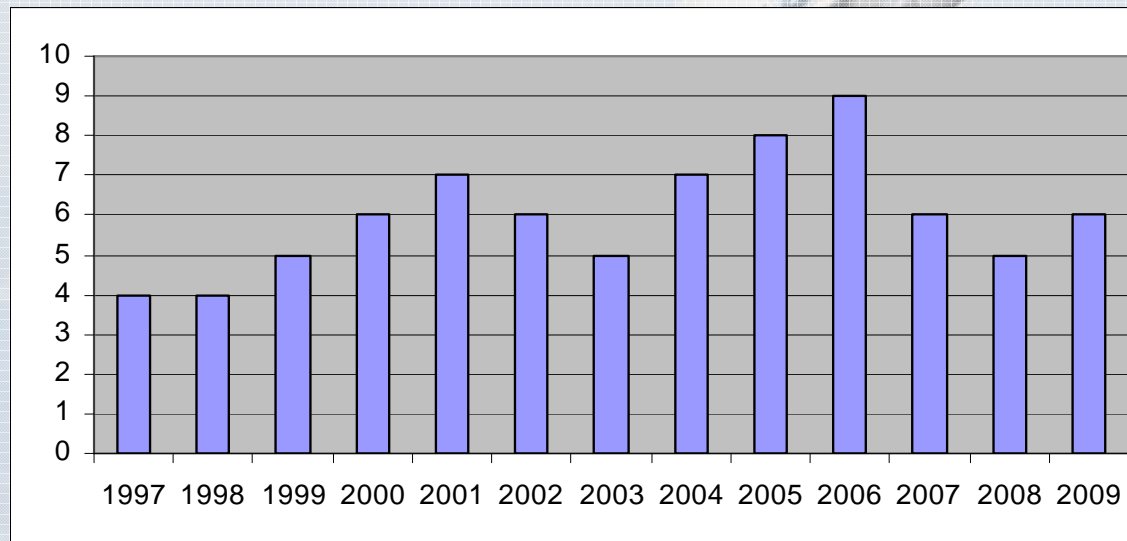
Operated in parabolic flight since 1997

Record :

81 Parabolic Flight Campaigns

9717 Parabolas

3900 Flight Hours (vs 2300 hr/y for an airliner)



For 2010,
6 Parabolic Flight
Campaigns to be
performed

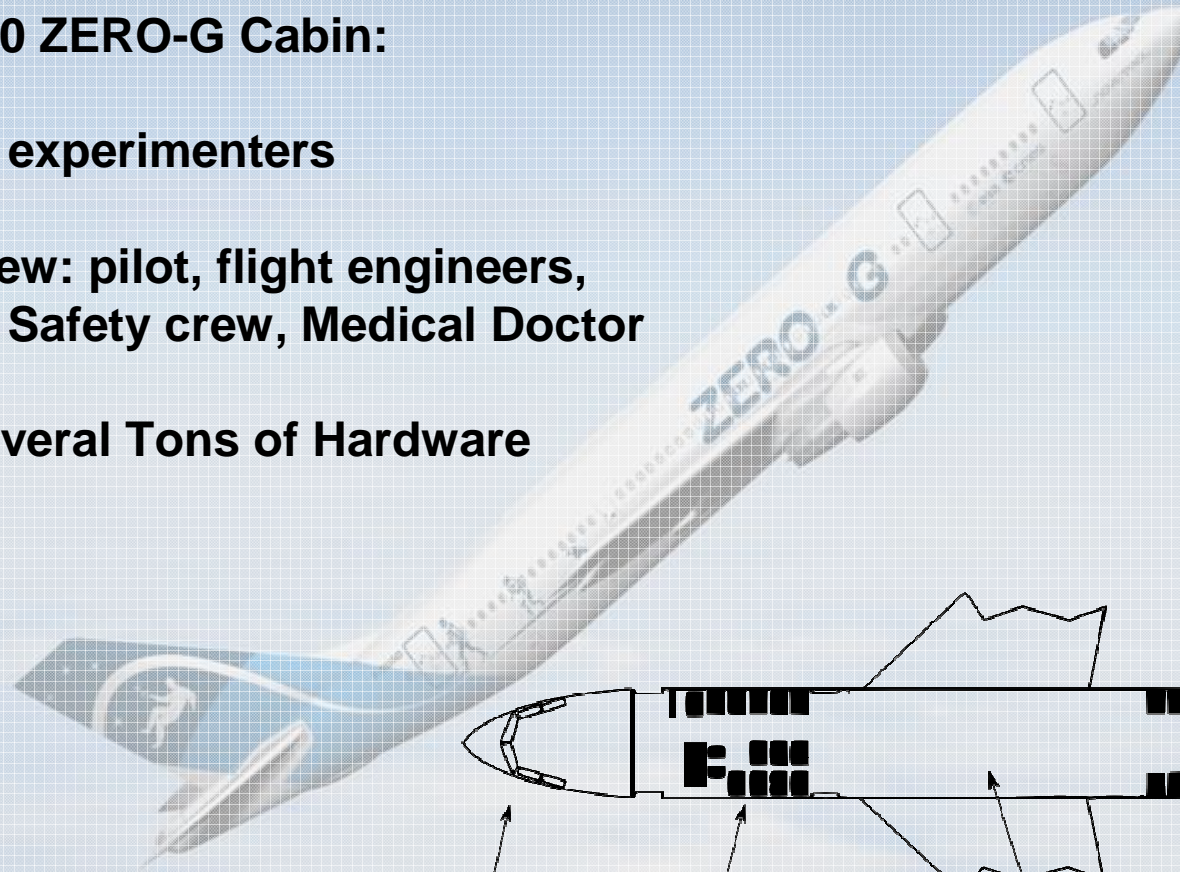


A300 ZERO-G Capabilities - Cabin (1/4)



A300 ZERO-G Cabin:

- 40 experimenters
- Crew: pilot, flight engineers, Safety crew, Medical Doctor
- Several Tons of Hardware



Cockpit

Front seat area

Experiment test area

Rear seat area





A300 ZERO-G Experiment Test Area:

Widest microgravity testing area in parabolic flight



Overall dimensions:

20m x 5m x 2m

65.5ft x 16.4ft x 6.5ft



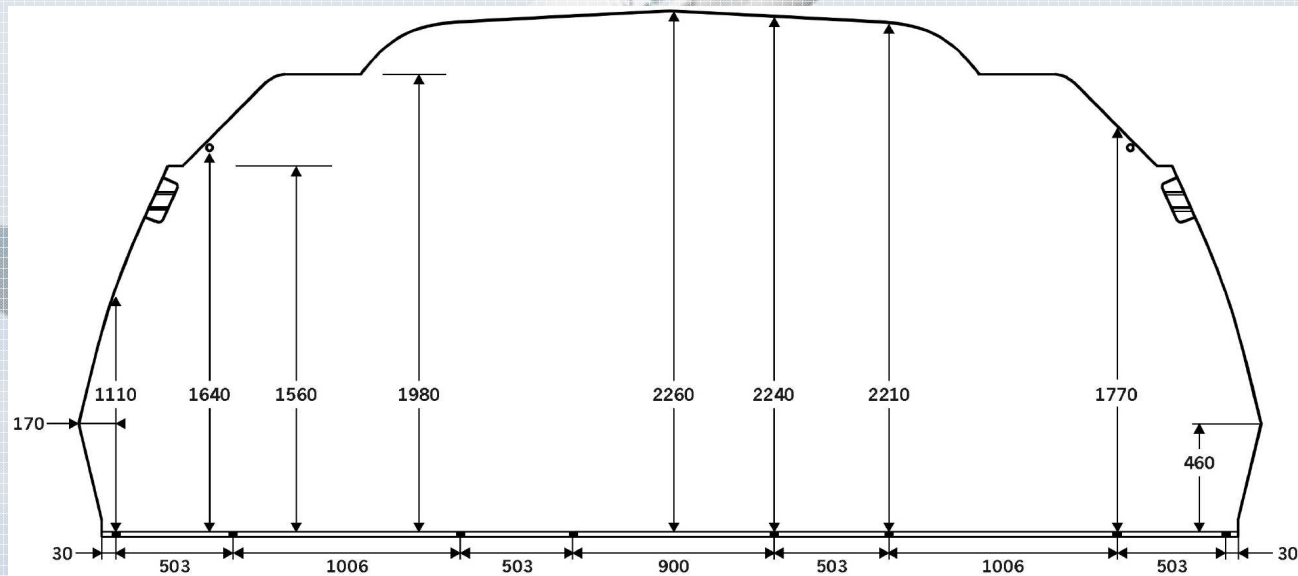


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A300 ZERO-G Capabilities - Cabin (3/4)

A300 ZERO-G Experiment Test Area:

- An average of 13 experiments (75 exp/y)
- Possibility to have hardware in Free-Floating
- Several Test subjects could be tested in different orientations





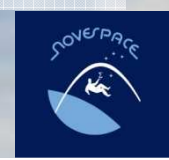
A300 ZERO-G Experiment Test Area: Test of long hardware



JAXA
ETS-VIII
deployment



DLR Boom deployment





During the flight, following means are available: power sources

- Power Supply in AC
 - 10 electrical panels w/ 4x230V-AC sockets available
 - max. 2kVA / electrical panel
- Power Supply in DC
 - 5 electrical panels w/ 2x28V-DC sockets available
 - max. 560 VA / electrical panel



Electrical panels are available all along the experiment test area





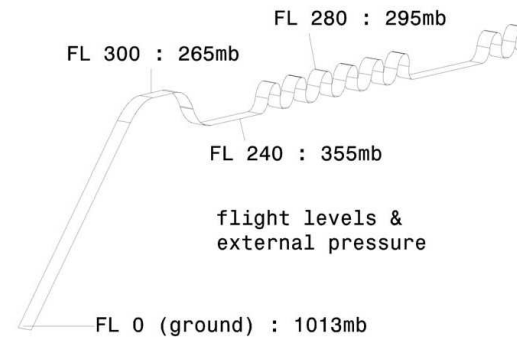
During the flight, following means are available: vent-lines

- 4 overboard vent ports / vent-lines

Ports used to

- exhaust experimental products out of test cell
- decrease the pressure within a test cell

Overboard vent ports are connected to outside atmosphere



Overboard vent ports are available at each the experiment test area corners





During the flight, following means are available: handrails

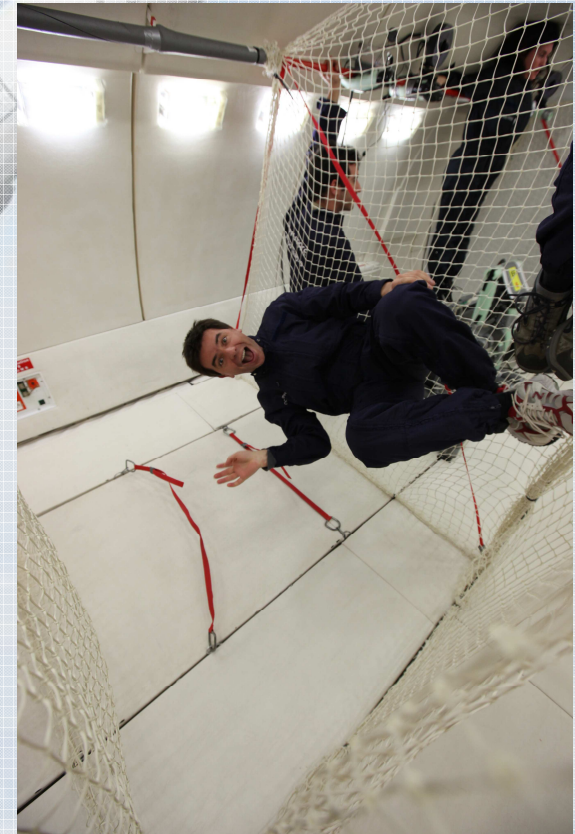
- 2 rigid handrails along the test experiment area
 - Camera fixation
 - IR camera emitters for Life Science experiment
 - ...
- 1 soft handrail at cabin ceiling





During the flight, following means are available: vertical nets

- Possibility to isolate some parts of the experiment test area to avoid test subject disturbance
- to perform Free-Floating with piece of hardware
- ...



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NOVSPACE PFC Schedule (1/2)



From Selection up to Parabolic Flight Campaign :

- Selection from 4 to 6 months before the flights
- Technical Workshop
- Technical Definition of the flight configuration:
 - Hardware definition through technical documentation,
 - NOVSPACE internal review board of experiment design,
 - Validation and acceptation of H/W by Flight Test Center & NOV,
 - Validation of shared means available in flight and on site,
 - Science goal vs Safety,
 - 1 team, 1 NOVSPACE engineer.
- Administrative matters management
 - Attendee List,
 - Medical Assessment,
 - Liability Release Form



NOVSPACE PFC Schedule (2/2)



Standard Parabolic Flight Campaign :

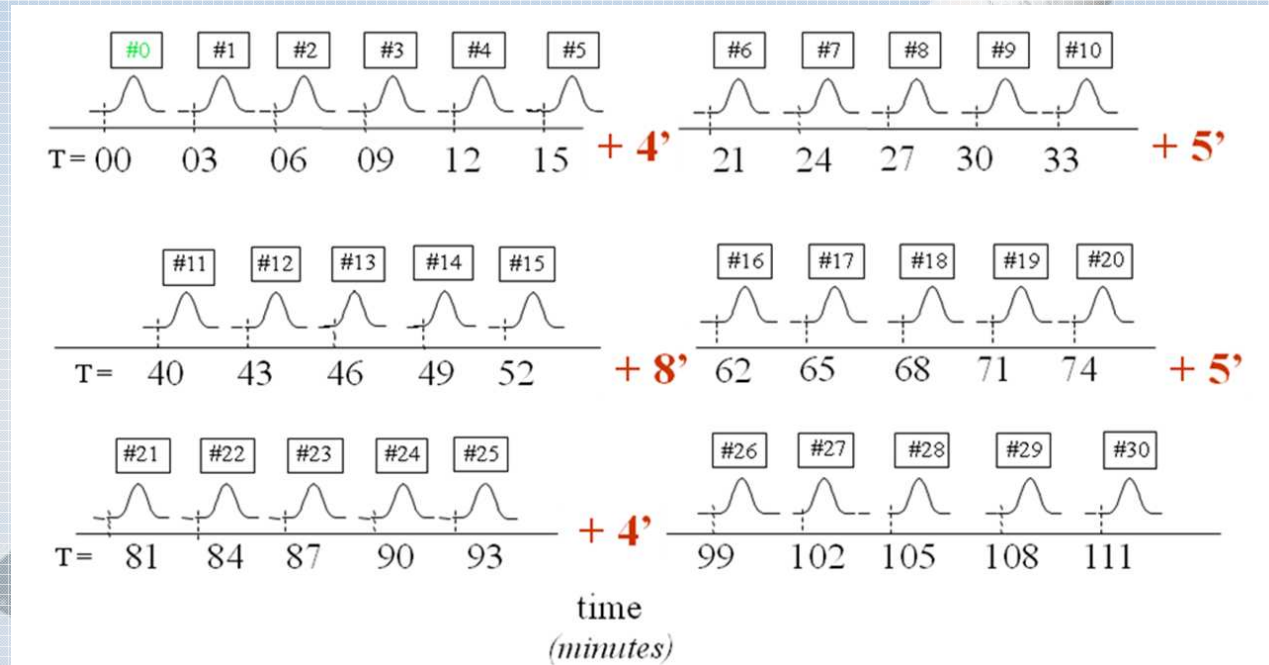
- 2 weeks
- 12 to 15 experiments
- 3/4 flights are performed over 3/4 days:
 - experiment changes in between flights,
 - bug correction, ...
- Each flight are made of series of parabolas:
 - In total 31 parabolas
 - Experimental parameter could be adjusted in between parabolas or set of parabolas
- Mainly from Bordeaux-Merignac airport



NOVSPACE Flight Profile



Standard Flight Profile



Flight Profile could be adjusted upon requests.

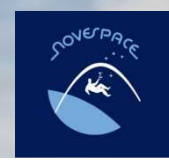
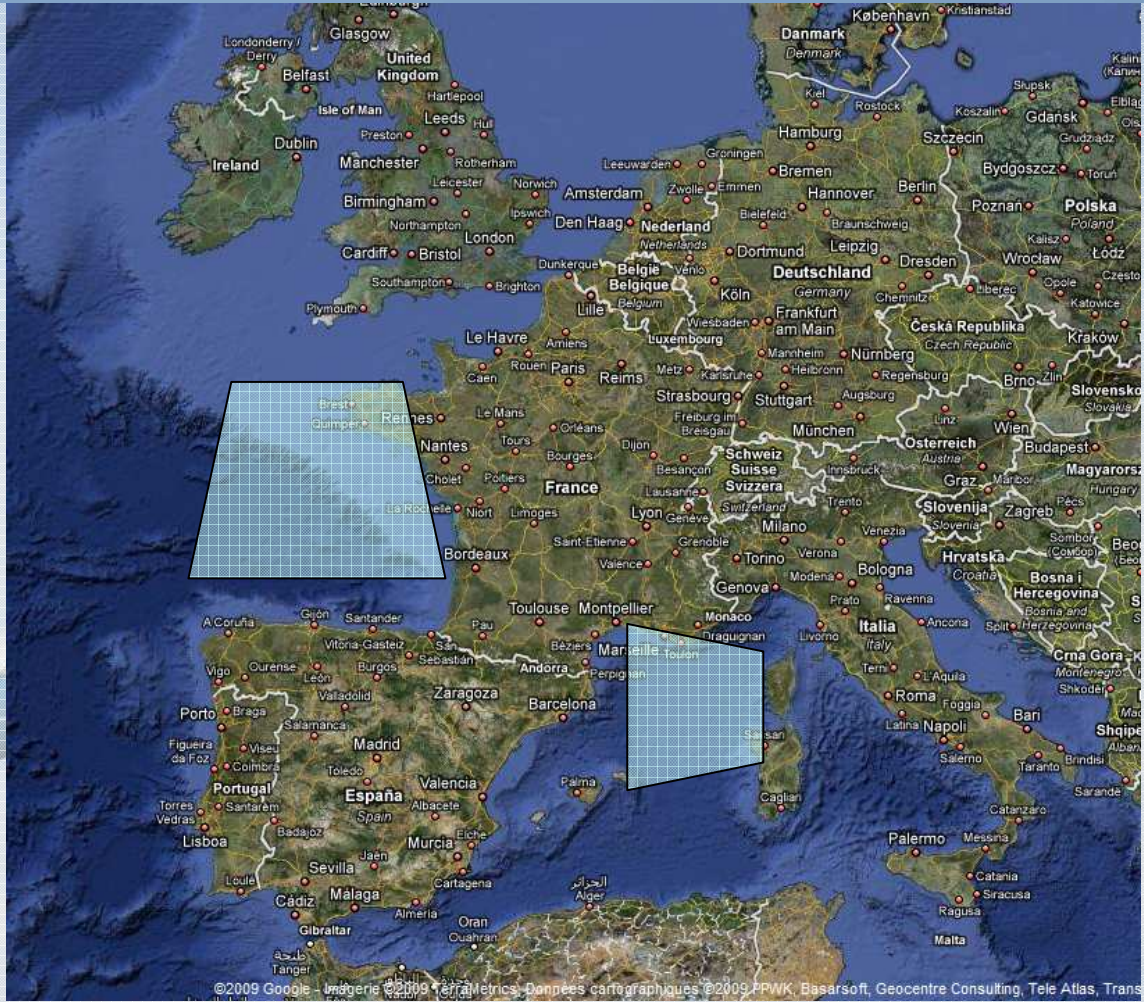


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NOVSPACE Flight Areas



Dedicated
Flight
Area





Science!

- Gravity hides phenomena that are key to solving outstanding scientific questions.
- The effects of gravity tend to make the execution of experiments or the analysis of experimental results difficult and sometimes even impossible.

As results, microgravity proved particularly useful in the research fields of Physics, Biology, Chemistry, Physiology, Space hardware improvement.

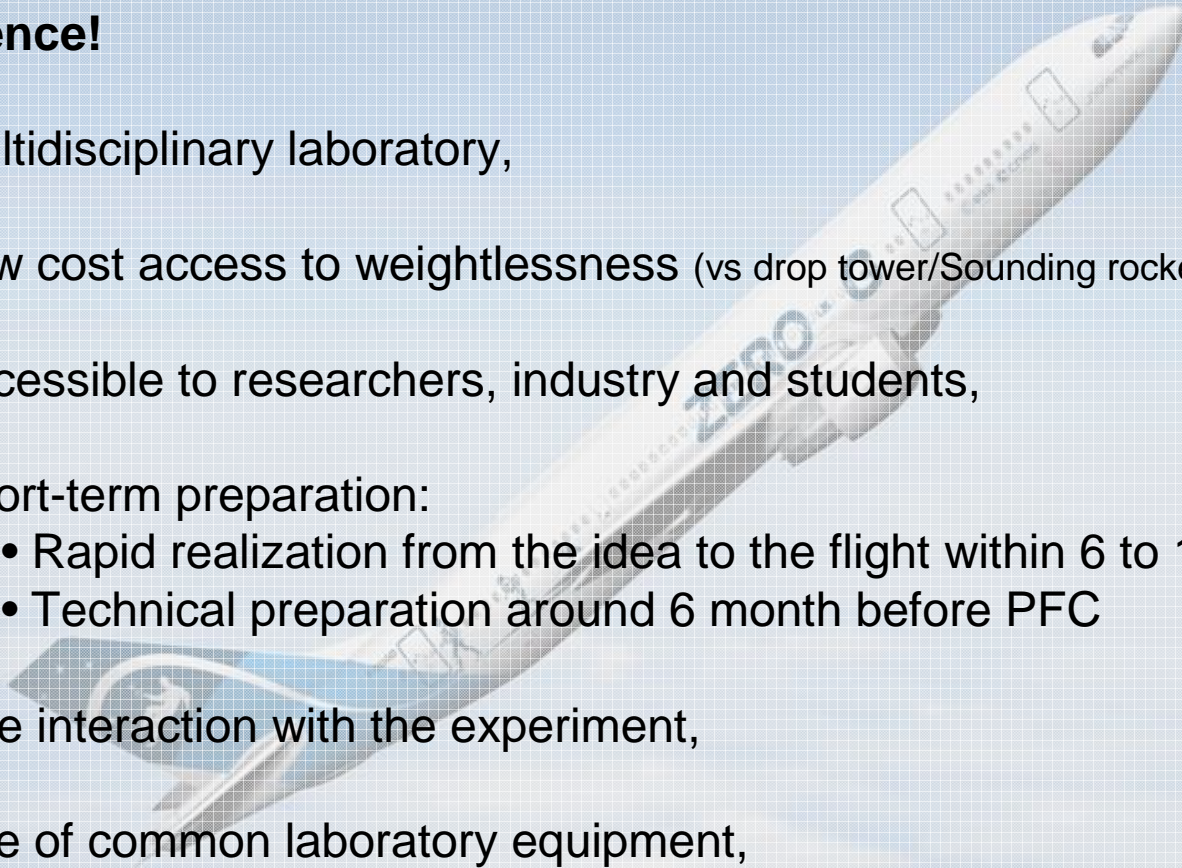
- Parabolic Flights are one platform for microgravity research.
- Advantages: low cost, repetition of several period of 0g, fast access, live fine tuning, experimenter acting on H/W,





Science!

- Multidisciplinary laboratory,
- Low cost access to weightlessness (vs drop tower/Sounding rocket/ISS),
- Accessible to researchers, industry and students,
- Short-term preparation:
 - Rapid realization from the idea to the flight within 6 to 12 months
 - Technical preparation around 6 month before PFC
- Live interaction with the experiment,
- Use of common laboratory equipment,
- Hundreds of scientific publications





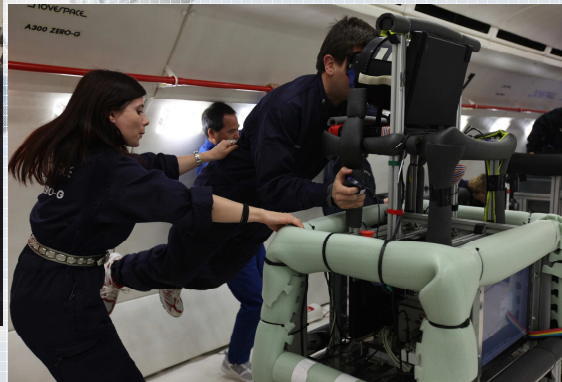
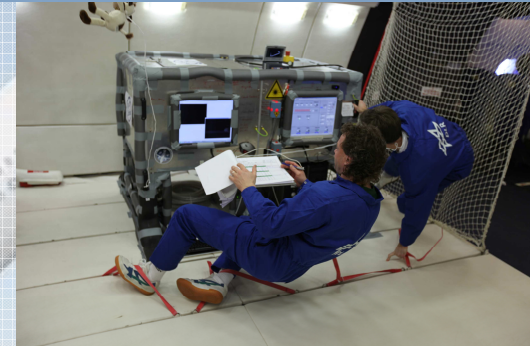
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Why Parabolic Flight? Science! (3/3)

Science!



Biology,
Physiology,
Physics,
Combustion,
Material Science,
Fluid Science, ...



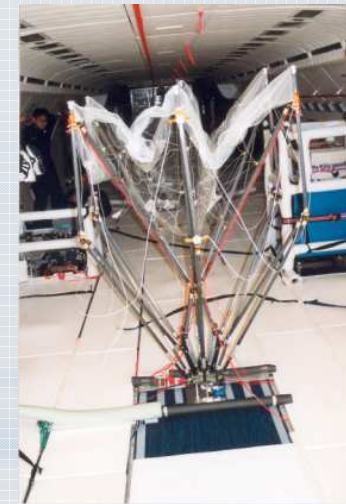
Why Parabolic Flight? Technology!

Technology!

Deployment technology
(solar arrays, antennas...)

Test of Cubesat POD

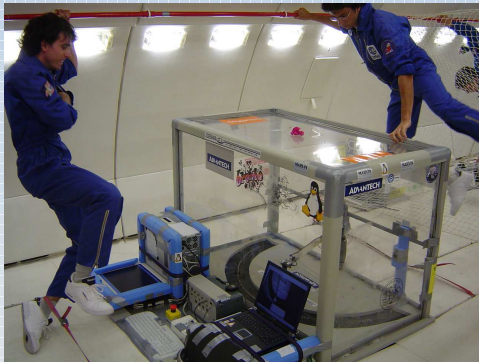
Tests before Space flights



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Why Parabolic Flight? Education!

Education! ... for next generation of scientist and space engineer



Project Management



Experiment design



Astronaut Training!



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Why Parabolic Flight? Communication!

Communication!



Credit DLR

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NOVSPACE Partial/Hyper-G Level



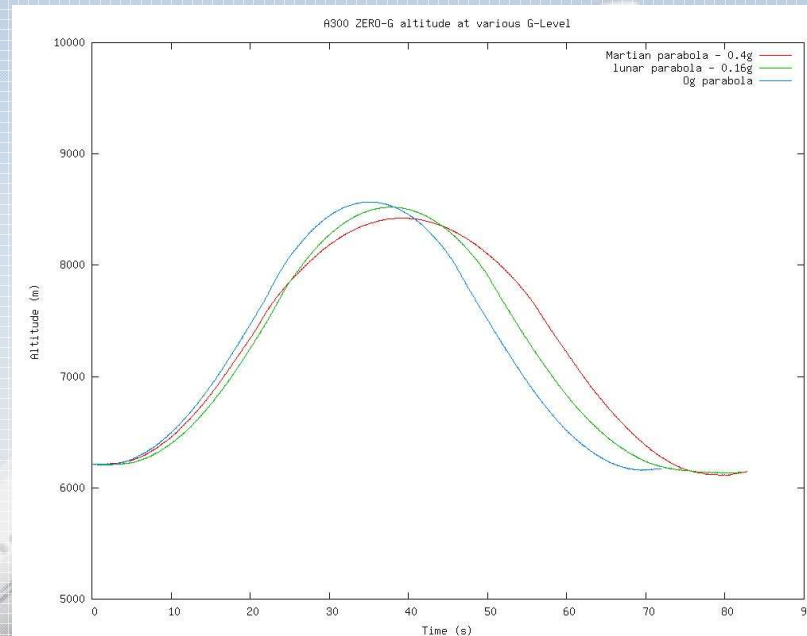
NEW!

Microgravity – 0g
Duration : 22 s

Lunar G level – 0.16g
Duration : 25 s

Martian parabolas – 0.4g
Duration : 35 s

Hypergravity-G level – 1.4g, 1.8g
Duration : several minutes

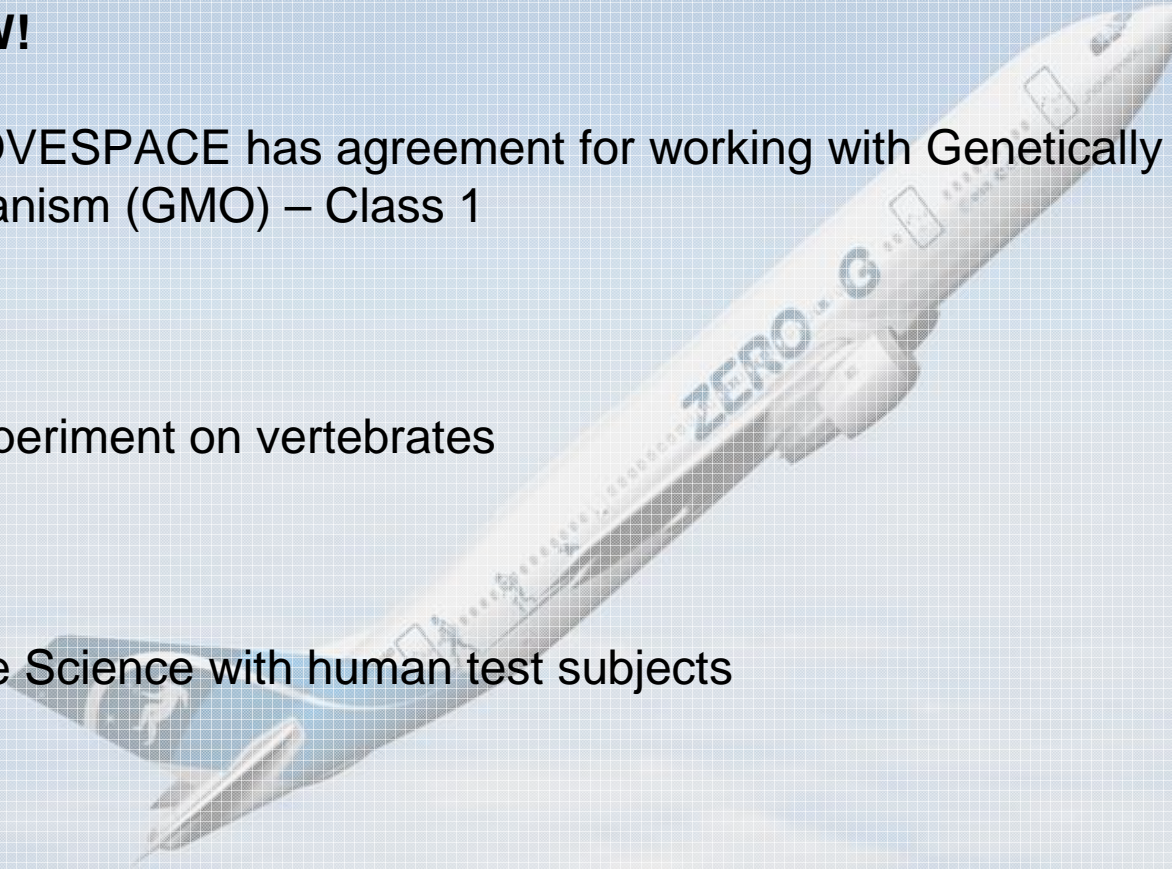


Research requiring specific authorization



NEW!

- NOVSPACE has agreement for working with Genetically Modified Organism (GMO) – Class 1
- Experiment on vertebrates
- Life Science with human test subjects
- Authorization for using X-ray sources



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How to access to A300 ZERO-G?



- Canada is a cooperating state within ESA,
- Granting access to Canadian scientific community to ESA Parabolic Flights (Univ. Laval, CSA)
- ESA Continuously Open Research Announcements (Announcement of Opportunity) at:
<http://spaceflight.esa.int/users/index.cfm?act=default.page&level=16&page=1613>
- Collaboration with European Experimenters (Univ. York)





ANY QUESTIONS?

This presentation is available upon request!

Credit Nasa

