# NOVESPACE

## Table of Contents

- European Parabolic Flight Program overview
  
  Introduction of NOVESPACE 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
NOVESPACE

Introduction of NOVESPACE (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
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)
NOVESPACE
Program Overview

Partners and Customers

CnES
ESA

Customers

DLR
JAXA
EADS
... Other industries

A300 ZERO-G owner
Program manager

Aircraft maintenance

Sabena Technics
TAT Group

Flight Test Center
Flight operation & Safety

MINISTERE DE LA DEFENSE
DGA

CSA – April 2010
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- **Access to European Parabolic Flights for Canadian Scientific Community**
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
Bought by NOVESPACE 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 Cabin:

- 40 experimenters

- Crew: pilot, flight engineers, Safety crew, Medical Doctor

- Several Tons of Hardware
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
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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NOVESPACE
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,
  • NOVESPACE internal review board of experiment design,
  • Validation and acceptance 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 NOVESPACE engineer.
• Administrative matters management
  • Attendee List,
  • Medical Assessment,
  • Liability Release Form
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
Standard Flight Profile

Flight Profile could be adjusted upon requests.
NOVESPACE Flight Areas

Dedicated Flight Area
Why Parabolic Flight? 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 a result, 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
NOVESPACE
Why Parabolic Flight? Science! (3/3)

Science!

Biology, Physiology, Physics, Combustion, Material Science, Fluid Science, ...
Why Parabolic Flight? Technology!

- Deployment technology (solar arrays, antennas...)
- Test of Cubesat POD
- Tests before Space flights
Why Parabolic Flight? Education!

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

Project Management

Astronaut Training!

Experiment design
NOVESPACE
Why Parabolic Flight? Communication!

Communication!

Credit DLR
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NOVESPACE
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
NOVESPACE
Research requiring specific authorization

NEW!

• NOVESPACE 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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NOVESPACE
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