



Armstrong Flight Research Center Microgravity Flight Services

Industry Day

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Overview of Current NASA Demand for MFS

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Overview of Current NASA Demand for MFS

Recent History:

- NASA JSC Reduced Gravity Office provided payload support
 - › All flights were Public Aircraft Operations with NASA airworthiness certification and payload safety responsibility
 - › NASA provided a hangar and ramp at Ellington Field, Houston, for experimenter support, payload integration, and flight operations
 - › NASA provided payload analysis and safety approval
 - › NASA provided aeromedical support for airsickness mitigation
- Contract provided aircraft, maintenance, and flight support
 - › Aircraft deployed from Contractor base to Ellington Field
 - › Contractor provided air & ground crew, payload installation, & flight
- Total flight weeks for 2012, 2013, and 2014 were 12, 9, and 9 respectively.
 - › Number of flights was dependent on quality, availability, and cost.

Overview of Current NASA Demand for MFS

Three Main NASA Customers:

- Flight Opportunities Program
 - › Provides NASA grants to NASA researchers, Universities, and Private Companies who want to validate and demonstrate developing space technologies.
- JSC Reduced Gravity Education Flight Program
 - › Provides a unique academic experience for undergraduate students and educators to successfully propose, design, fabricate, fly, and evaluate a microgravity experiment of their choice. Contributes to NASA's goal of nurturing the interest of a new generation in science, technology, engineering, and math (STEM) related careers.
- Individual NASA Projects
 - › Consists of projects with a need to test systems, components, or processes bound for the International Space Station and beyond.

Overview of Current NASA Demand for MFS

Flight Opportunities Program

- Sample Experiments include:
 - Launch propulsion systems
 - Thermal management systems
 - Tele-robotics
 - Materials science
 - Structural and mechanical systems
 - Manufacturing
- 4 Flight Weeks a year
(16 – 20 flights)



FOP Experimenters ride-out hyper-g during an August NASA C-9 flight.



Same Experimenters spring into action during zero-g.

Flight Opportunities Program

Charter:

To facilitate maturation of cross-cutting space technologies for NASA's Space Technology [Mission Directorate] . . .

. . . while achieving a goal of the National Space Policy to "Encourage and Facilitate" the growth of the U.S. commercial space industry

Create the innovative new space technologies for our exploration, science, and economic future.

- NASA Strategic Goal 3

Energize competitive domestic industries

- National Space Policy Goal 1

About Flight Opportunities

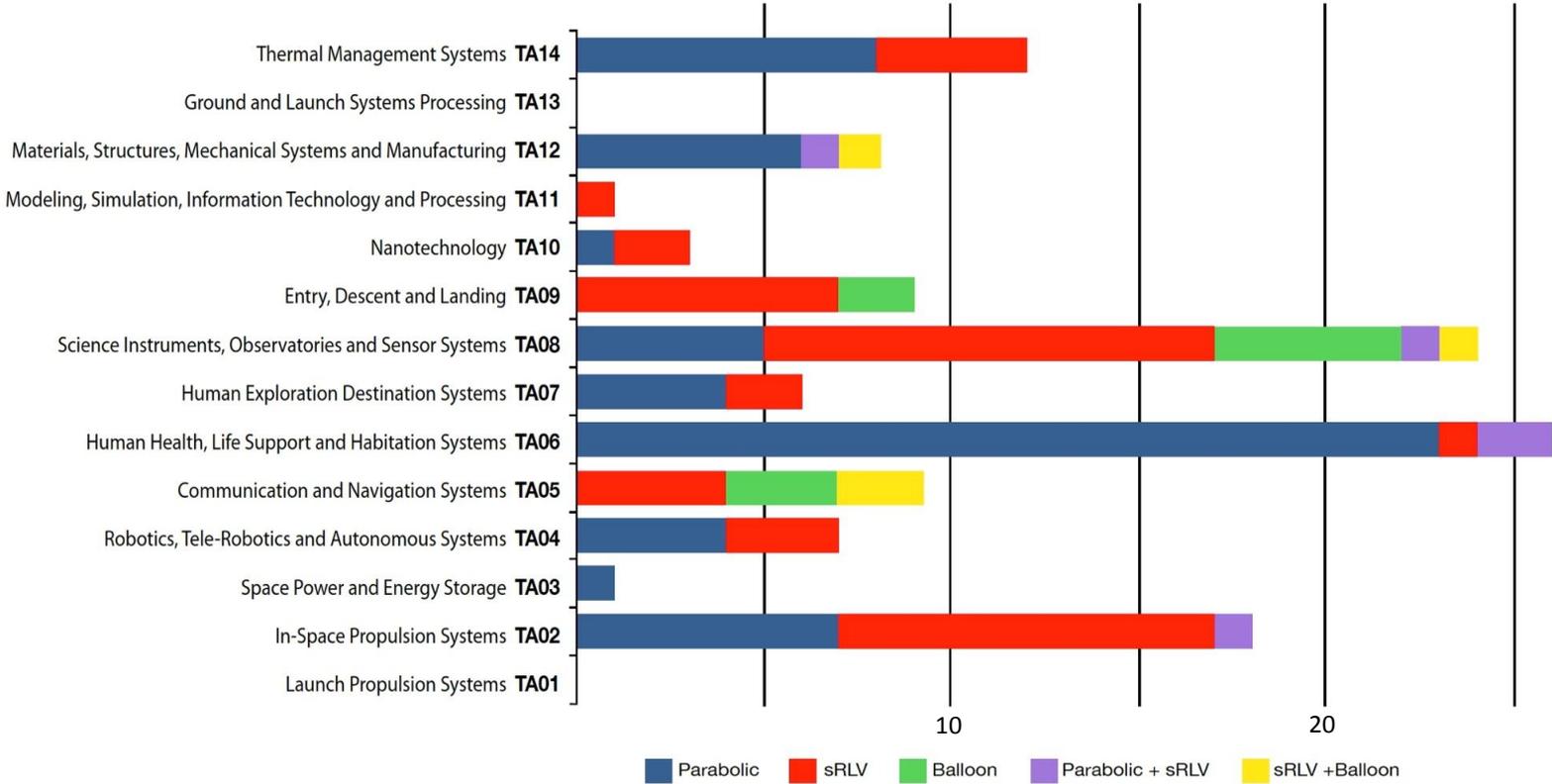
The Flight Opportunities Program within the NASA Space Technology Mission Directorate (STMD) helps foster the growth of the commercial spaceflight market while helping fulfill the overall goal of advancing space technology to meet future mission needs. The program achieves these self-reinforcing objectives by selecting promising technologies from industry, academia and government, and testing them on commercial suborbital launch vehicles. This approach takes technologies from a laboratory environment and gives them flight heritage, while also feeding the development of the spaceflight technologies and infrastructure being used by the companies Flight Opportunities purchases flights from.

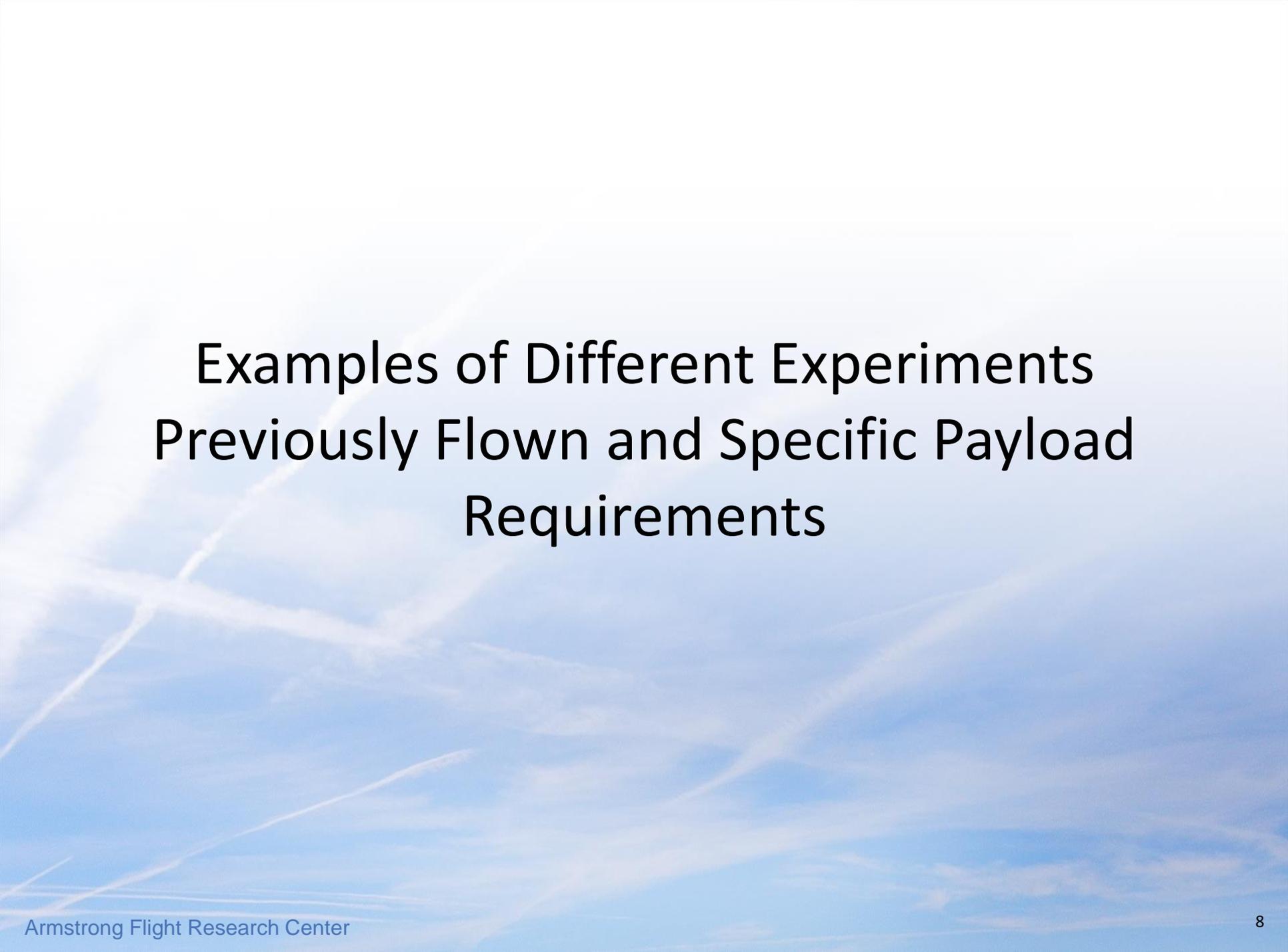


Flight Opportunities Program

	# Of Payloads	Flights	RGO Flight Week	Platform Used
2011	18	12	01, 02, 03	ZGC
2012	25	16	04, 05, 06, 07	ZGC
2013	23	20	08, 09, 10, 11, 12	ZGC
2014	22	23	13, 14, 15, 16	ZGC/NASA C9
Total	88	71	16	

Flight Opportunities Program





Examples of Different Experiments Previously Flown and Specific Payload Requirements

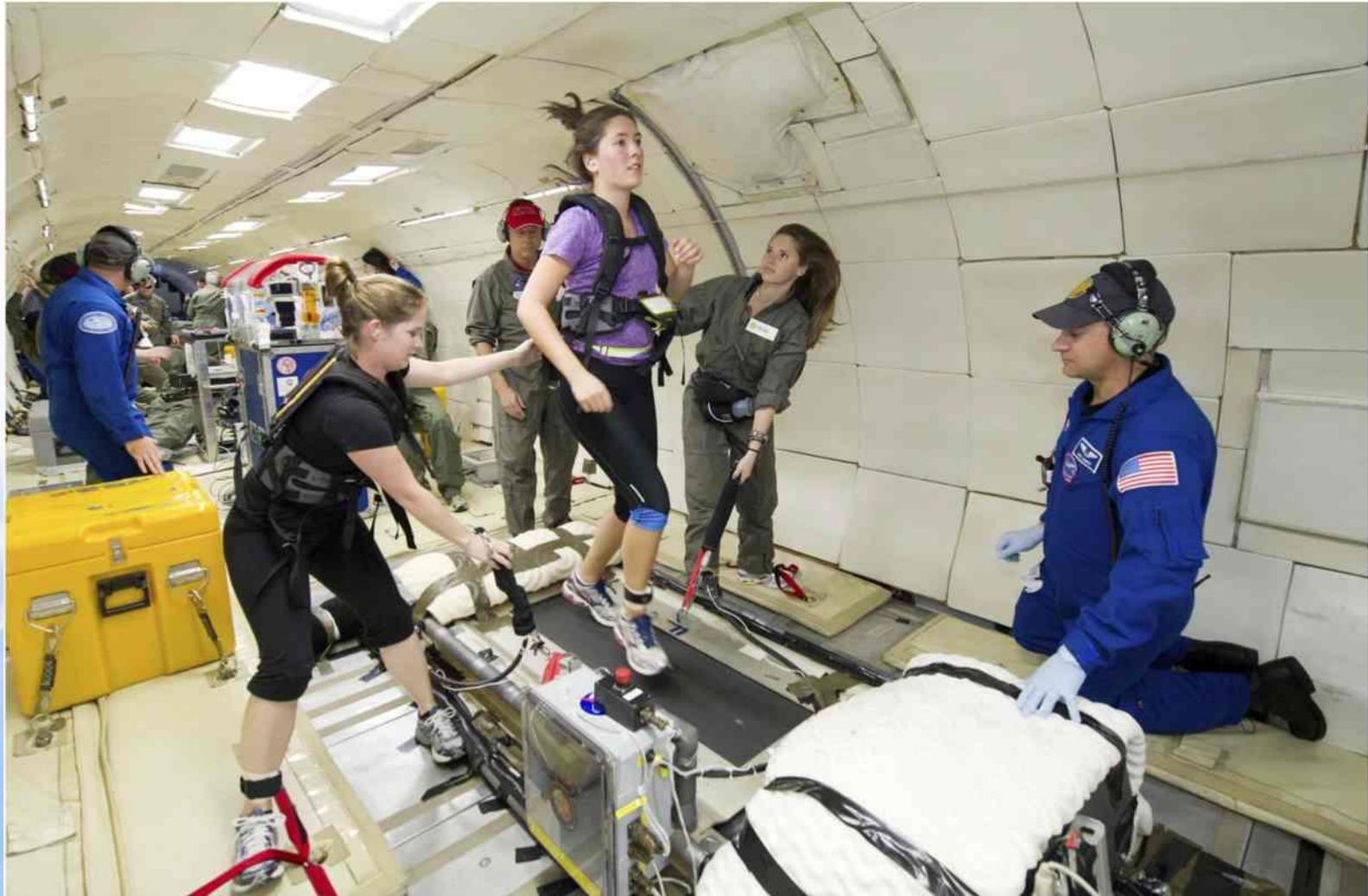
Free float

Testing control theories and performance



Non-standard power (230vac)

Validating software models of skeletal loading conditions



Projectiles

Testing space tether deployment to de-orbit satellites



Combustion

Observing changes in welding



Venting

Testing of a direct Ammonia Alkaline fuel cell and optimizing the electrochemical ammonia reduction subsystem



Human testing

Using Ommaya ports from former cancer patients to tap into the spinal fluid for measuring intracranial pressures.



Pressure Systems

Testing a new non-CO2 fire suppression system



Compressed Gas

Multiple types of gas and reasons for using them



Lasers & Seated positions

Human testing of body reactions to 0g. Laser sensor in headbands



Heavy / Large

Robot capture with human keep out zones and object containment



Overview of Current NASA Demand for MFS

Reduced Gravity Education Flight Program

- Sample Experiments include:
 - Combustion of regolith with magnesium
 - Fiber supported droplet combustion of biofuels
 - Material degassing
 - Liquid stabilization
 - Autonomous and adaptive docking
 - Electromagnetic position sensing
- 4 Flight Weeks a year (16 – 20 flights).



Univ. of Florida students observe contained experiment.



Univ. of Missouri, Rolla, students test medical device.

Overview of Current NASA Demand for MFS

NASA Projects

- Sample Experiments include:
 - IVA/EVA robotics
 - Space suit and tool testing
 - Fluid transfer, mixing, separation, and phase change testing.
 - Measurements of intraocular and intracranial pressures on human subjects
 - Human testing of drug delivery methods
 - Human testing of ultrasound and eyewash devices
- 3 - 4 Flight Weeks a year (12 – 20 flights).



Constellation seat testing



Constellation seat ingress/egress testing

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Summary of Potential Demand

- › Flight Opportunities
 - 4 Flight Weeks a year
(16 – 20 flights)
- › Reduced Gravity Education
 - 4 Flight Weeks a year
(16 – 20 flights)
- › NASA Projects
 - 3 - 4 Flight Weeks a year
(12 – 20 flights)
- **12 Flight Weeks Anticipated**
 - › 20 Flight Weeks Maximum
 - › Total will increase or decrease depending on quality, availability, and cost



NASA KC-135 just prior to retirement

