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IPAS: International Paper Airplanes in Space

Getaway Special Team 2009

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IPAS



International Paper Airplanes in Space

Project Overview

IPAS is an outreach project which will allow students from elementary schools around the world to participate in a spaceflight experiment. The involved students will construct and fly paper airplanes on Earth and record data on flight duration, flight characteristics, and total distance flown. Contests will be held at each school to select which of the many planes will fly. These airplanes will be sent to the ISS and flown again by the SFP with similar data recorded. The students will then be able to see how common objects act in space.

Payload Requirements

Mass: 100 g

Dimensions: 22 cm x 28 cm x 0.5 cm

Power: None

Data Acquisition: 1 hr video



Experiment Objectives

Outreach is the main focus of this project. Elementary school students will explore how microgravity is different from Earth gravity by using familiar classroom objects to participate first-hand in research. A few of the project goals are to:

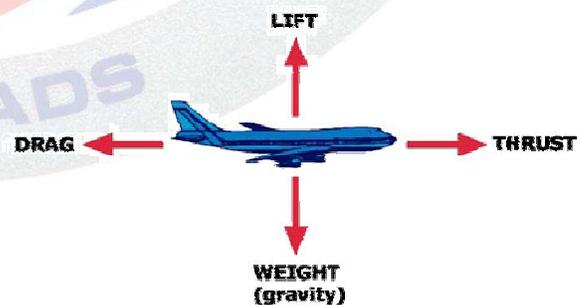
- Reach out to ~20 schools from the 16 ISS member countries (about 600 students).
- Select school-wide winners who will send their airplanes on the ISS.
- Create a project-wide video on the results to teach the students why their planes flew as they did.

Justification

While professional aerodynamicists could easily explain why the planes flew as they did, the children will be asked scientific questions such as:

- Do you think the planes will do the sort of tricks they do on Earth?
- Will you even be able to tell if they are flying or not?
- With weight removed from the lift-weight-thrust drag equation, what will happen?
- Do atmospheric conditions in microgravity have the same effects on the flight of the airplanes as they do on Earth?

Experiment Setup



Simplified force free-body diagram for a plane.
What happens when weight is removed?

Experiment Design

Contests will be held in elementary schools around the world to select 20 paper airplanes for flight on the ISS. Ideally, planes will be chosen from classes in each of the ISS partner nations. Elementary schools will be contacted through international students attending USU. Teachers at each school will select which paper airplanes will fly in space, thereby engaging more students.

Paper airplanes will be constructed from 8½" x 11" or A4 medium weight typing paper. Planes may be decorated with colored pencils, but no tape, glue, staples, or other attachments are permissible. Students will video record ground flights under controlled conditions, if possible. They will also describe the room in which their tests were done and record (if possible) the temperature, atmospheric pressure, relative humidity and altitude for their tests. They will provide a written or oral prediction of the effects of microgravity on their paper airplanes.



These ground tests will be repeated and recorded by GAS team members at USU and (if desired) by the SFP prior to launch. Planes will be stowed in a 1 gal (8 mil thick) vacuum zip-lock low density polyethylene bag for transport to the ISS. These tests will be repeated and video recorded by the SFP in microgravity conditions on the ISS. The SFP can note visual observations during the tests on the audio track of the recording. Finally, the planes and a compiled video of all Earth and ISS flights will be sent to the students. Students will be asked to record differences in the ground and microgravity experiments for comparison with GAS observations.

Involvement of the Space Flight Participant

Training time for the SFP is minimal, as it is expected that they will have some experience in this area. The SFP must become familiar with camera operations. If desired, the SFP can make a series of videos of ground based flights, with accompanying video commentary. On orbit, the SFP will be required to fly the paper airplanes, film the flights, and make audio notes on how the airplanes perform. It is also desired that the SFP narrates the video with a fun and enthusiastic tone.

SFP On-orbit Time Required: 60 min

SFP Training Time Required: 10 min

SFP Ground Test Time (optional): 60 min

Critical Safety Issues

We have identified three primary risks for this experiment. One is that the flying paper airplane may hit someone, in the eye, for instance. To mitigate this risk, care should be taken to not throw the paper airplanes near other astronauts. The second risk is similar – that the paper airplanes could be lodged in a critical area of the station. Care should be taken to not throw the paper airplanes near critical equipment with gaps large enough to admit a paper airplane. Perhaps the most serious risk is that working station crew will be distracted and want to participate. Should this be the case, the experiment can either be rescheduled for their spare time or performed twice so the station crew can participate.

Project Timeline

An initial draft of participation guidelines for teachers has been prepared. Work to identify potential student contacts has been initiated with the USU International Student Office. An estimated timeline for project design, dissemination, and safety review milestones is listed in the table to the right.

Date	Milestone
May 11	Packet for dissemination for teachers completed
May 18	Schools identified. Contacts made.
May 26	Prototype delivered for safety review.
June 8	Planes selected and returned from schools.
June 15	Safety review complete.
June 22	Ground videos complete. Planes and instructions delivered to SFP.

Project Leads

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