

An Experiment Carrier Capsule Demonstrator Project with Hyperspectral Imaging for VTVL Vehicles.

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History

- STS GetAway Special (GAS) Program
- Hyperspectral Design
- Broward College Student Research
- Northrup Gruman Lunar Lander Challenge

Current Educational Programs

- Air and Space Educational Consortium (ASEC)
- Masten Space Systems Payload Demonstrator
- Space Protein Growth Experiment

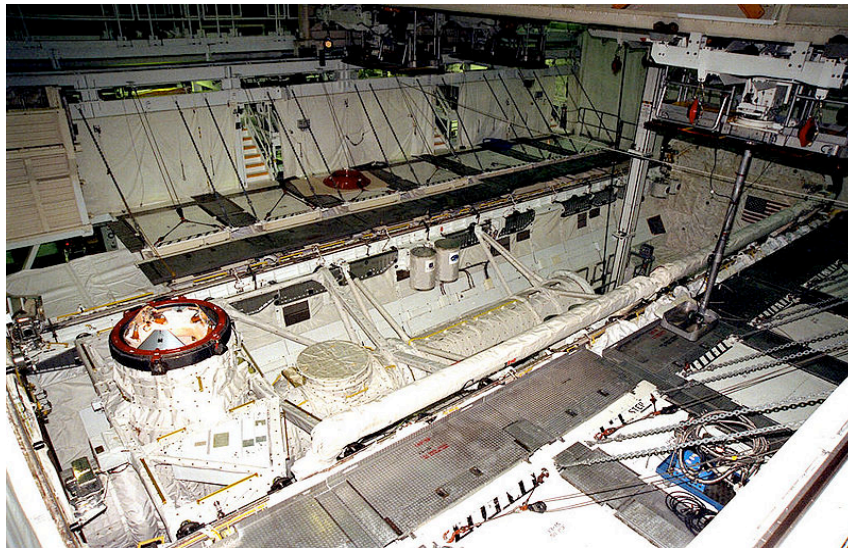
STS GetAway Special (GAS) Program

- Designed to provide small ventures a pathway to space via the STS.
 - Small Business
 - Research Ventures
 - Educational Facilities
- Pathway

Reservation → Integration → Flight → De-Integration →
Post-Flight Activities

NASA Small Payloads

GetAway Special



<http://nix.larc.nasa.gov/info?id=KSC-98PC-0520&orgid=5>

Hitchhiker Bridge

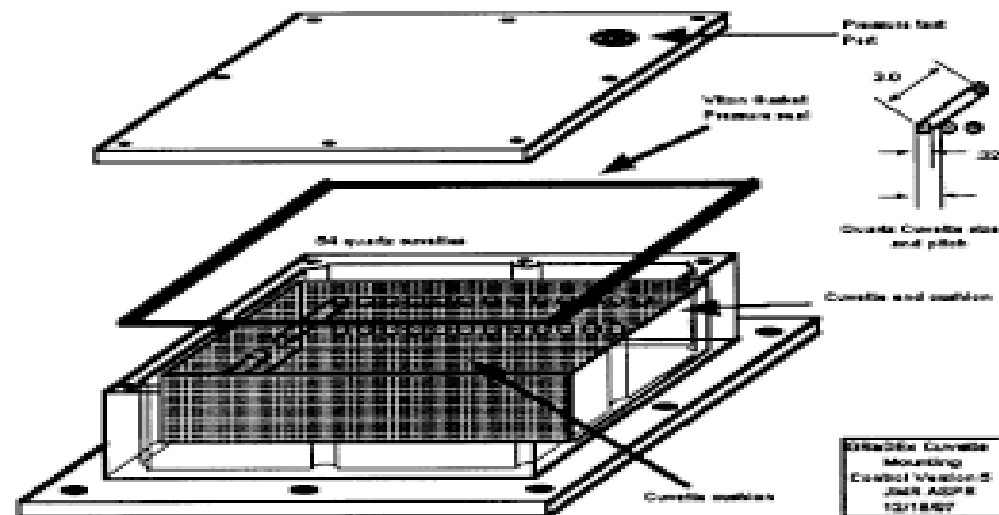


<http://mediaarchive.ksc.nasa.gov/detail.cfm?mediaid=9528>

G-743 aboard STS 91



GRADEX

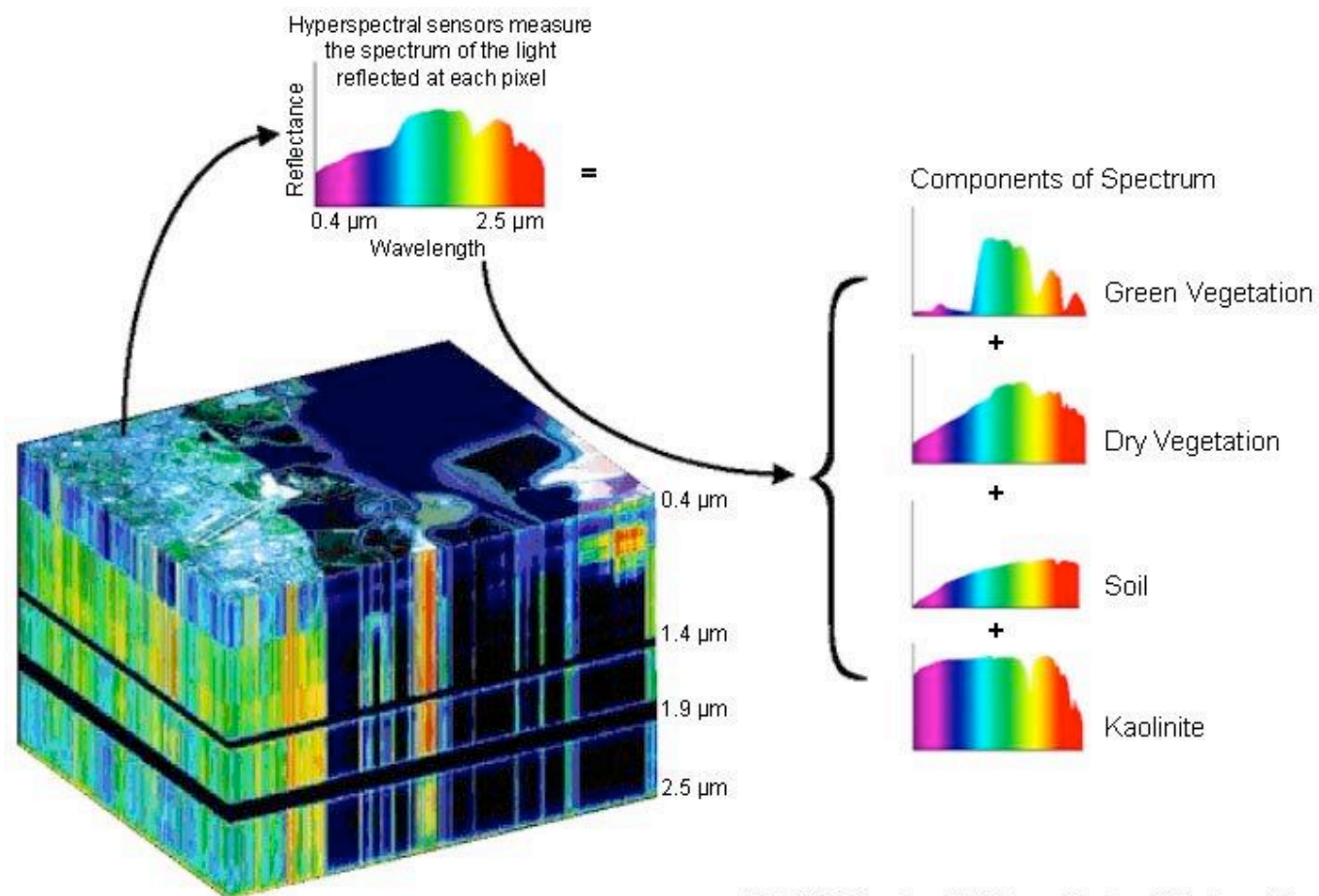


Educational Outcomes

- Provided student participation in the payload development engineering flow
- Provided student experiment experience
- Provided space business experience for application to real world situations

Hyperspectral Design

- Hyperspectral Technologies have aided in Geological Information Systems since Landsat (1972)
- Recent projects applications
 - Mars Reconnaissance Orbiter
 - LCROSS
- Broward developed TAMSE (Terrestrial Atmospheric MultiSpectral Explorer) in 1994 – 1998 with a hyperspectral imager



(NEMO Project Office, United States Navy)

space_congress.pdf - Adobe Reader

4.2 Optical Design

The heart of the HEHSI design is a Sagnac interferometer. The Sagnac is a two-beam, common-triangular-path interferometer, shown in Figure 1.

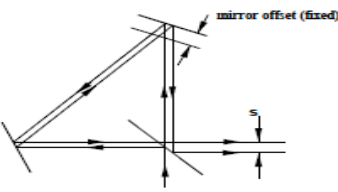


Figure 1: Sagnac interferometer

One beam transits the interferometer in a clockwise direction, while the other transits the same path in a counterclockwise direction. If the two mirrors were placed symmetrically with respect to the beam splitter, then the two rays would exit the interferometer in the same direction and at the same position. If one mirror is offset from a symmetric position, however, then the two rays exit in the same direction, but at positions symmetrically offset from the optical axis by a distance $s/2$. The path difference through the interferometer is a function of the angle of the ray entering the interferometer, but does not vary with the position of entry. The interferogram (fringe pattern) is localized at infinity, so a lens – referred to as the Fourier lens – is used to image the fringes onto the detector array. The modulus of the Fourier transform of this interferogram gives the spectrum of the source.

Figure 2 shows the complete optical design, including the Fourier lens. The optics consist entirely of commercial-off-the-shelf (COTS) components, with a total cost of \$1743.

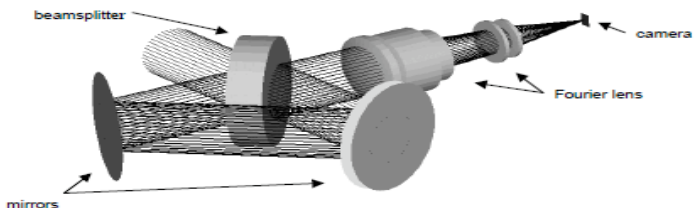







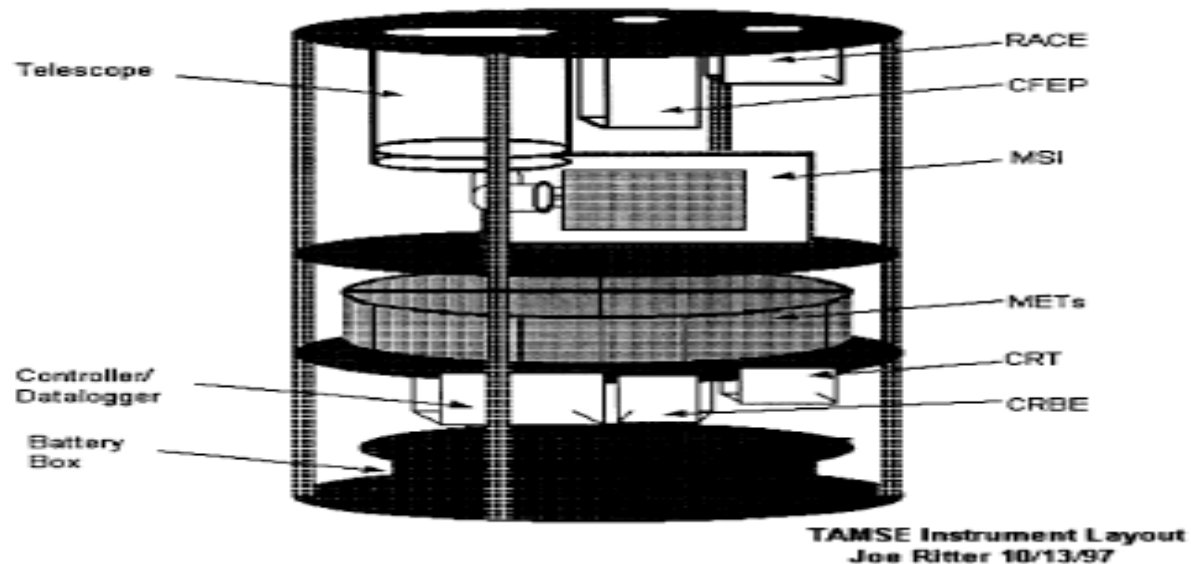


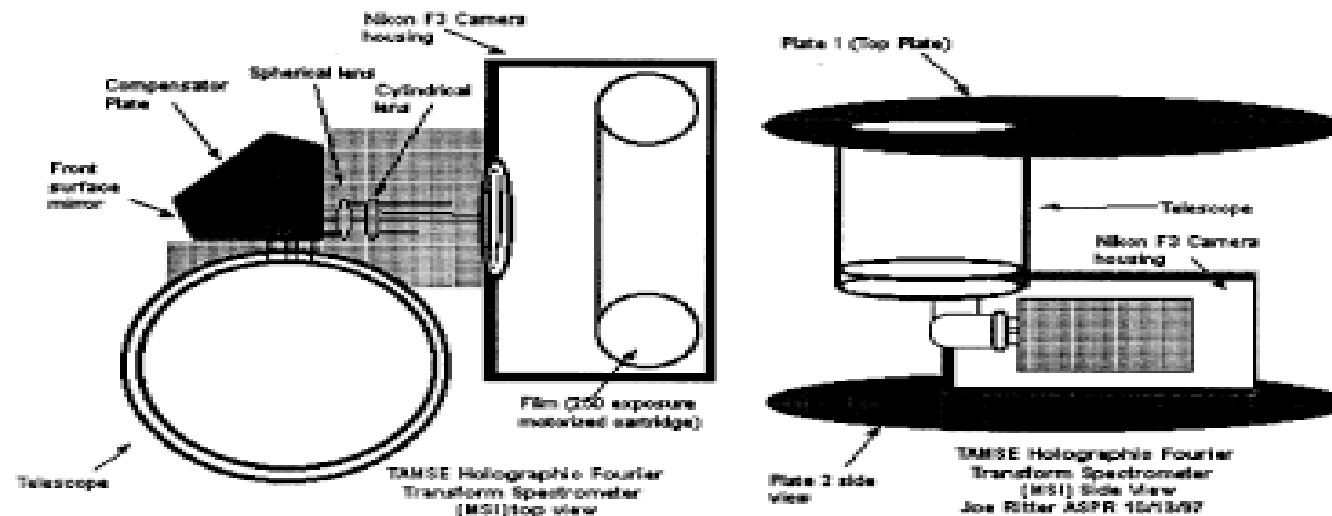
Figure 2: HEHSI optical design

Start |     Microsoft PowerPoint - [...] |  <http://www.ecrc.usgs.g...> |  space_congress.pdf - ... |  10:30 AM

TAMSE GAS Can Layout



MultiSpectral Imager



Educational Outcomes

- Provided for student system engineering experience
- Provided for direct application of concepts in optics for real world scenarios
- Provided for space business planning and operational experience

Broward College Student Research Programs

- Three Student KC-135 Research Flights
 - Studied the various properties of fluids in microgravity
 - Involved payload design, integration, and flight
- Educator Zero-G Flights
 - Continued to present, study fluid mechanics in microgravity
 - Involved lesson planning, presentation
- Individual Research Programs
 - AFM imaging













Educational Outcomes

- Provided student design, construction, and analysis of suborbital experiment
- Provided an opportunities to present students with concepts in the classroom leading to new student projects
- Provided an environment for student team building and experiment operation

Northrup Grumman Lunar Lander Challenge

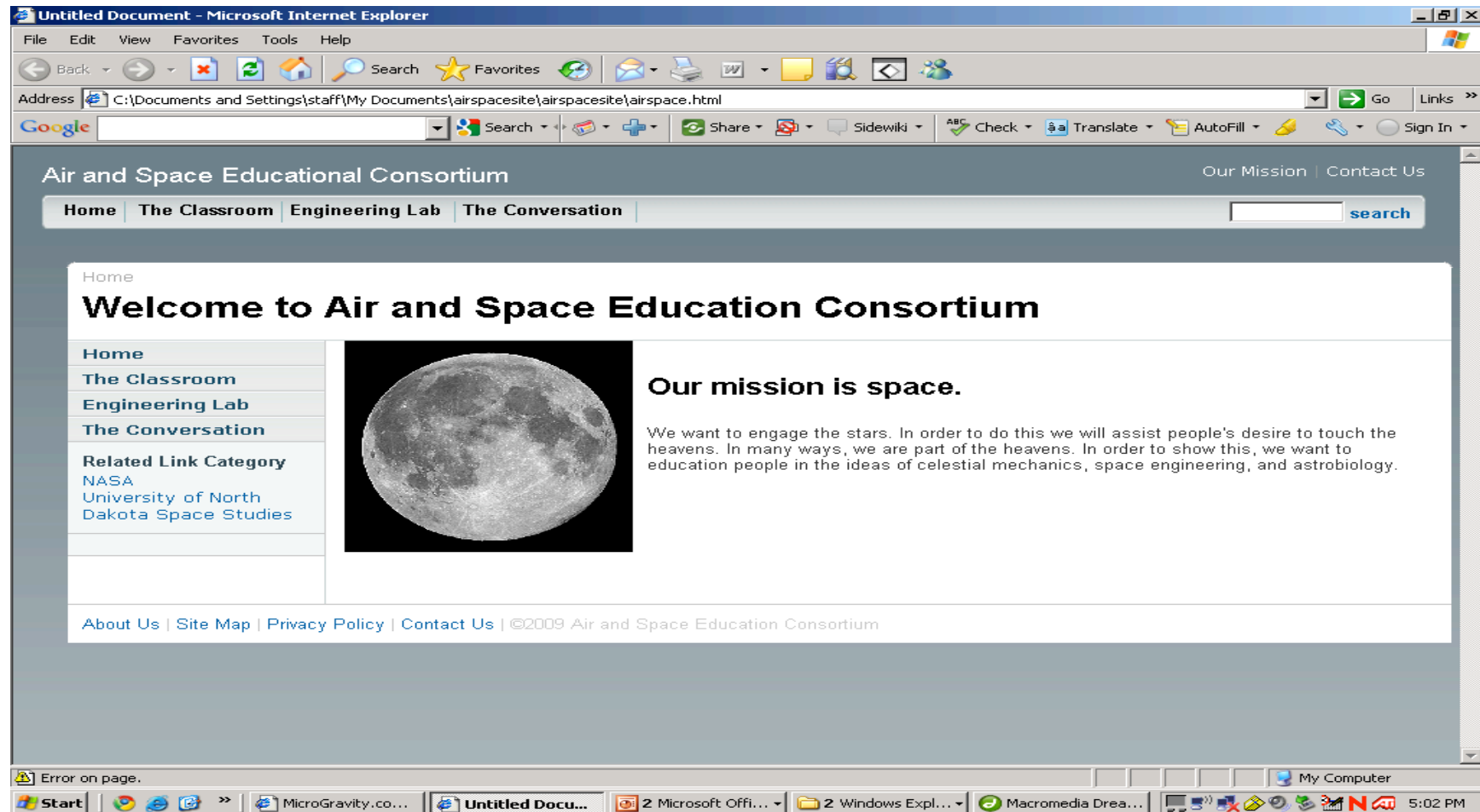
- An X-Prize foundation prize to develop a Vertical Take-off Vertical Landing (VTVL) vehicle with enough delta V to land and return from Moon
- Phase I – A 50 km high, 100 m flight with a outbound and inbound leg with a hover for 90 seconds at the destination pad.
- Phase II – Same flight with two exceptions; a 180 second hover and the flight must be completed in a 150 minutes time period.
- A tie in either phase would be broken by landing accuracy at both the home and destination pads.



<http://ian.kluft.com/pics/mojave/mss-llc-l2-200910/>

Air and Space Education Consortium

- Various former students have proposed a forum in which they communicate with professionals and other students
- An educational forum that acts as both a platform for the student-based projects and networking site for educators and their students.



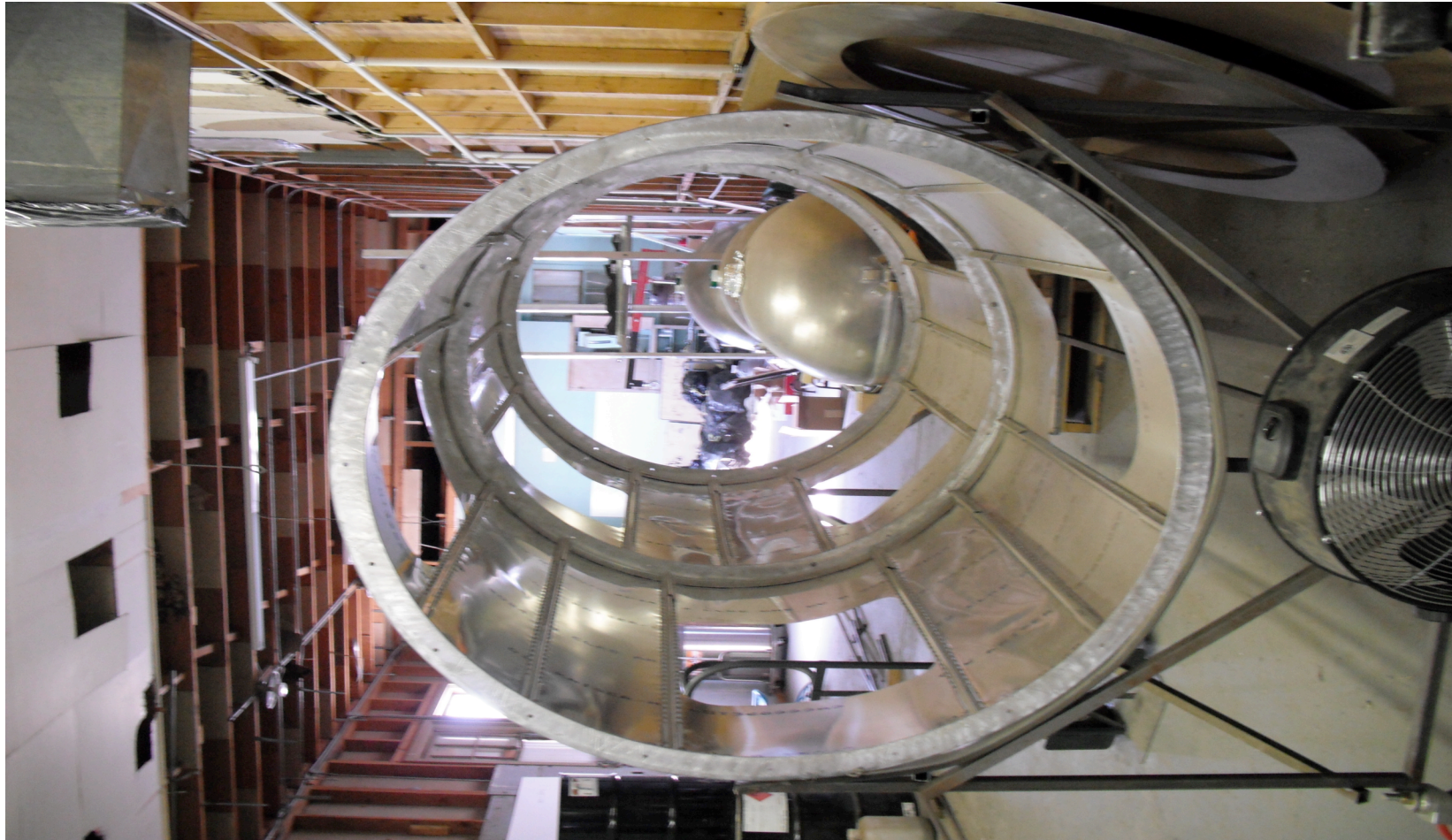
Masten Space Systems Payload Demonstrator

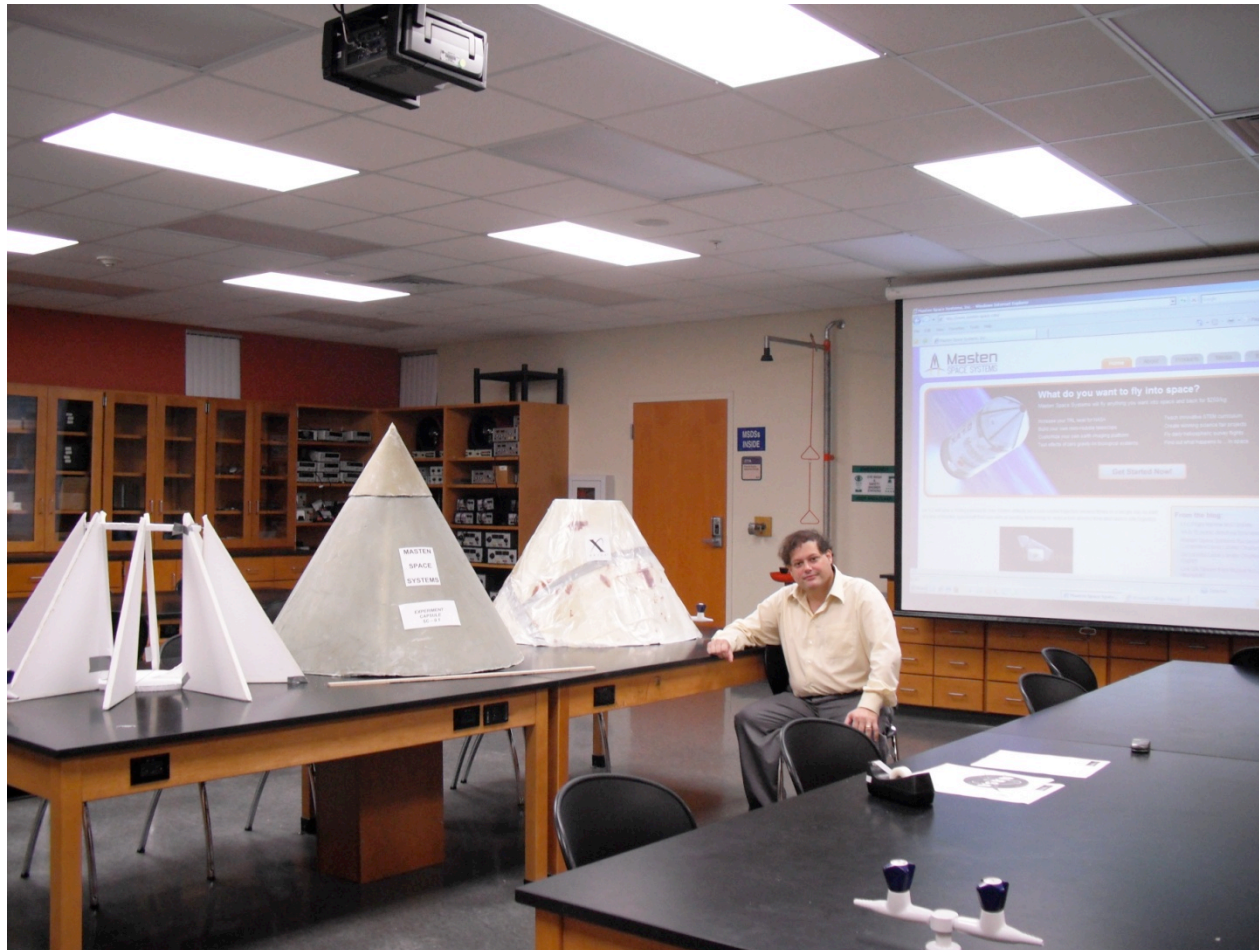
- Masten Space Systems (Mojave, CA) founded on the principle of VLVT vehicles
- Generation One rockets comp won Phase II Northrup Grumman Lunar Lander Challenge
- Broward College is developing Payload Demonstrators
 - A student-based project leading to flying inexpensive payloads on second generation vehicles



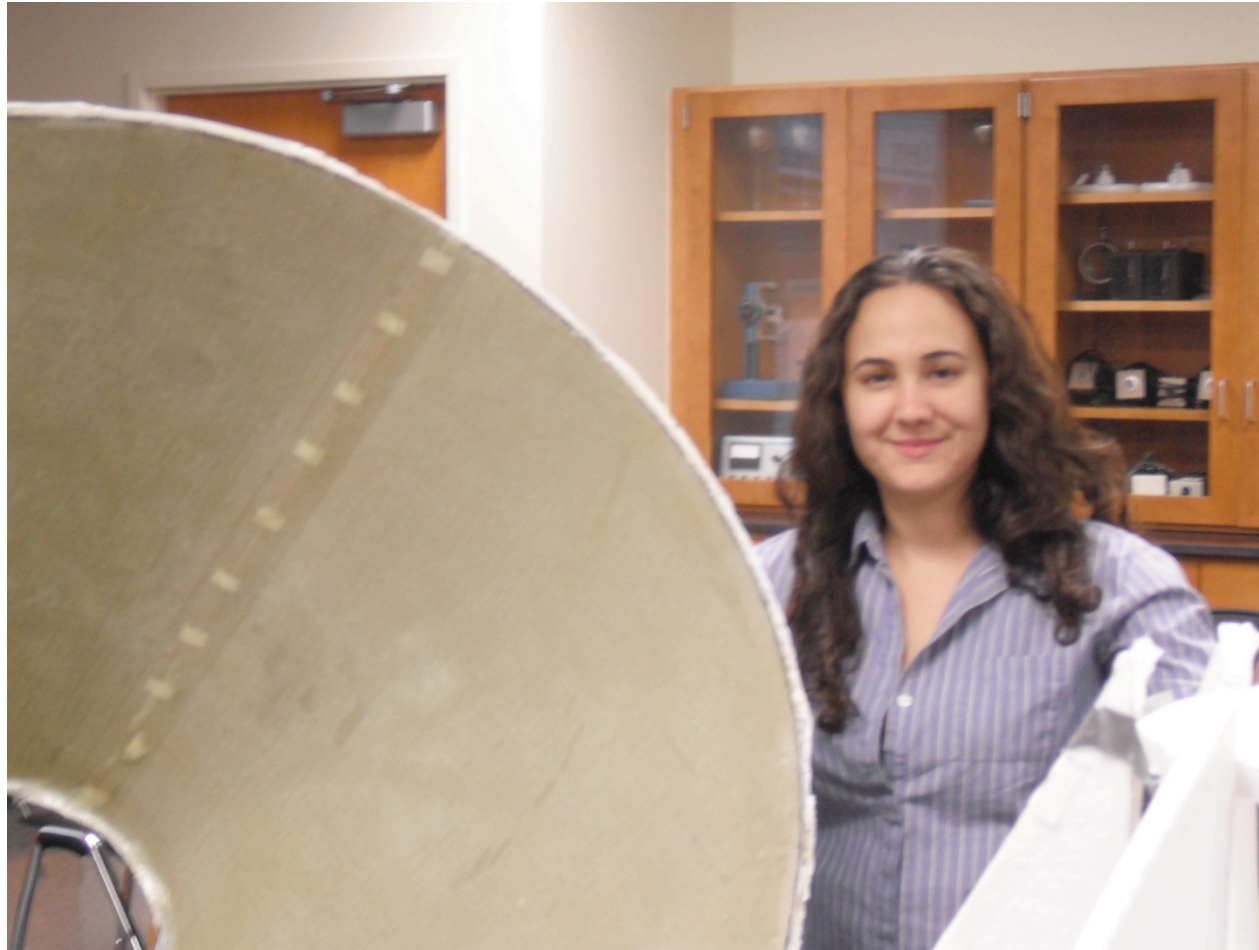












Proposed Outcomes

- Student designed and built demonstrator with multiple experiment units for various applications
- Student planned training program for future users of the rocket with user manual written by students
- A student-based experiment similar to the hyperspectral designed for TAMSE

Protein Growth Experiment

- Broward College has been involved with different protein crystals associated with student-based research
- Now we are aiming for a payload assignment this year carrying proteins including PPAR-gamma and Urokinase; two proteins important in diabetes and cancer research



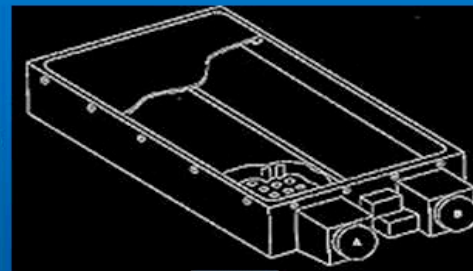
<http://www.hightechscience.org/experiment.htm>



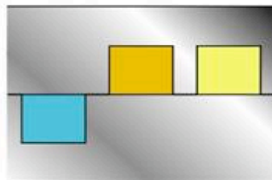
Broward College

ASEC

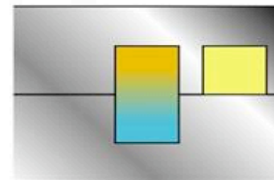
DMDA (Dual Materials Dispersion Apparatus) Space Processing Hardware



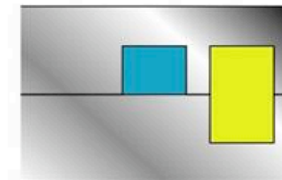
Basic DMDA operation



Prelaunch



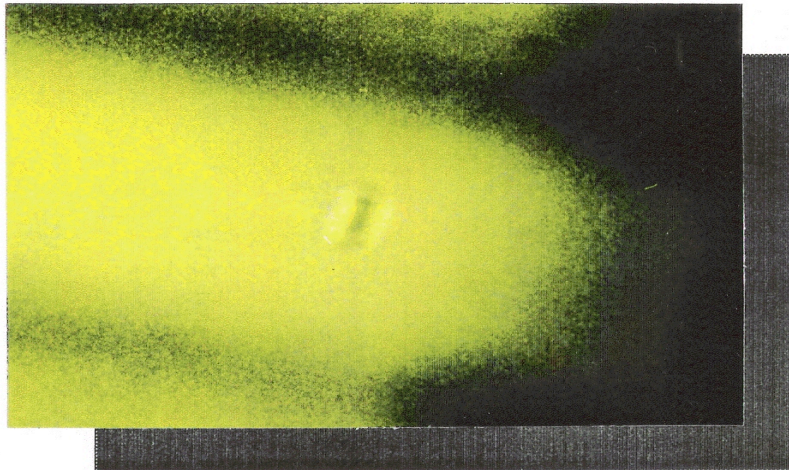
On-orbit



Termination

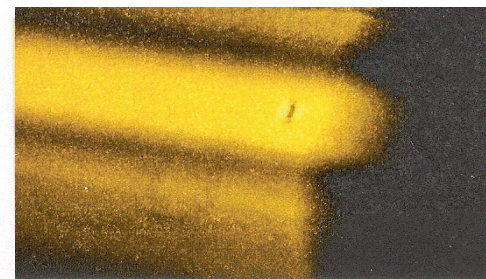


Urokinase Protein Crystal Growth in Microgravity A Case Study in Cancer Remediation



Blow-up of Urokinase Protein Crystal
(50 micron crystal)

- On Earth this protein crystal requires 6 or more months to grow
- In Space this protein crystal was grown in ITA's Automated Laboratory in 8 days
- Increased growth rate in Space (size) permits structure determination
- Structure determination permits rational drug design



Urokinase Protein Crystal
(50 micron crystal)

STS-56, 1993,

Proposed Outcomes

- Allow for student-based planning for experimentation, networking, and analysis for a space business/university – based payload
- Allow for student/mentor papers analyzing the structure of PPAR-gamma and Urokinase possibly leading to pharmaceutical uses for these proteins