ASMO
American Student Moon Orbiter

21st AIAA/USU Conference on Small Satellites
August 15, 2007

Dr. Yvonne Clearwater
ASMO Project Manager
NASA, Ames Research Center
American Student Moon Orbiter

NASA scoping and feasibility efforts underway for:

- Hands-on student involvement in U.S. space exploration program
- Students and faculty to design, build, register, launch and own ASMO
- NASA to serve as coach and mentor to student teams
- Targeting launch of a (TBD) secondary payload in 2011 to a highly elliptical 2 year lunar orbit

Possible: International collaboration and integrated mission objectives with ESA via the European Student Moon Orbiter (ESMO)
ASMO to be NASA-Wide and Nationwide

Initial Sponsor: NASA HQ Office of Education

• Proposed as a nationwide NASA Education Initiative

Initial NASA ASMO Partners:

• Project Management: Ames Research Center (ARC)
• Systems Engineering: Glenn Research Center (GRC)

• Broad NASA Participation:
  • All NASA Centers will be encouraged to participate
  • Student workshops will be distributed across Centers
ASMO Project Team

**ASMO Project Office at ARC:**
- Dr. Yvonne Clearwater, *Project Manager*
- Kenneth Ashford, *Project Intern*

**Project Champions:**
- Dr. S. Pete Worden, *ARC Center Director*
- Dr. Woodrow Whitlow, *GRC Center Director*
- Prof. Robert Twiggs, *Stanford University*
- Steve Wozniak, *Apple Co-Founder*

**International Collaboration:**
- Dr. Roger Walker, *ESA/ESMO PM*
- Garvey McIntosh, *OER/IR NASA HQ*
- Sascha Tietz, *University of Stuttgart*

**ASMO Partner at GRC:**
- Steve Oleson, *Lead Systems Engineer*
- Carol Galica, *GRC Education Liaison*

**Key NASA Technical Support:**
- Dr. Jennifer Heldmann, *Lunar Scientist/ARC*
- Peter Klupar, *Small Spacecraft Office/ARC*
- Robbie Schingler, *Small Spacecraft Office/ARC*
- Dr. Beverly Girten, *Chief, New Business Office/ARC*
- Deborah Feng, *Deputy Director, Strategic Communications and Development/ARC*
Why Participatory Exploration?

• Hands-on/minds-on experience in a NASA mission

• Preparing the next generation technical workforce for NASA and the nation

• Higher Education and K-12 pipeline enrichment

• Educate and inspire students in STEM disciplines

• Lowering perceived barriers to public participation in space exploration

• Opportunities for unprecedented international collaboration
Possible Mission Opportunities

• Exploring new levels of cooperative and distributed design and engineering
• Experience in building spacecraft faster and cheaper
• Testing communication protocols
• Advancing communication networks to support landed lunar rover missions (esp. with ASMO & ESMO in coordinated orbits)
• Pushing solar cell technology
• Radiation hardening for missions above LEO
• Lunar gravity mapping
## ASMO Pre-Phase A Highlights

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASMO Design Feasibility Study</td>
<td>Jan 01, 2007</td>
</tr>
<tr>
<td>NASA Project Manager Selected</td>
<td>Feb 6, 2007</td>
</tr>
<tr>
<td>First Student Intern Joins ASMO Team</td>
<td>April 1, 2007</td>
</tr>
<tr>
<td>NASA Project Plan Completed</td>
<td>May 30, 2007</td>
</tr>
<tr>
<td>Initiate NASA/ASMO – ESA/ESMO Dialog</td>
<td>July 26, 2007</td>
</tr>
<tr>
<td>ASMO Presentation at CubeSat ‘07</td>
<td>Aug 11, 2007</td>
</tr>
<tr>
<td>ASMO Paper at SmallSat ’07</td>
<td>Aug 15, 2007</td>
</tr>
<tr>
<td>Public Roundtable to Express RFI Intent</td>
<td>Aug 15, 2007</td>
</tr>
</tbody>
</table>
ASMO Phase A Planning

- RFI Release, (optimal target date) Fall 2007
- RFI Submissions to NASA Fall 2007
- NASA HQ Go/No-Go for RFP Release Late Fall 2007
- RFP Release Late Fall 2007
- RFP Workshop Winter 2007
- Proposal Submissions to NASA Early 2008
- Selection of University Teams Early 2008
- Mission Design Workshop Spring 2008
- System Requirements Lock Fall 2008
- NASA HQ Go/No-Go for Phase B Fall 2008
ASMO University Teams

- Direct, hands-on project management and systems engineering
- Execution of and fund raising to support:
  - Design, build, and test payload and subsystems
  - Integration, launch, insurance, and operations of spacecraft
- Programmatic coordination with ESA for ASMO-ESMO mission interoperability and communications
Continuing NASA Role as ASMO Coach/Mentor (2008 - 2013)

- Project management oversight (ARC)
- Systems engineering oversight (GRC)
- Host 2 student workshops per year
- Coordinate controlled access to NASA people, content and facilities
- Identify and monitor key decision points
- Facilitate design reviews
- Continue Strategic Communications
- Maintain NASA - ESA working relationship
- Possible roles in final assembly, integration and testing
- Possible role to broker the ASMO launch
Organization of SSETI and ESMO in Europe

ESA Education Office
(provides technical support, facilities, reviews, launch negotiations)

SSETI Association
Student Space Exploration & Technology Initiative
(provides administration, infrastructure, workshops)

Funding for workshops

Project Management
(Roger Walker)

System Engineering

Subsystem 1
(primary & backup)

Subsystem 2
(primary & backup)

University A

University B

08/15/07
Yvonne Clearwater, PhD, NASA ASMO Project Manager
Possible ASMO Student Team Structure

NASA:
- Project Management (ARC)
- System Engineering (GRC)

Project Management

System Engineering

Space Segment

Satellite Bus
- ADCS
- Communication
- Mechanics
- OnBoard Data Handling
- Power
- Propulsion
- Structure
- Thermal

Payload
- Instrument 1
- Instrument 2
- Instrument 3
- ...

Ground Segment
- Configuration
- Ground Station
- Mission Analysis
- Mission Control Computer
- Operations
- Risk Analysis
- Simulation

Additionally:
- Finance
- Infrastructure
- Legal
- Public Relations

Yvonne Clearwater, PhD, NASA ASMO Project Manager
Introducing OSSPREE

Open Source
Space Participatory
Research & Exploration
Enterprise

08/15/07
Yvonne Clearwater, PhD, NASA ASMO Project Manager
Opportunities for International Collaboration

ASMO-ESMO could be the first-ever NASA – ESA student-level joint mission project

ASMO-ESMO could be NASA’s broadest cooperative engineering educational venture to date
ASMO Status Summary

- Scoping effort underway to determine interest and feasibility of a nationwide NASA education initiative
- Participatory Space Exploration: Students and faculty to design, build, register, launch and own ASMO
- NASA to serve as coach and mentor to student teams
- Targeting launch of a (TBD) secondary payload in 2011 to a highly elliptical 2 year lunar orbit
- Possible: International collaboration and integrated mission objectives with ESA/ESMO
http://asmo.arc.nasa.gov