The University Student Launch Program (USLP) Workshop & Competition

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National Council of Space Grant Directors Meeting

New York City, NY

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Overview

• Background Information
• Educational Value of Model Rocketry
• Innovation of USLP
• Rocketry Education Pipeline
• Goals & Agenda of Workshop
• Kick-Off Workshop
• Workshop Attendees
• Workshop Group Photo
• USLP Competition
• Deliverables
• Rocket Configuration
• Launch Operations, Preparations & Recovery
• Launch Field & Location
Background: Why Start a University Rocket Program?

- National Space Grant Student Satellite Program: Crawl-Walk-Run-Fly
- The World of Student Space Hardware: CricketSats/CanSats/BalloonSats/Student Satellites
- Starting Student Space Hardware Programs - A How To Workshop
  http://spacegrant.colorado.edu/studentsat/
- What about rockets at the University Level? Other University examples, i.e. Montana State University (MARS: Montana Advanced Rocket Systems)
Background: Why Start a University Rocket Program?

• Amateur rocketry has been around a long, long, time!
  *Early 1960s - first commercially available model rocket kits*

• Rocketry organizations:
  – National Association of Rocketry (NAR) - www.nar.org
  – Tripoli Rocket Association - www.tripoli.org

• Rocket competitions:
  – University Student Launch Program - USLP (http://uah.edu/ASGC/Uc
 University Level
  – Student Launch Initiative (http://education/msfc/nasa.gov/docs/127.htm
 High School Level
  – Team America Rocketry Challenge (http://www.rocketcontest.org)
 High/Junior High School Level
  – WSGC Student Rocket Design Competition (http://uwgb.edu/wsgc/funding/sr2004.asp)
 University Level
  – Utah State University Rocket Competition

• An overwhelming amount of help on the web!
Educational Value of Model Rocketry

- Model rocketry is a progressive educational activity
- An exercise and illustration of STEM principles for younger grades
- A STEM research tool for secondary and university levels
- University level: A hands-on interdisciplinary “Design, Build, Fly, Analyse” Space Grant Program
Innovation of USLP

- It is a unified university program using sport rocketry through Space Grant and NASA instead of individual and independent projects.
- Application of manageable size rockets allows economical flying on nearby sites.
- Direct connection in the rocketry education pipeline for workforce development.
- The NASA USLP directs college students in designing, building, testing, and launching large model rockets with scientific payloads. This unique hands-on experience allows students to learn to apply science and math in a systems engineering program.
# Rocketry Education Pipeline

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<tr>
<th>Grade</th>
<th>1</th>
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<th>4</th>
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<tbody>
<tr>
<td>Activity</td>
<td>Toy ‘pop’ Water/air Bottle Rockets</td>
<td>Beginner ModRoc Kits, 2 stage, payloads</td>
<td>Build and Launch Sessions</td>
<td>Science Concepts and Processes</td>
<td>TARC, Directed Payload Experiments</td>
<td>Launches, Contests and Consulting</td>
<td>Technology Application, Proofing, Investigation, Measurement, Data interpretation</td>
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<td>NAR Support</td>
<td>Launch Demos, Talks</td>
<td>Build and Launch Sessions</td>
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<td>Lesson/Standard</td>
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<td>Science Concepts and Processes</td>
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<td>NASA Connection</td>
<td>NES</td>
<td>TARC</td>
<td>SLI</td>
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**Building Student Launch Hardware: A How To Workshop**
Another Piece Now Formally Added: USLP

### Rocketry Education Pipeline

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<th>Activity</th>
<th>Lesson/Standard</th>
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<tr>
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<td>Toy ‘pop’</td>
<td>Physical Concepts and Processes</td>
<td>NES</td>
<td>USLP</td>
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<td>Water/air Bottle</td>
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<td>TARC</td>
<td>Rockets and Payloads</td>
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<td>TARC</td>
<td>Integrations and Applications of Multiple Technical Disciplines</td>
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<td>Beginner ModRoc Kits, 2 stage, payloads</td>
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<td>TARC</td>
<td>USLP</td>
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<td>TARC, Directed Payload Experiments</td>
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<td>3</td>
<td>Launches, Contests and Consulting</td>
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<td>SLI type Rocket and Payloads</td>
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<td>Mentoring, Launch Support</td>
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<td>Developing Experiments, Scientific Method, Inquiry, Reasoning</td>
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<td>6</td>
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Goals of Workshop

• Introduce the attendees to the tools they will need to start a student launch program

• Help the attendees gain the confidence they will need to start a student launch program

• Familiarize the attendees with high powered rocketry

• Familiarize the attendees with the University Student Launch Program (USLP)

• Have fun building, launching and recovering a small sounding rocket
Agenda of Workshop: Day 1

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.
 Agenda of Workshop:  Day 1 Cont.

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Agenda of Workshop: Day 2

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Agenda of Workshop: Day 2 Cont.

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Agenda of Workshop: Day 3

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Kick-Off Workshop

- Kick off USLP with a 3-day workshop held at University of Alabama in Huntsville, August 10-12, 2006

- Academic Affairs Office at NASA/MSFC partner with Space Grant Universities to sponsor USLP Rocket and Payload Teams during 06/07 academic yr.

- NASA USLP designed to engage students at University level in learning opportunity involving design, construction, test, and launch of reusable launch vehicle and science-related payload.
Kick-Off Workshop Cont.

- Various Presenters from:
  - University of Alabama
  - Montana State University
  - University of Alabama in Huntsville
  - NASA Marshall Space Flight Center
  - National Association of Rocketry (NAR)

- Guest speaker, Mr. Steve Cook, Director of the Exploration Launch Office at NASA

- Water Rockets
- Build Rockets & Launch
- Tour of UAH Propulsion Research Center
- US Space & Rocket Center Tour/IMAX Movie
Workshop Attendees

- Alabama A&M University (2 faculty/3 students)
- Arkansas State University (1 faculty/2 students)
- Central State University in Ohio (1 faculty)
- Fisk University in Tennessee (2 faculty/1 student)
- Florida Space Institute (1 faculty)
- Harding University from Arkansas (2 faculty/4 students)
- Mississippi State University (2 students)
- Montana State University (2 faculty/4 students)
- University of Alabama (1 faculty/2 students)
- University of Alabama in Huntsville (3 faculty/1 student)
- University of Mississippi (1 faculty/1 student)
- University of Tennessee at Knoxville (1 faculty/2 students)
- Vanderbilt University (1 faculty)
Building Student Launch Hardware: A How To Workshop

USLP Workshop Group Photo
USLP Competition

- Requires 8 mo. commitment to successfully design, construct, test, launch & recover a reusable rocket/science payload
- Performance criteria:
  - Carry a science payload (instrumentation) during flight
  - Target altitude of 5,280 ft. above ground level
  - Launch vehicle & science payload to be recoverable/reusable
  - Preparation time on launch day shall not exceed 4 hours
  - Data from payload shall be collected, analyzed & reported
  - Must have a tracking device
  - Only commercially-available, NAR approved motors (Hybrids are allowed as long as they are commercial)
  - Teams must provide own launch equipment
  - Teams must test vehicle & recovery system prior to arrival in Huntsville
USLP Deliverables

• Reusable rocket/science payload ready for launch April, 2007
• Scale model of rocket design with payload prototype should be flown before Critical Design Review (CDR)
• Reports & presentation due 11/13, 1/15 & 3/12
• Final report for rocket & payload due 5/11
• Team should have web presence no later than 11/6
• Copies of products developed given to MSFC for public showing
• Electronic copy of comprehensive report with results pertaining to outreach activities
• Safety plan
• Preliminary Design Review (PDR)
Typical USLP Rocket Configuration

Loaded mass: 8 kg (17.6 lbs)  2217mm (7.2’) length, 100mm (4”) dia
Launch Operations/Preparations

- FAA to give airspace clearance to 10,000’
- HARA will provide standard firing system and launch pads
- HARA will set-up, check, and conduct launch operations with students
- Student Teams assemble, prepare rockets
- Teams provide own launch special needs
- Although teams can design different size rockets, the target altitude is still 1 mile
USLP Launch and Recovery

Flight Profile

Launch

Drogue chute 5000’

Main chute 500’

Landing
Launch Field Location

Sod Farm in Manchester, TN