JHU/APL CubeSat Initiatives

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Who is JHU/APL?

- **Not-for-profit** University research and development laboratory
  - DoD chartered “University Affiliated Research Center” (UARC)
  - Founded 1942 (in space since 1957)

- **Staffing:** 4,200+ employees
  (70% scientists & engineers)

- **Business areas:**
  - Air & Missile Defense
  - Biomedicine
  - **Civilian Space**
  - Homeland Protection
  - Infocentric Operations
  - **National Security Space**
  - Precision Engagement
  - Science & Technology
  - Strategic Systems
  - Undersea Warfare
  - Warfare Analysis
APL Exploration from the Sun to Pluto

- First spacecraft launched just two years after Sputnik
- 64 spacecraft launched to date
- >150 instruments launched to date

Yellow: APL Spacecraft/Mission
White: APL Instrument/Component/
Other Significant Support
Italics: In Development
A tradition of “Firsts” in space since 1958

1958 Satellite Navigation System
1961 Nuclear-powered spacecraft
1963 Gravity gradient stabilization
1967 Color picture of the full Earth
1972 Drag-compensated satellite
1975 Pulsed plasma thrusters
1982 Autonomous satellite navigation with GPS
1984 Artificial comet
1986 Intercept of a thrusting target in space
1988 Autonomous target acquisition and track
1996 Hyperspectral Imager in space (MSX)
1996 Invention of Polymer Battery
2001 Landing on an asteroid (NEAR)
2003 Re-Configurable Self-Repairing Processor (on FEDSAT)
2004 Orbital Mercury exploration mission launched (MESSENGER)
2006 Mission to Pluto (New Horizons)
CubeSat Community Involvement

- JHU/APL recognizes the presence of a vibrant university space community
- In October 2006, APL Space Department management approved a series of initiatives
  - Advocacy for CubeSat/nanosatellite secondary payloads on missions in which APL is involved
  - Support the university space community
  - Sponsor student interns
  - APL CubeSat development

XI-V (U. of Tokyo)  MEROPES (Montana State)  ICE Cube 2 (Cornell)  SEEDS (Nihon U.)
University Access to Space

- APL is advocating for inclusion of CubeSats and/or nanosatellites on our missions
  - One very promising opportunity in CY08/09
- What can you do to help?
  - Demonstrate technologies/capabilities of interest to the sponsor community
    - Anything that enhances the primary payload’s mission is particularly valuable
  - Develop advocacy materials
    - Fact sheets
    - Presentations
    - Risk mitigation descriptions

Flight PPODs from Jul 06 DNEPR launch
Support the University Space Community

- APL space department has agreed to make many of its capabilities available on a low- or no-cost basis
  - Personnel (scientists, engineers, managers) for peer review and advising
  - Environmental test facilities
    - Cost of materials only
    - Non-interference basis with other JHU/APL work
  - Satellite communications facility
    - 5-, 10-, and 18-meter dishes
    - Significantly discounted rate
Student Internships

- APL currently offers student summer internships
- APL may link additional summer internships and/or part-time employment to students working on APL CubeSats
APL CubeSat Initiatives

- Objective: Improve access to space for APL-developed technologies
- Why CubeSats?
  - Best opportunity to establish secondary launch opportunities:
    - Proven deployer
    - Multiple launches on many different launch vehicles
    - Small size and mass
  - Well established technical standard
  - Emerging community of low-cost university and commercial hardware providers
- CubeSats may enable high-value science to be performed by swarms of spacecraft

PPOD Deployer
MEPSI (Aerospace Corp.)
APL CubeSat Implementation Approach

- **Goal:** Perform entire CubeSat missions at a cost that is affordable on modest IR&D funds
- **Approach:** Fly APL payloads on university-built buses
  - APL seeking partnerships with potential CubeSat bus providers
  - APL staff provide mentoring and review to reduce risk and enhance training value for students
- **Seek external sponsors where possible to enable more ambitious projects**