

# Small Satellites: Advancing University Scientific Research and Workforce Development

Presentation to the Scientific and Technical Subcommittee of  
the UN Committee on the Peaceful Uses of Outer Space

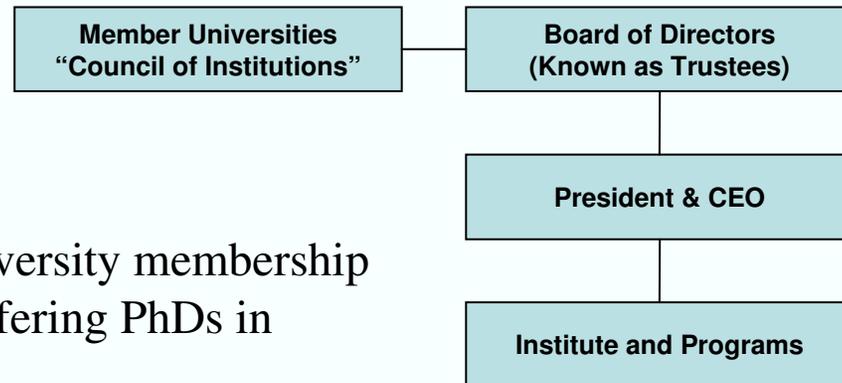
Agenda Item 14 of the Fifty-first Session, Vienna, 11 February 2014



W. David Cummings  
Universities Space Research Association

# Universities Space Research Association

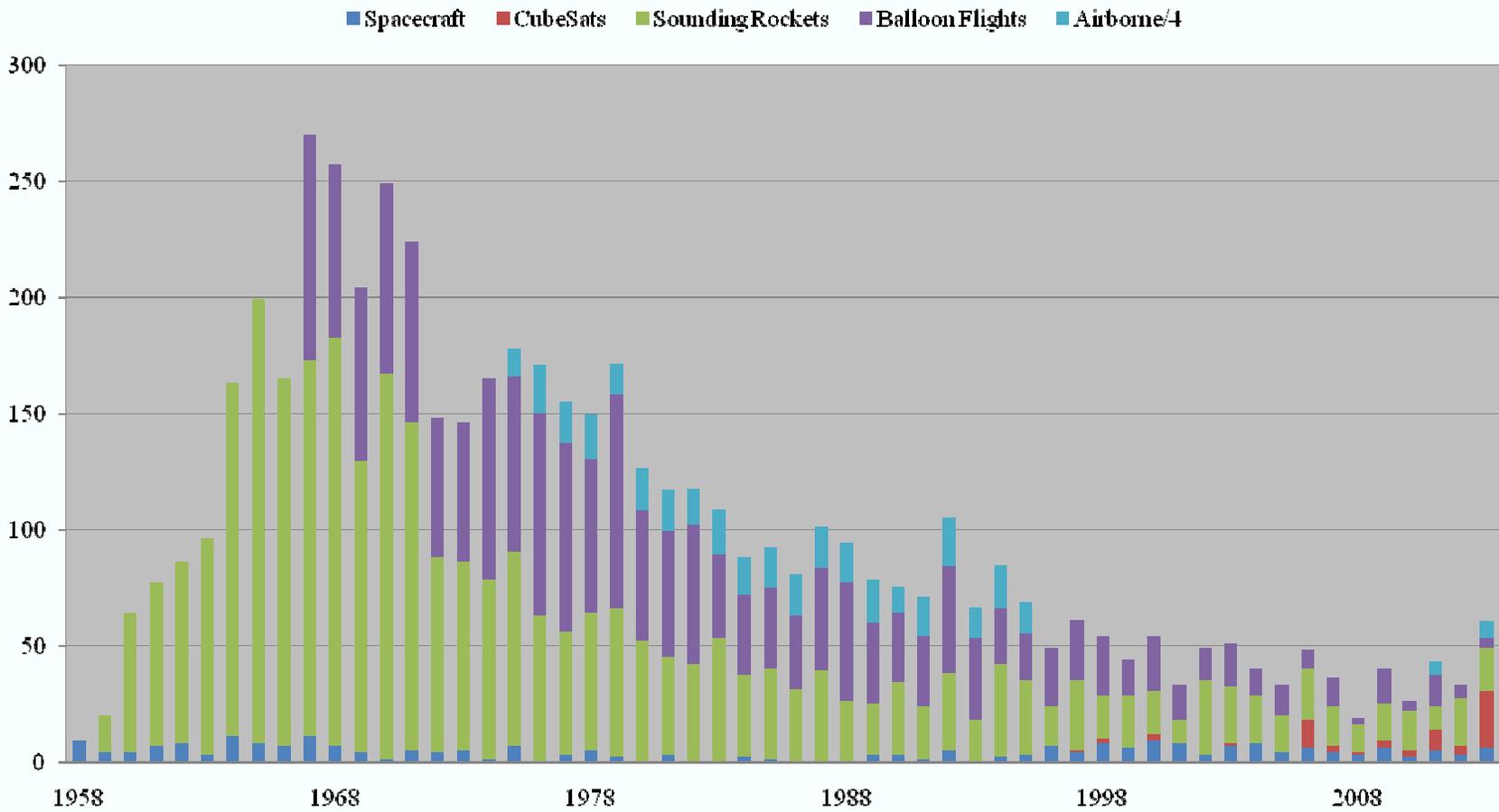
- Created in 1969 by the U.S. National Academy of Sciences at NASA's request.
- Governance grounded in a broad university membership of 105 major research universities offering PhDs in science and technology.
- Nonprofit purpose of space-related science, technology, and engineering.
- Operate national facilities, institutes, and programs.
- Engaged in research with 285 universities and 100 other organizations in FY2013 in 985 separate collaborations.
- Funded under contracts and cooperative agreements with NASA; other U.S. agencies, such as the National Science Foundation and the Department of Defense; and German Aerospace Center (DLR).



# Board of Trustees

Wesley Harris	Region I	Massachusetts Institute of Technology
Judith Pipher	Region II	University of Rochester
Scott Pace	Region III	The George Washington University
Eric Sheppard	Region IV	Hampton University
Hans-Peter Röser	Region V	University of Stuttgart
John Carlstrom	Region VI	University of Chicago
Elizabeth Protas	Region VII	University of Texas Medical Branch
Edward Weiler	Region VIII	University of Colorado, Boulder
Steven Kahn	Region IX	Stanford University
Jan Van Prooyen	At-large	Los Alamos National Laboratory (ret.)
James Crocker	At-large	Lockheed Martin Corporation
David Frost	At-large	Frost & Associates, Inc.
Jay Johnson	At-large (Financial)	Los Alamos National Laboratory
Frederick Tarantino	USRA Pres. & CEO	
Victoria Coverstone	COI Chair	University of Illinois at Urbana-Champaign
Robert Holzworth	COI Vice Chair	University of Washington

Number of U.S. orbital and suborbital opportunities for graduate students to gain hands-on experience in the Earth and space sciences by year of launch.



# Advantages of CubeSats for University Research

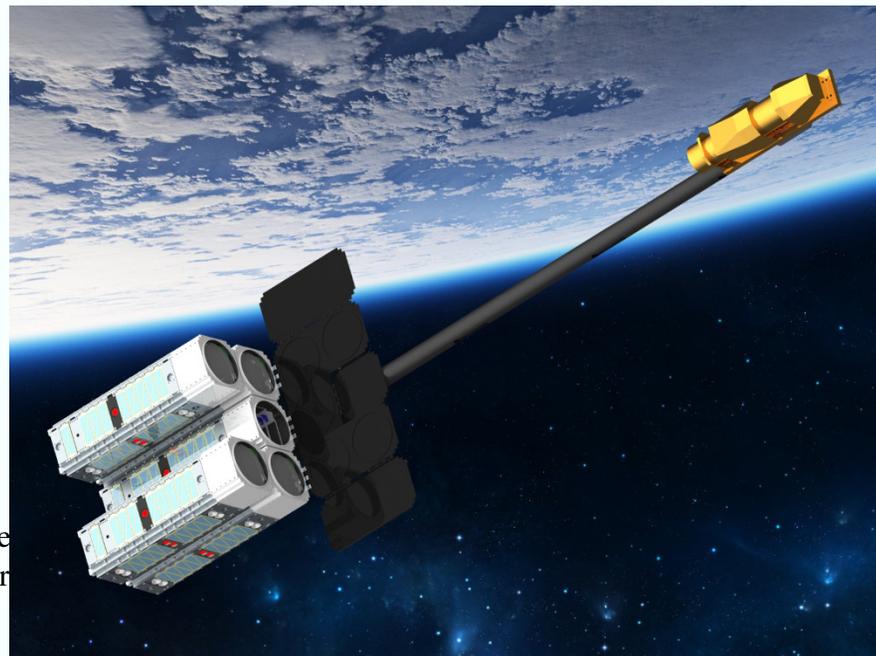
- Low-cost orbital platform for hands-on research opportunities for students.
- Reasonable life cycle for thesis research – frequent access to space.
- Training for young space professionals in the design, integration, testing, and operation of spacecraft – systems-level engineering (undergraduate and graduate).
- Standardization allows lower costs due to more vendors providing component solutions.
- Constraints on size, weight, power, etc., are driving innovations.

# Advantages of CubeSats for University Research (Continued)

- Low-cost use of space assets to test and qualify revolutionary concepts – new operations approaches, space components, measurement techniques and other space technologies.

Shown at right is an artist rendering of Caltech's concept for an Autonomous Assembly of a Reconfigurable Space Telescope (AAReST).

(Figure courtesy of Keith Patterson, Professors Sergio Pellegrino and Craig Underwood and the other members of the AAReST team at Caltech and the University of Surrey)



# Example of a U.S. Student-led CubeSat Project

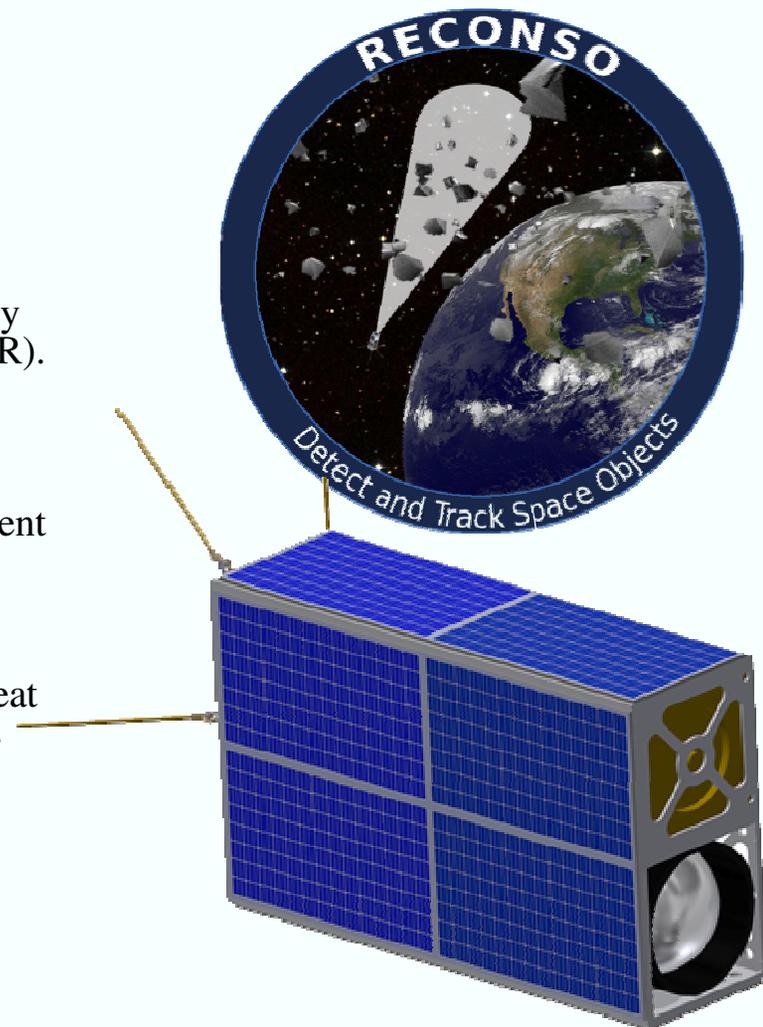
**RECONnaissance of Space Objects (RECONSO)** is a student-led CubeSat project at the Georgia Institute of Technology in the U.S. that is focused on efforts to mitigate the threat of space debris.

RECONSO is a participant in a competition supported by the U.S. Air Force Office of Scientific Research (AFOSR).

RECONSO will place an optical payload in Low Earth Orbit (LEO) to discover and track space objects at low cost. Inertial bearing and apparent magnitude measurement will be processed on-board and downlinked to Georgia Tech for further processing and distribution.

This data will directly support efforts to mitigate the threat of space debris to national and international space assets by supplementing existing Space Surveillance Network (SSN) sensors.

Figures courtesy of Prof. Marcus Holzinger of Georgia Tech.





# Summary

U.S. university research leaders are enthusiastic about using CubeSats because:

- They represent an opportunity for low-cost, hands-on training of young space professionals;
- They are well suited for some categories of thesis research; and
- They provide a low-cost way of testing and qualifying new space technologies and concepts; including
  - Possible new ways to mitigate the threat of space debris.

U.S. CubeSat radio frequency spectrum use is regulated by the U.S. FCC, and the FCC requires compliance with orbital debris mitigation guidelines.

U.S. CubeSats abide by NASA Procedural Requirements and Technical Standards for limiting orbital debris.

Thank you