

The background of the slide is a composite image of space. In the foreground, the Earth's horizon is visible, showing a blue atmosphere and white clouds. In the middle ground, the Moon is shown in a large, detailed view, with its characteristic dark spots and craters. The background is a deep black space filled with numerous stars of varying colors and sizes, some with prominent diffraction spikes.

SMALLSATS AND SCIENCE ONE (OF MANY) NASA PERSPECTIVES

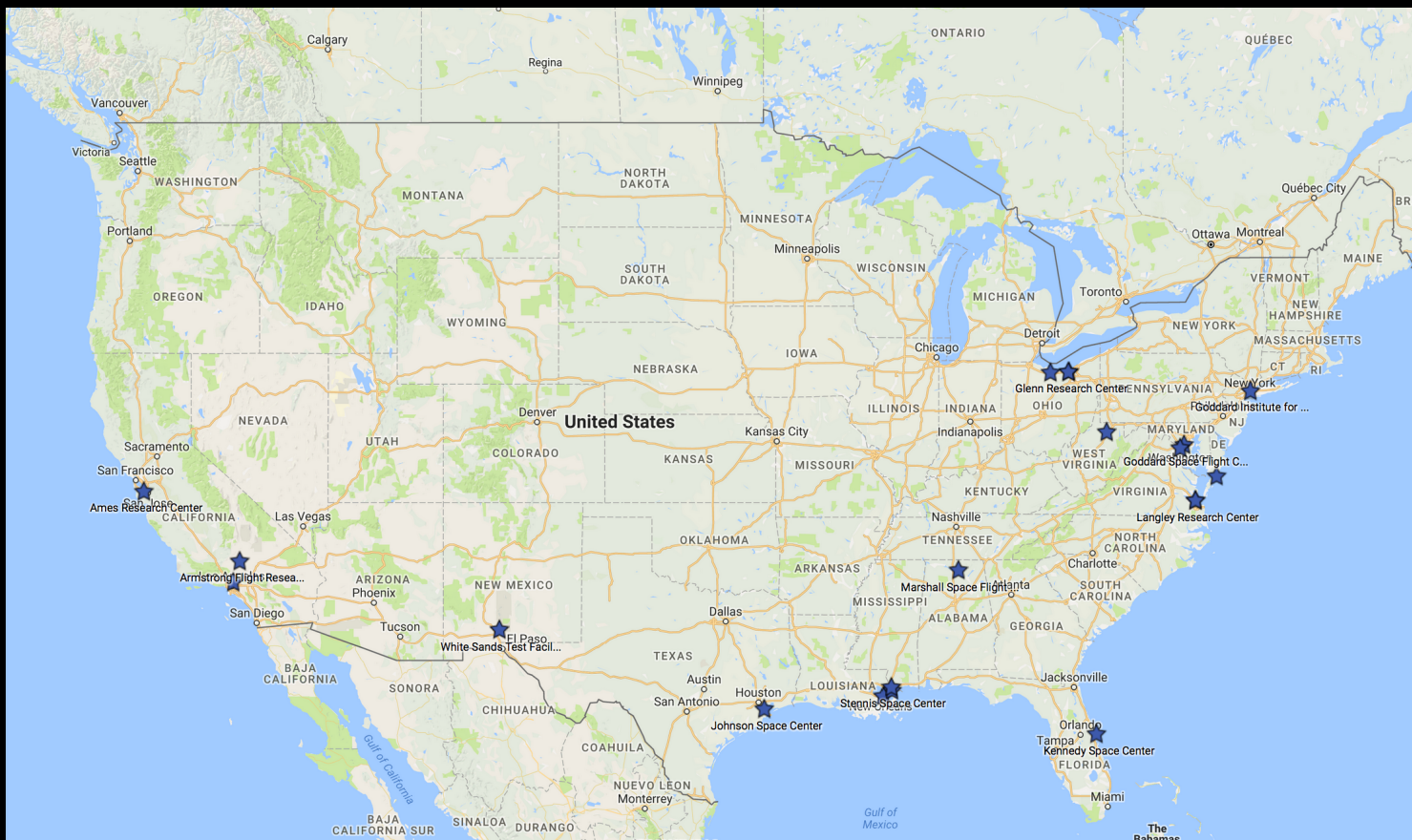
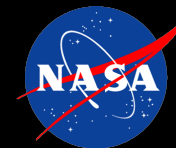
Imagination is more important than knowledge.

Albert Einstein

Michael Johnson
Chief Technologist
Applied Engineering and Technology Directorate
NASA Goddard Space Flight Center

Pacific Operational Science and Technology Conference
9 March 2017

NASA Centers



NASA is comprised of 9 centers

Goddard Space Flight Center



Goddard Space Flight Center

- GSFC Greenbelt, Maryland
- GSFC Wallops Flight Facility, Virginia
- IV&V Facility, West Virginia
- Goddard Institute for Space Studies, New York
- Ground Stations at White Sands Complex, New Mexico



Greenbelt

White Sands Complex



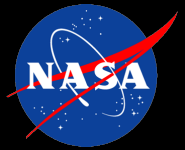
Wallops Flight Facility



Goddard Institute for
Space Studies



Independent Verification and
Validation Facility



Goddard Space Flight Center Missions

Robotic Science and Exploration is a significant component of the NASA mission

NASA Mission:

Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.



Heliophysics, Earth Science, Astrophysics, and Planetary Missions

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SmallSat Science Missions?



Question:

Are “SmallSat” and “credible science missions” consistent?

SmallSat Science Missions?



Are the terms “SmallSat” and “credible science missions” consistent?

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

SPACE STUDIES BOARD
Division on Engineering and Physical Sciences

Thinking Inside the Box
The Committee on Achieving Science Goals with CubeSats Community Symposium



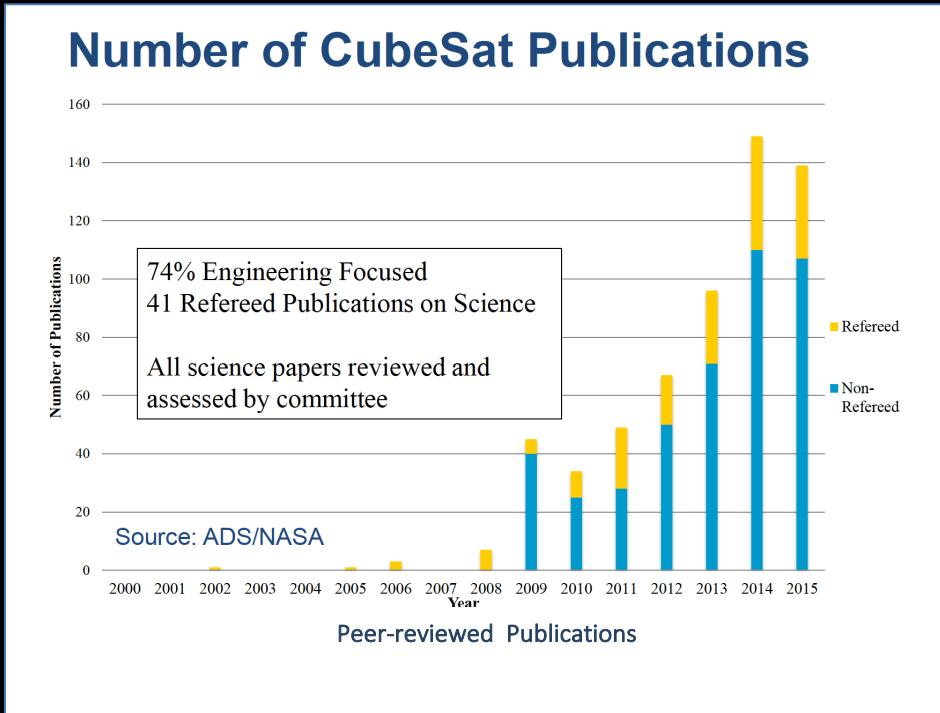
Ref: Achieving Science Goals with CubeSats symposium, 2-3 September 2015
http://sites.nationalacademies.org/SSB/SSB_167274

The National Academies of Science (NAS) sought to answer this question.

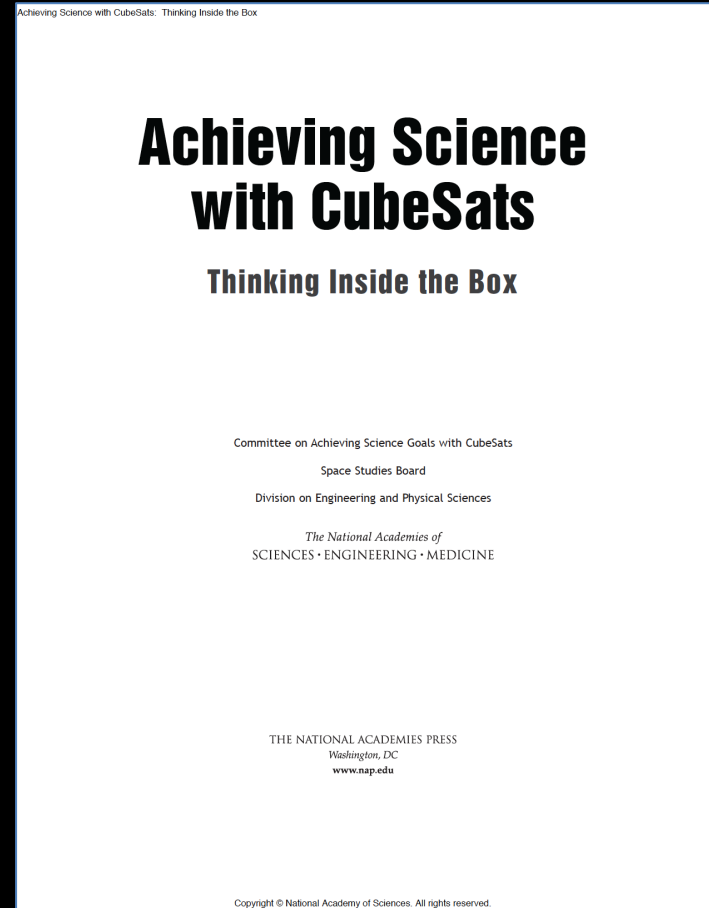


SmallSat Science Missions?

Answer:
There is no “inherent” inconsistency.



Ref: Thomas Zurbuchen, NASA Associate Administrator, Science Mission Directorate

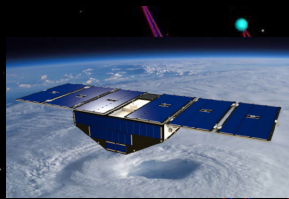


NASA-funded National Academies Report, 2016
ref: goo.gl/osCSQ3

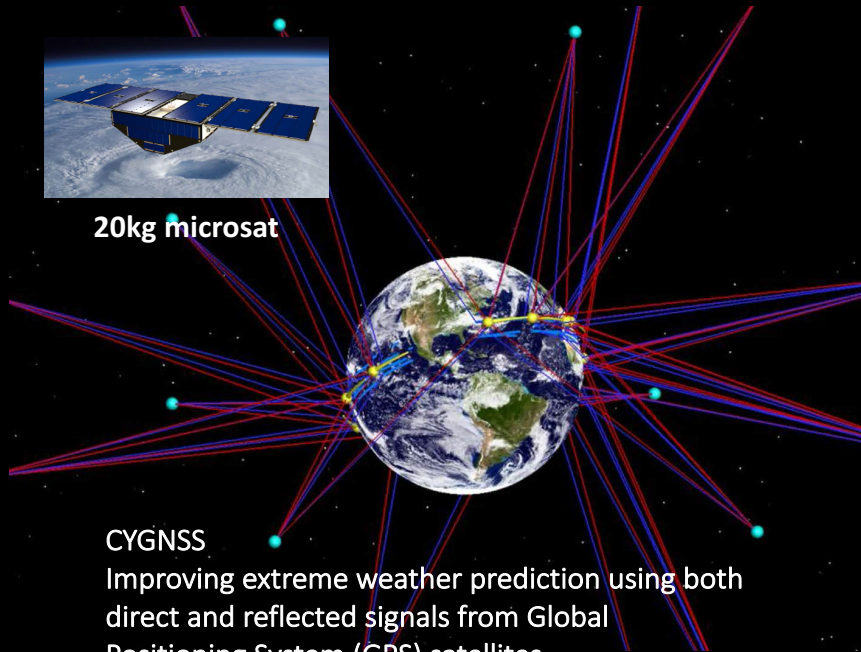
“CubeSats have already produced high-value science, as demonstrated by peer-reviewed publications in high-impact journals.” -NAS Finding

SmallSat Science Missions

Examples: Achieving both targeted science and distributed observations

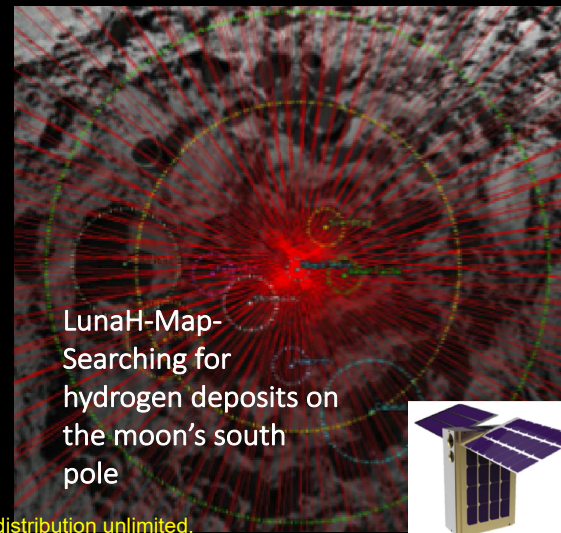
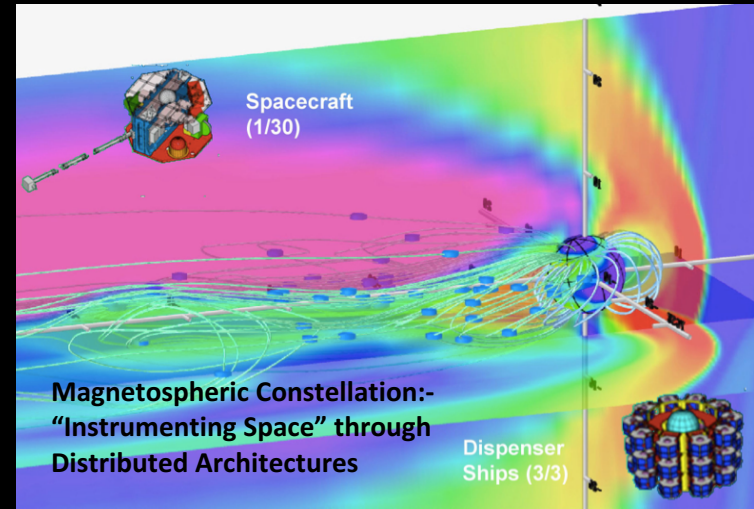


20kg microsat



CYGNSS

Improving extreme weather prediction using both direct and reflected signals from Global Positioning System (GPS) satellites



LunaH-Map-
Searching for hydrogen deposits on the moon's south pole

SmallSat Science Missions



Take Home:

“SmallSat” and “credible science” are consistent.

However...

(see the *SmallSat Reliability: Issues and Solution Approaches* presentation)

