

NSGSSP



Rapid Proliferation of Small Sats: Implications for Space Grant

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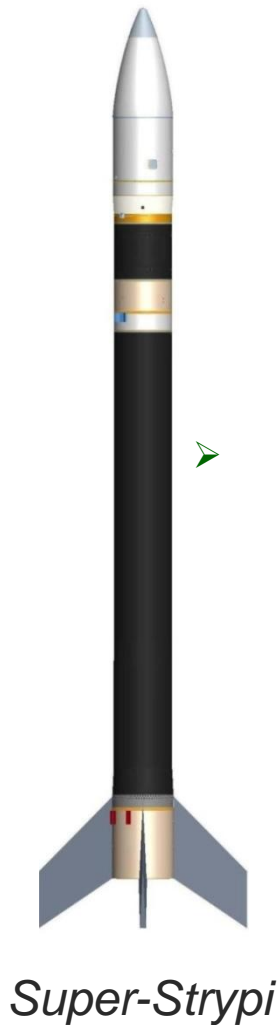
Demand for “Space”

- *In less than 60 years of space flight, the world has launched about 6500 satellites to space of which about 1000 are still operating...*
- ***In the next 5 years, 3 companies (SpaceX/Google: 4000, OneWeb: 900, Samsung: 6000) will attempt to launch almost 11,000 small satellites..... They plan upgrades on 18-month cycles...***
- ***Demand for space launch and small sats has shifted from Government to commercial groups.***
- ***The demand for skilled aerospace engineers and technicians should be fulfilled by Space Grant.***

Shifting Needs & Economics of “Small Space”

- ***Payload Cost usually equals or exceeds launch vehicle costs.***
 - RocketLab Electron – 150kg to 500km orbit at \$4.9M
 - Virgin Galactic Launcher One – 200 kg at \$10M.
 - Firefly – 200 kg at \$8-9M
 - Super-Strypi – 300 kg to 500 km orbit at \$15-18M.
- **New commercial satellite statistics**
 - Mass: CubeSat to ~120 kg
 - Durability: 3-24 months
 - Replacement cost: Less than \$1M up to \$10M
- ***“Sweet Spot” Complete Missions for \$10 - \$25M***

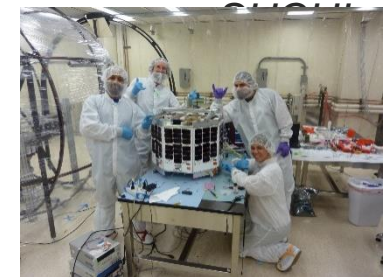
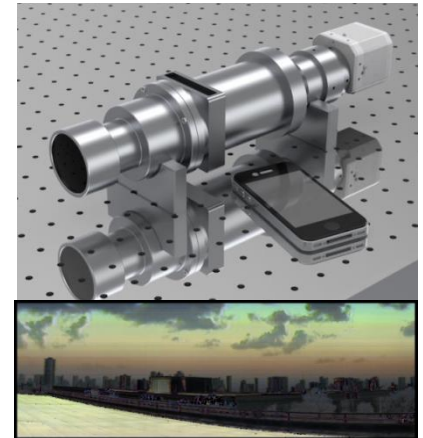
Space is still hard... ORS-4 – November 3, 2015



- *The Operationally Responsive Space Office with support from the Sandia National Laboratories, University of Hawaii and other partners is developing a orbital small launch vehicle.*
 - Goal is to deliver 300kg to Low Earth Orbit (LEO).
 - Develop and test fly three new solid rocket motors from Aerojet-Rocketdyne.
 - **Future mission cost is \$15M/launch compared to +\$30M for other US alternatives.**
 - UH/HSFL's HiakaSat will fly as the primary payload on the Integrated Payload Stack
 - NASA EPSCoR hyperspectral imager flies on HiakaSat.
- *Partnerships Developed*
 - Space Act Agreement with NASA Ames: Development of HiakaSat
 - Strategic Alliance Agreement with Aerojet-Rocketdyne: Solid rocket motors
 - Pacific Missile Range Facility: Support for all HSFL activities
 - Sandia National Laboratory: Rocket development
 - Alaska Aerospace Corporation: Future launch opportunity
 - *Northrop-Grumman: Space technology test-bed on HiakaSat



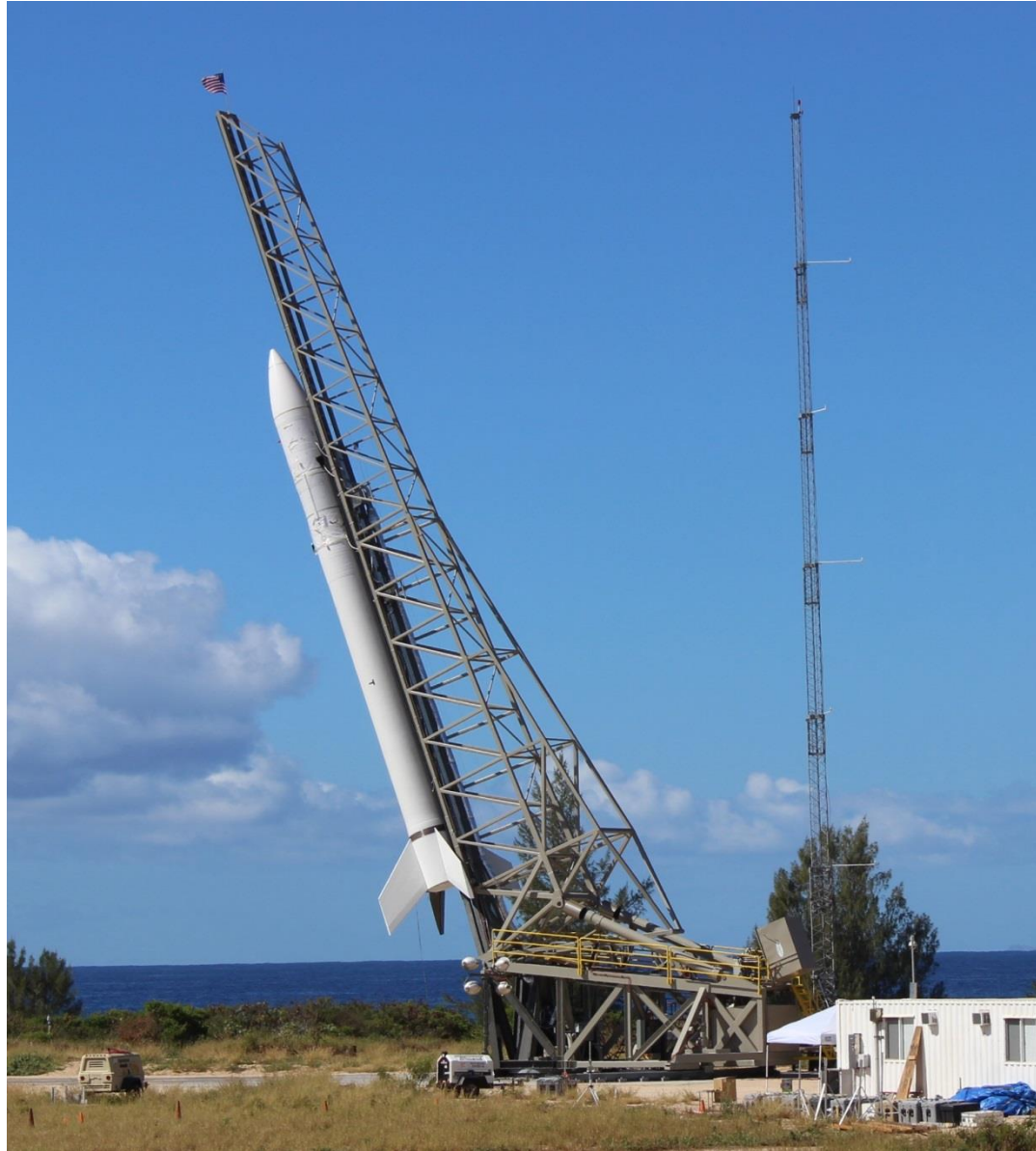
AJR motor test -2012



HiakaSat



First Vertical Lift of Rocket



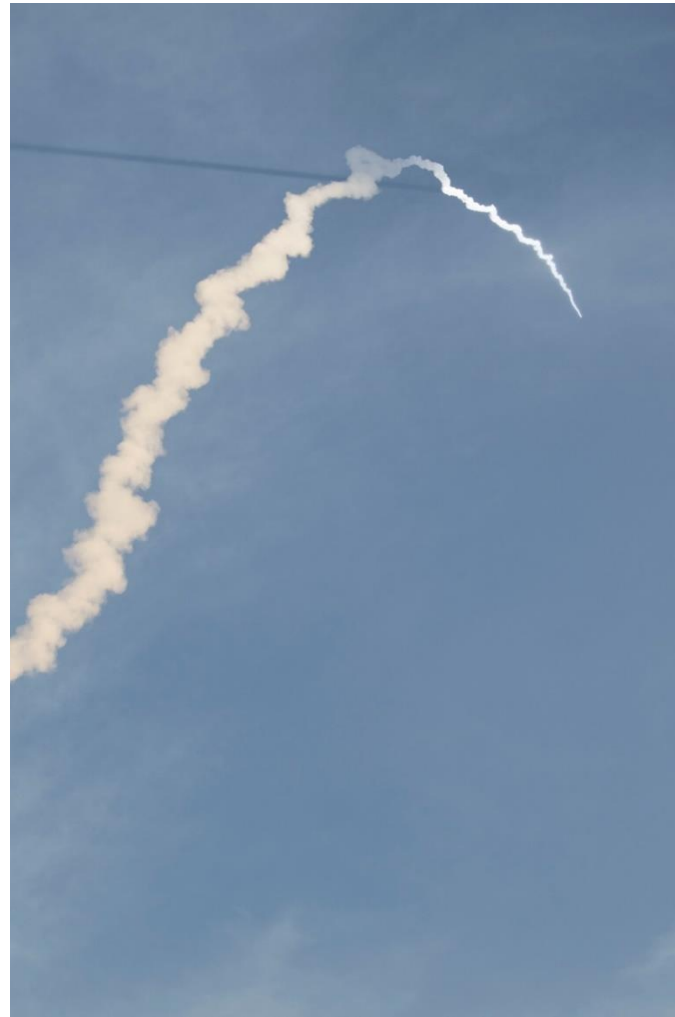
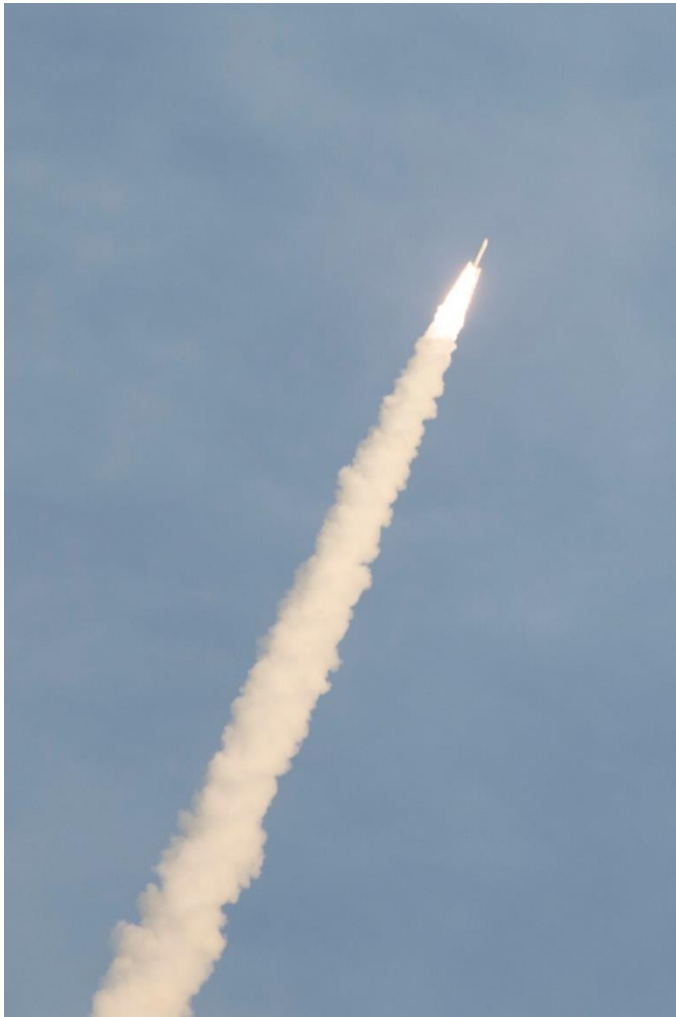
Launch Pictures – Ignition and Rail Travel



Launch Pictures – Free Flight – 1st Stage Burn



Launch Pictures – Rocket Failure




NASA Ames, Montana State, Utah State, St. Louis University/
Vanderbilt, Pumpkin Inc., and HSFL all lost satellites.

Failure Investigation Ongoing: Shroud material shed during flight

https://www.youtube.com/watch?v=TXvvdGb81cU

YouTube



Inaugural Launch Fails for Super Strypi and ORS-4

SpaceVids.tv

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Published on Nov 3, 2015

A demonstration launch of a new rocket for the Department of Defense in the United States has ended in failure after video provided by the University of Hawaii shows the rocket begin to oscillate in its spin stabilized flight.

Ideas for the future of NSGSSP

- Workforce training opportunities are most important!
- NSGSSP should have a web site that announces small sat schedules – Future Launch Date, Currently Operating, Last Mission Date
- We need to leverage the NSGSSP and Space Grant Network.
 - **NSGSSP Workshop for students**
 - Start small with common bus – 3-U CubeSat
 - Develop design book of successful subsystems.
 - Bulk component buys lower costs for all.
 - Hands-on Workshop for students and by students with mentors – not commercial
 - Annual or every two years??
 - **Draw on small sat faculty expertise across clusters of neighboring States**
 - **Inventory Test Equipment across NSGSSP**
 - Offer test support to other student teams
 - Derive common set of test equipment and operations/procedures manuals with on-line student support.
- More Ideas Welcome!