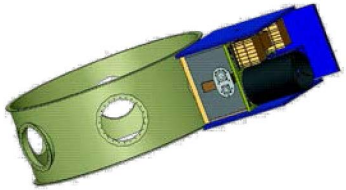
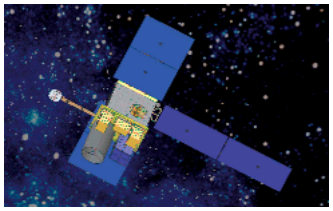
A Systems Approach to Lower Cost Missions

Following the Rideshare Paradigm





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Abstract

A Systems Approach to Lower Cost Missions: Following the Rideshare Paradigm

- Capabilities have evolved over the last 10 years
- Coordination is enabling
- Currently done ad hoc
- Challenge is to match the users with the capabilities
- A paradigm is defined, with an example taken from developments over the last decade
- A way forward is presented

Introduction

A Systems Approach to Lower Cost Missions: Following the Rideshare Paradigm

- A "Rideshare Paradigm" is defined with 5 principles
- Idea is not new, NASA is rich with examples of international partnerships, etc.
- What is new, is the emergence of (limited) routine, low-cost space access, hopefully to be leveraged for more missions in this time of limited budgets
- A brief history is presented of progress in one option, following the 5 principles

Introduction: The Rideshare Paradigm

1. Develop partnerships
2. Share costs
3. Establish policy
4. Standardize interfaces
5. Do no harm

Introduction to the rideshare challenge: many options

A: Payloads

- Component experiments
- Sensors
- Deployables
- Electronics
- Instruments (all sizes)

B: Spacecraft

- Cubesat
- SIV
- 10–100 kg
- 100–200 kg
- 200–500 kg

C: Launchers & Adaptors

- PPOD
- ESPA ring
- Balloon
- Airborne
- UAV
- Minotaur
- Pegasus
- Taurus
- Delta II
- EELV

Background:
Developments over the last decade

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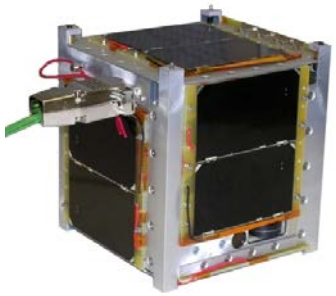
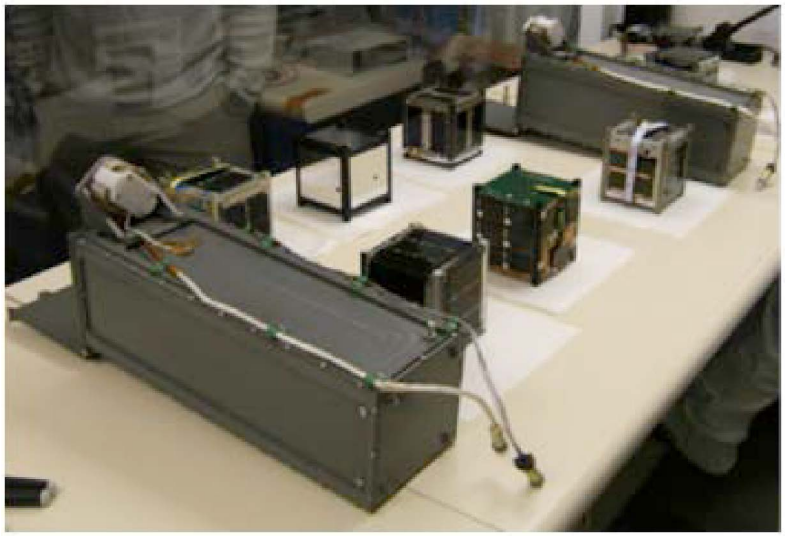
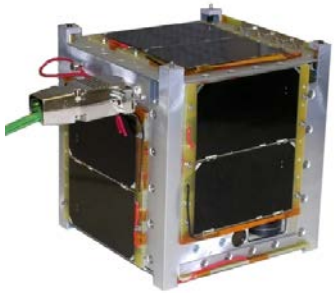
Case Study:
Cubesats and the 5 principles in 2002





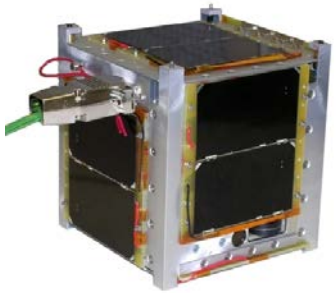
Principle #1
Develop Partnerships

- Key cubesat developers came to the 2002 Rideshare Workshop, seeking a ride to space for cubesats
- Advice was given for developing partnerships
  - Consolidate the universities
  - Establish one voice for the 100+ cubesats



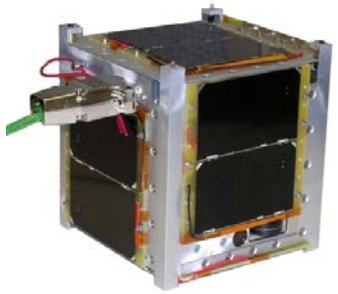
Principle #2
Share Costs

- This is actually a benefit of the Principle #1, but also had design implications for cubesats
  - The PPOD design deploys 3 cubesats at a time
- The costs savings is to the payload
  - Added costs to the spacecraft and launch vehicle are paid for by the payload, but still saves significantly than flying “alone”



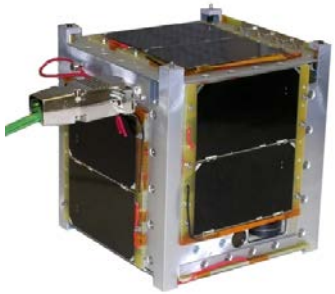
Principle #3
Establish policy

- There is now an Air Force policy which states PPODs will be flown on Minotaur launches
  - Provides a path for access to space
  - Without this path, there is no mission
- NASA is also developing PPOD launch access capability with policy yet to be established



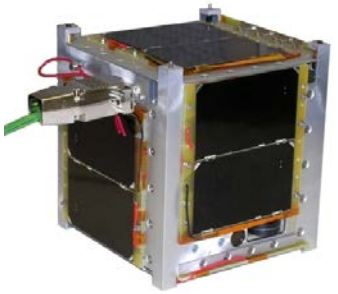
Principle #4
Standard Interfaces

- For the cubesat rideshare option, the standard interfaces principle is enabling.
  - (for some rideshare options, it is not enabling)
  - Un-related cubesats can ride together in PPOD
  - Standard PPOD design “keeps it simple”
  - Standard PPOD can be assessed once, then used on many times



Principle #5
Do no harm

- This was the successful, underlying design driver for the PPOD

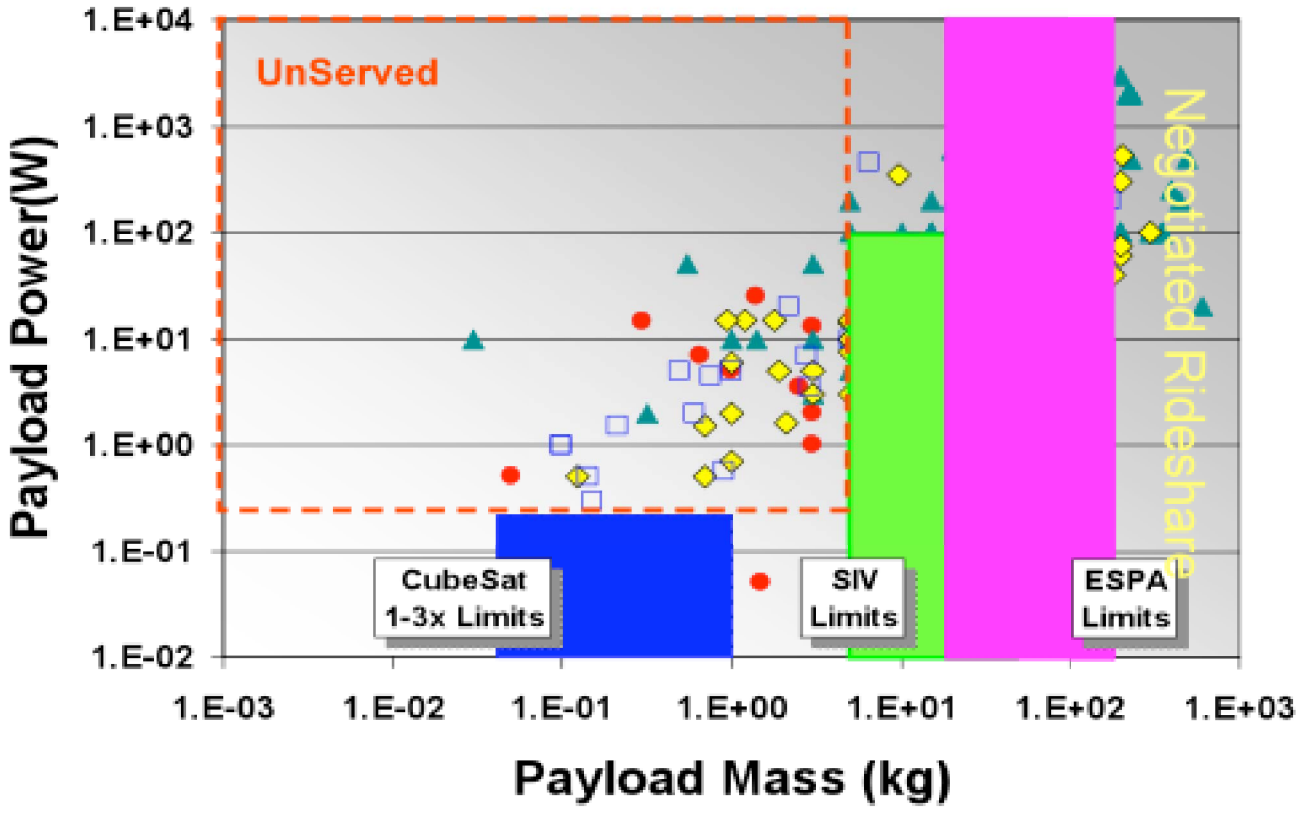


Next Steps

Challenges of a Systematic Rideshare Approach

- Who and where are the users?
- What is the optimum leveraging/partnership?
  - (what are the options?)
- What is traded? Mass? Power? Cost?
- How does one sort through these options?
- Are there policies/programmatics that can streamline rideshare?

Who and where are the users?



What are the options?

		TRL	Cost	Comments
Classic	Delta II replaced by EELV	High	> $150M	Cost will limit missions for NASA
	Pegasus, Taurus	High	$50 – 100M	Phasing out
Emerging	Taurus II	Low	Unknown	Available in 2012
	Minotaur I	High	< $50M	Available today. Limited NASA use
	Minotaur IV	Medium	< $50M	First launch in 2009. Limited NASA use
	Falcon I	Medium	< $10M	First successful launch September 2008
	UAV	High	< $10M	Available for low TRL payload
	High-altitude platform	Low	< $20M	In development
	Cubesat	High	< $50M	Good for experiments. Available today
	ESPA	High	< $20M	Available today but NASA policy not yet in place

A Path Forward

Understands the users; Knows the options; Uses emerging capabilities

Payloads

- component experiments
- sensors
- deployables
- electronics
- instruments (all sizes)

Spacecraft

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rideshare pathway

to space

Questions?