JOHN F. KENNEDY SPACE CENTER

LAUNCH SERVICES PROGRAM

ELaNa

Making it Happen!

CalPoly CubeSat Workshop 2012
April 18 - 20

Garrett Skrobot

ELaNa Project Manager

Launch Services Program

NASA

ELaNa

Educational Launch of Nanosatellite

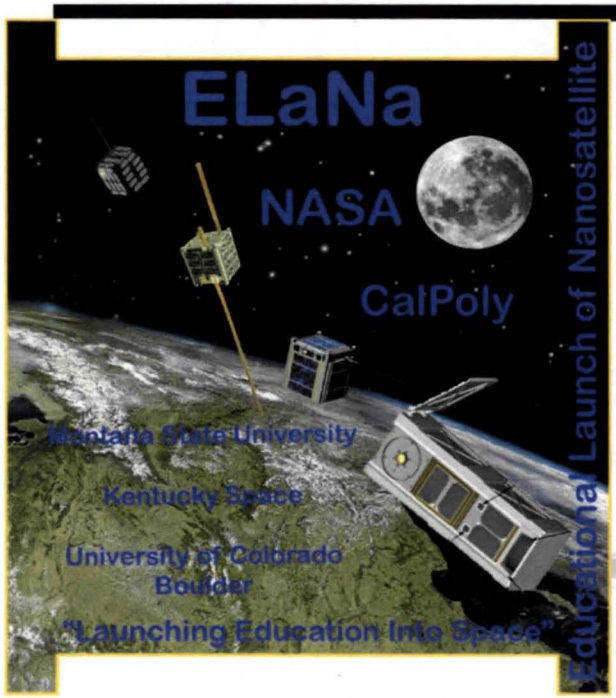
"Science, Technology, Engineering, and Mathematics"

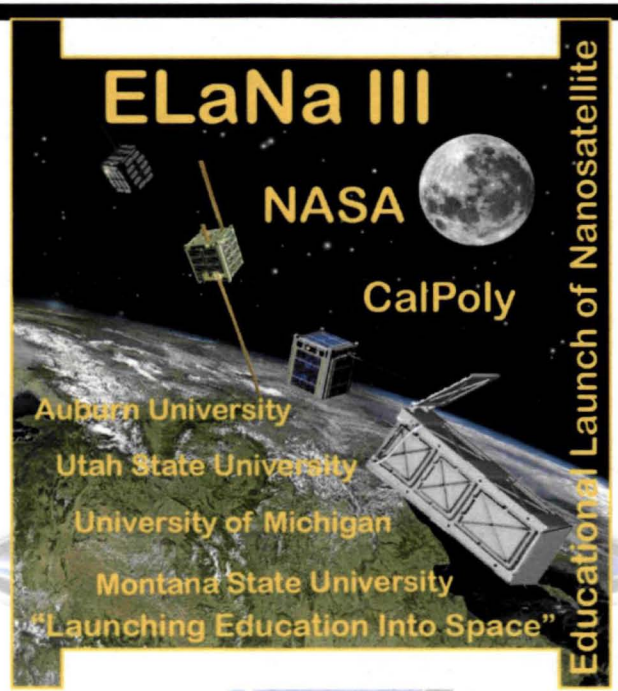
"Launching Education into Space"

JOHN F. KENNEDY SPACE CENTER

ELaNa CubeSat Missions

LAUNCH SERVICES PROGRAM





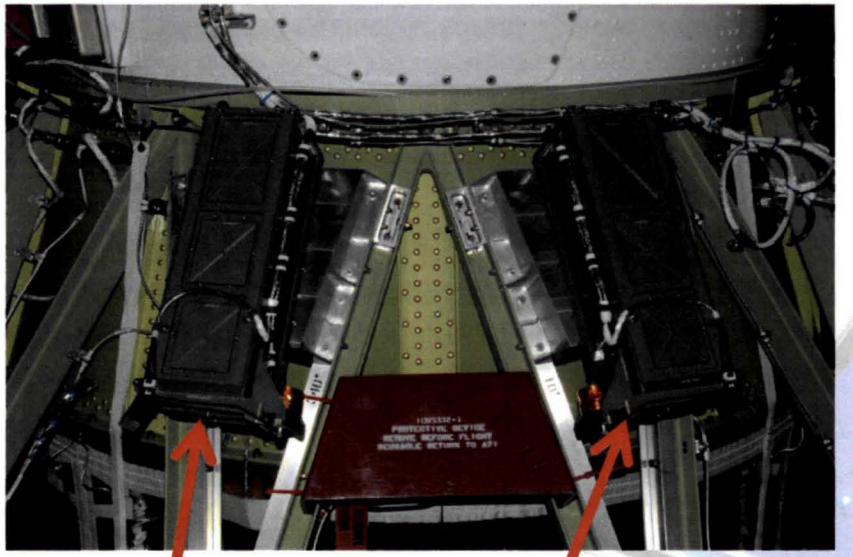
CUBESAT

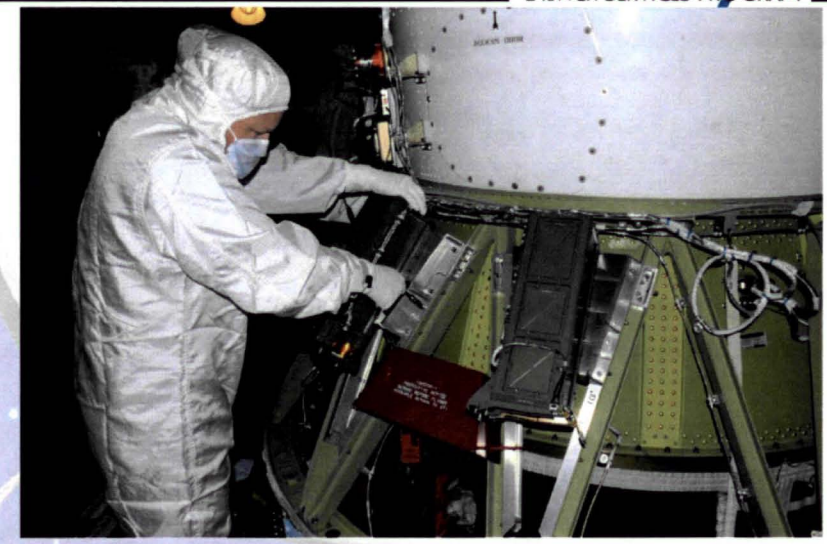
CALIFORNIA POLYTECHNIC STATE UNIVERSITY

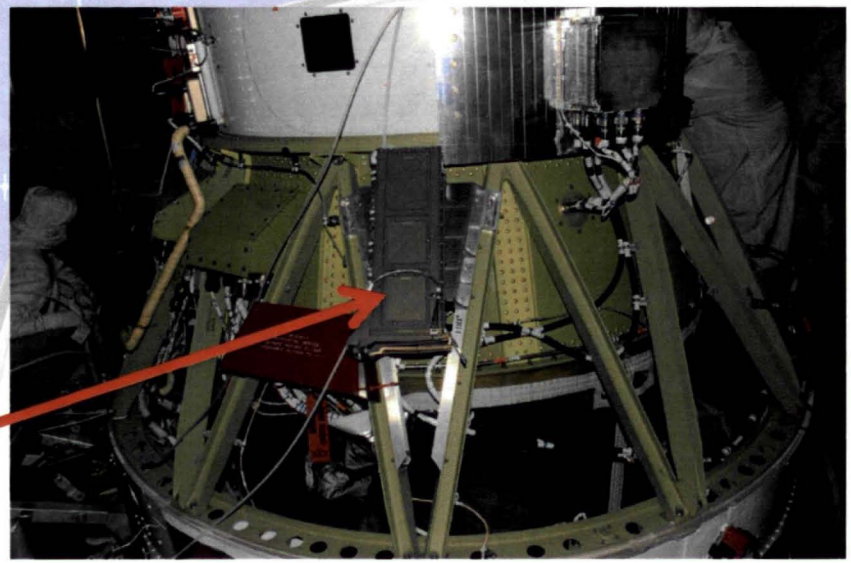
JOHN F. KENNEDY SPACE CENTER

ELaNa III

LAUNCH SERVICES PROGRAM







P-POD #3
DICE

P-POD #1
E1P-F2
AubieSat
Mcube/Cove

P-POD #2
RAX 2

JOHN F. KENNEDY SPACE CENTER

ELaNa III

LAUNCH SERVICES PROGRAM

PRIME

MONTANA STATE UNIVERSITY

SPACE SCIENCE AND ENGINEERING LABORATORY

DICE

ASTRA
USU/SDL
Clemson
Embry Riddle

AubieSat-I

DELTA 2 | VANDENBERG AFB, CALIFORNIA | ELaNa

RADIO AURORA EXPLORER

NATIONAL SCIENCE FOUNDATION

M-CUBED

MICHIGAN MULTIPURPOSE MINISAT

JOHN F. KENNEDY SPACE CENTER

NASA CubeSat Initiative

LAUNCH SERVICES PROGRAM

3 Calls for CubeSats has reached 24 States

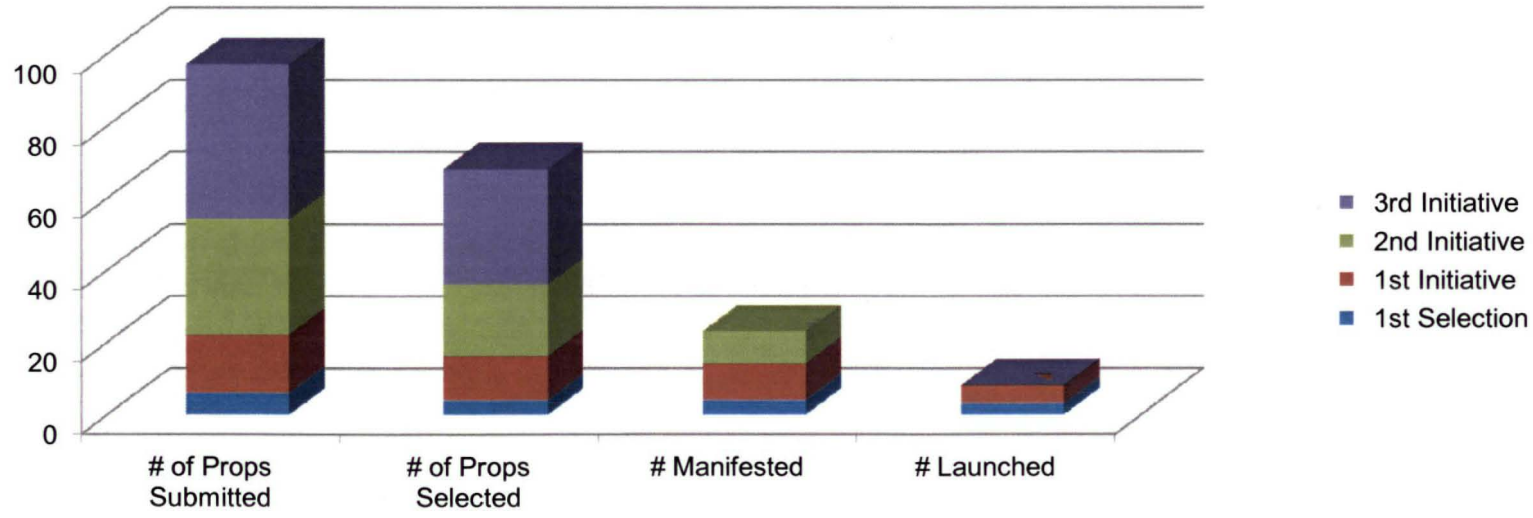
68 CubeSats Selected with 23 Manifested

JOHN F. KENNEDY SPACE CENTER

NASA CubeSat Initiative Proposals

LAUNCH SERVICES PROGRAM

	# of Props Submitted	# of Props Seleced	# Manifested	# Launched
1st Selection	6	4	4	3
1st Initiative	16	12	10	5
2nd Initiative	32	20	9	0
3rd Initiative	43	32	0	0
Total	97	68	23	8

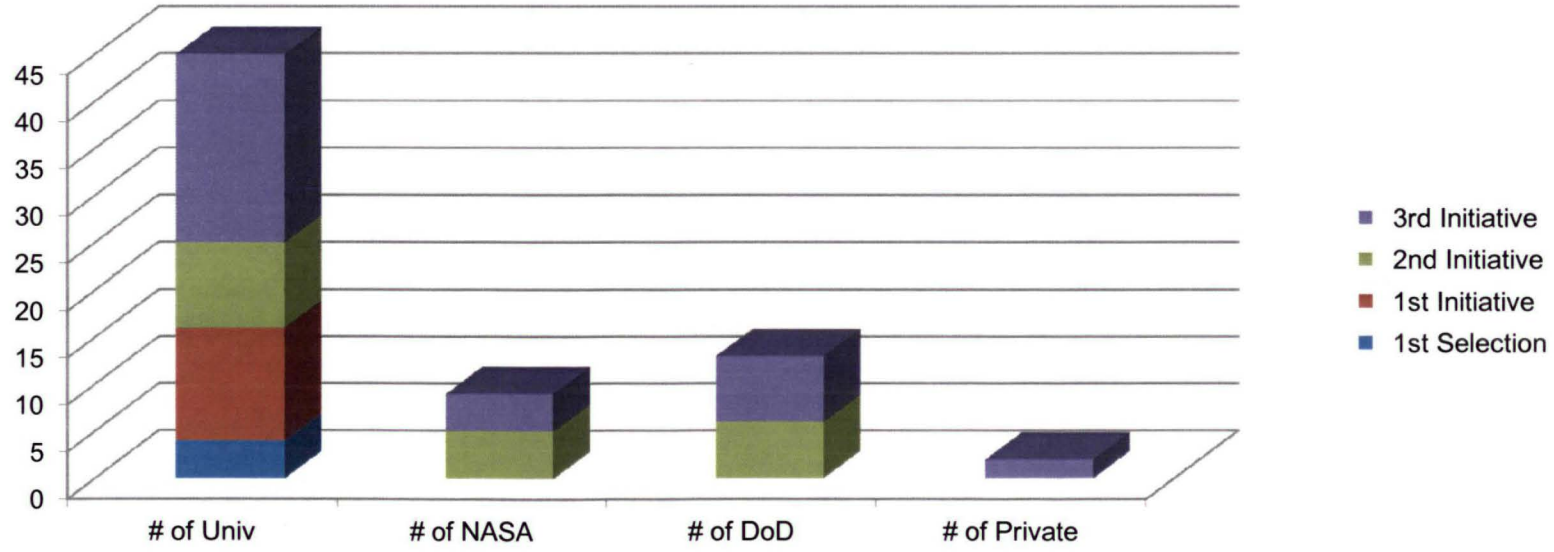


JOHN F. KENNEDY SPACE CENTER

NASA CubeSat Initiative Proposers

LAUNCH SERVICES PROGRAM

	# of Univ	# of NASA	# of DoD	# of Private
1st Selection	4	0	0	0
1st Initiative	12	0	0	0
2nd Initiative	9	5	6	0
3rd Initiative	20	4	7	2
Total	45	9	13	2

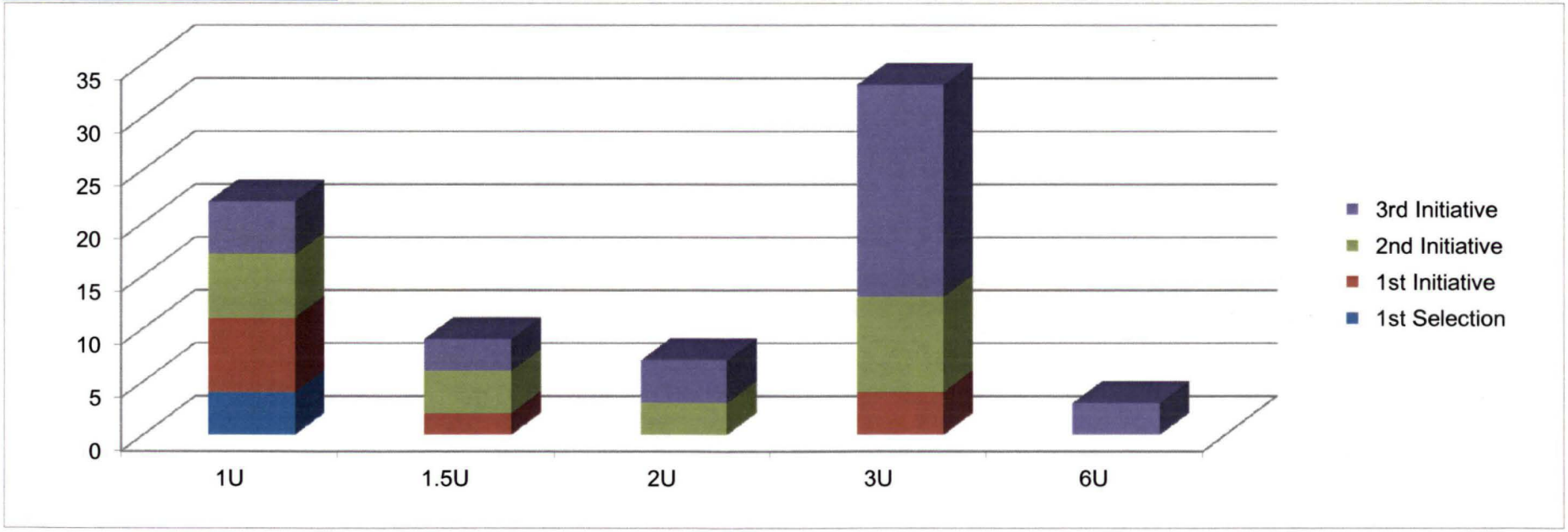


JOHN F. KENNEDY SPACE CENTER

NASA CubeSat Initiative
CubeSat Sizes

LAUNCH SERVICES PROGRAM

	1U	1.5U	2U	3U	6U
1st Selection	4	0	0	0	0
1st Initiative	7	2	0	4	0
2nd Initiative	6	4	3	9	0
3rd Initiative	5	3	4	20	3
Total	23	9	7	33	3

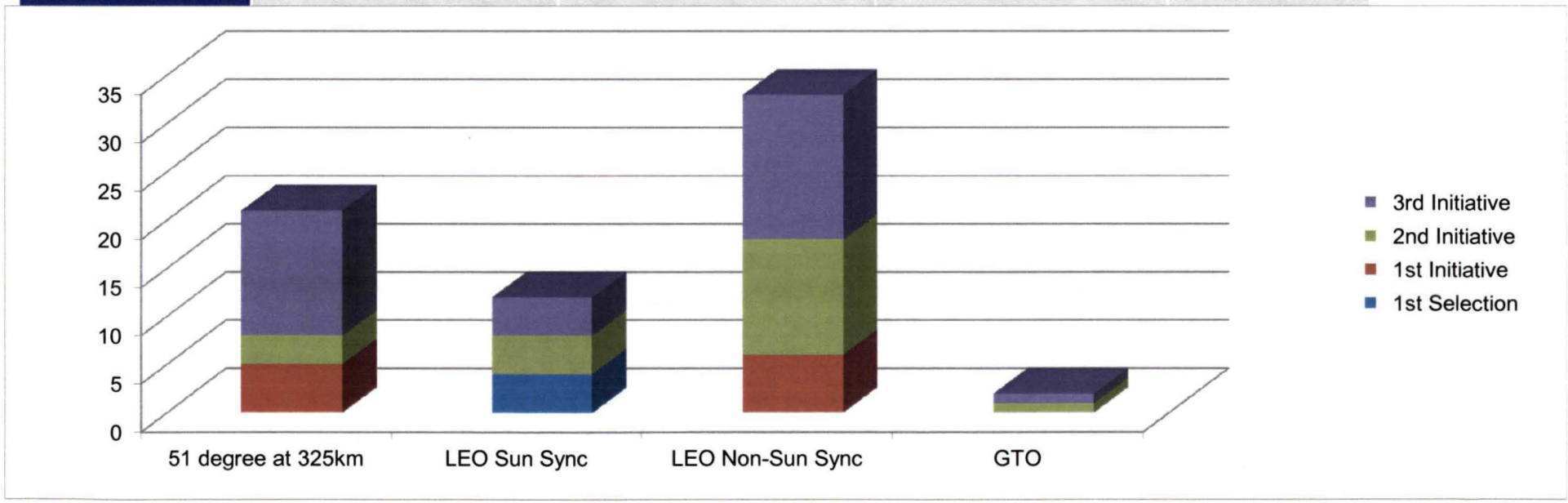


JOHN F. KENNEDY SPACE CENTER

NASA CubeSat Initiative CubeSats by Orbit

LAUNCH SERVICES PROGRAM

	51° at 325km	LEO Sun Sync	LEO Non-Sun Sync	GTO
1st Selection	0	4	0	0
1st Initiative	5	0	6	0
2nd Initiative	3	4	12	1
3rd Initiative	13	4	15	1
Total	21	12	33	2



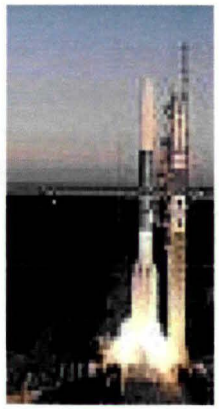
JOHN F. KENNEDY SPACE CENTER

NASA CubeSat Carriers

LAUNCH SERVICES PROGRAM

Atlas V		Delta IV	Delta II	Taurus XL	Athena	Falcon 9	
Common	ABC	Common	2nd Stg Struts Section	Aft End 3rd Stg	Aft End	CRS	Fairing
Studied	In Development Aug '12	Studied	Flown	Flown	Studied	In Development Dec '12	Starting Development 2014






JOHN F. KENNEDY SPACE CENTER

Manifested Missions

FY08 | FY09 | FY10 | FY11 | FY12 | FY13 | FY14

Failed to reach orbit

ELaNa I

March 4th

Sucessful

ELaNa III

October 25th

ELaNa VI

August

ELaNa IV

June

ELaNa V

December

Sept

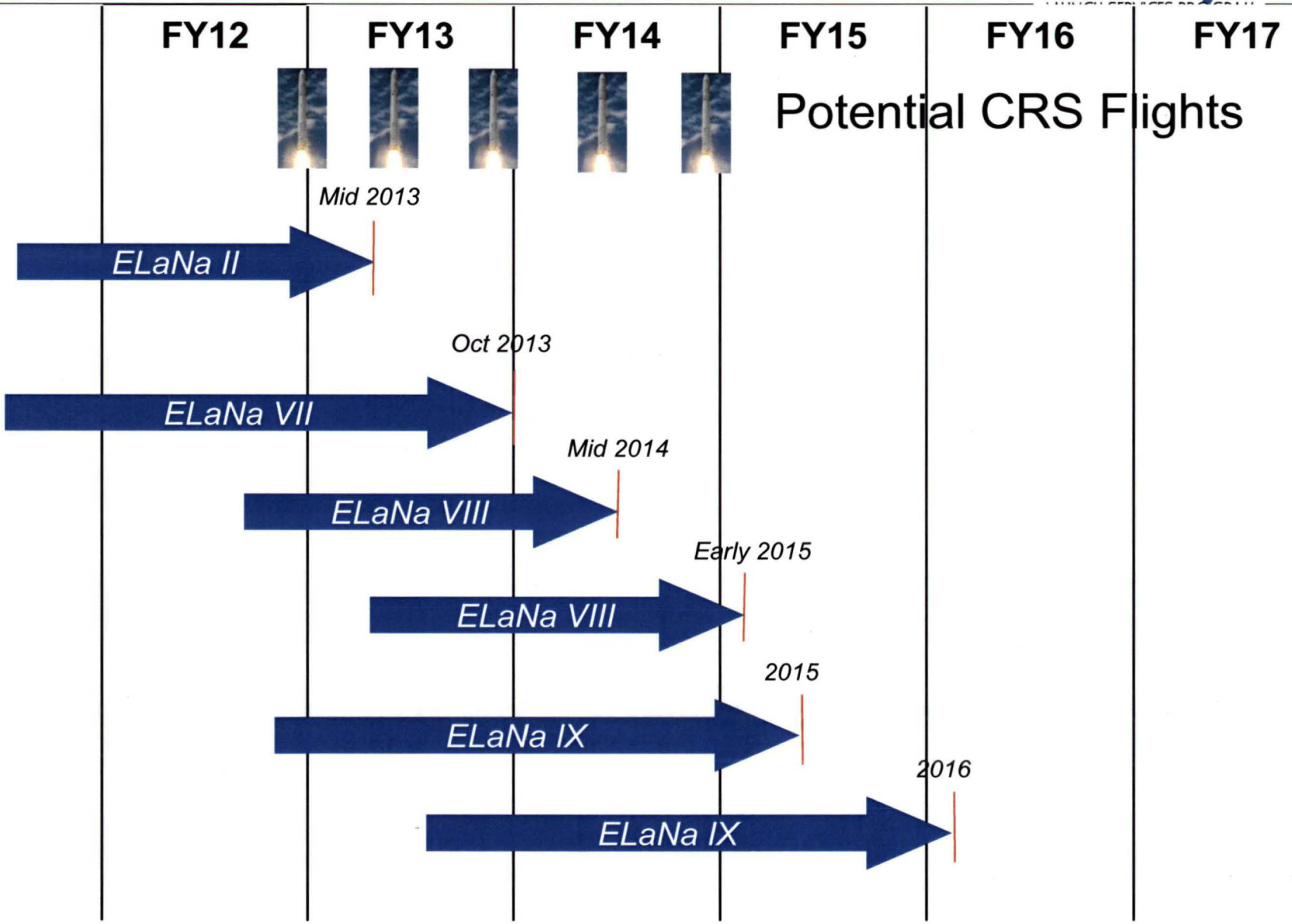
Feb

Demo Flight

JOHN F. KENNEDY SPACE CENTER

Mission of Opportunities

Potential CRS Flights



JOHN F. KENNEDY SPACE CENTER

Nano Launcher System

LAUNCH SERVICES PROGRAM

- During the CubeSat Workshop in August 2011, we talked about the Next Logical Step for the launching of CubeSats
- Our own Nano Launcher System
- *So where are we today?*

JOHN F. KENNEDY SPACE CENTER

Nano Launcher System

LAUNCH SERVICES PROGRAM

Conceptual

Phase I ---- Phase II ---- Phase III

High Altitude

1 Stage system

15k to 100k feet flights

Sub Orbital

1 Stage system
Large Tanks
Increase Engine

185 Km flights

Orbital

2 Stage system
Large Tanks
Increase Engine

450 Km flights

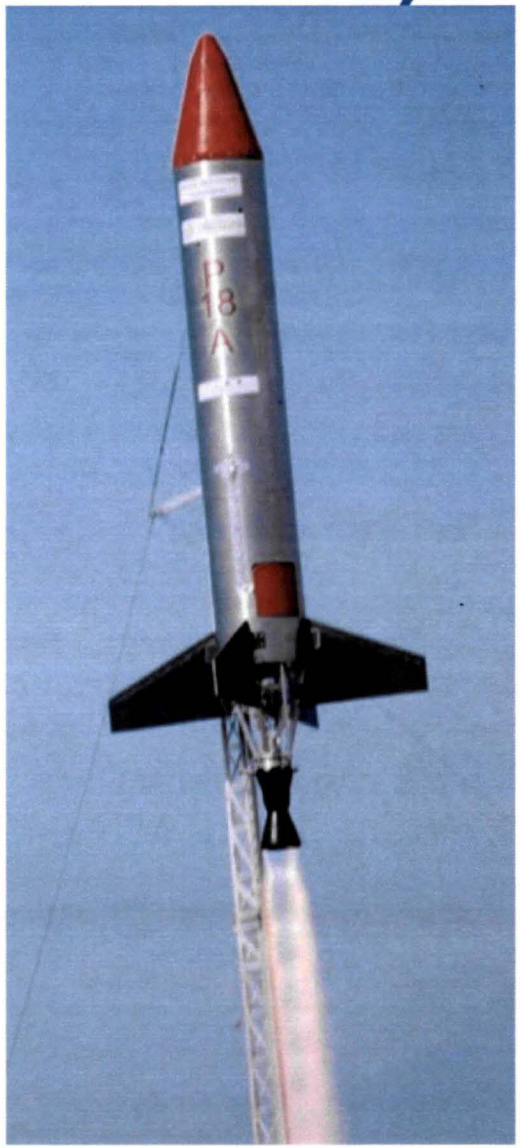
6 to 12 months

12 to 18 months

12 to 24 months

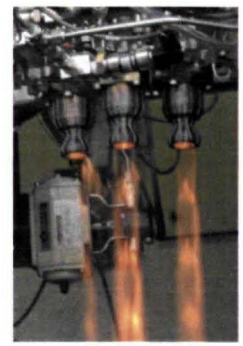
High Altitude Launcher

- **Launch Service Program has placed Garvey Spacecraft Corporation on contract for a series of high altitude launches**
  - **Flight 1**
    - » **Looking for riders!**
    - » **Launch Date Sept 2012**
    - » **Developing a system to eliminate P-POD and attach the CubeSat to the interface Deck**
  - **Flight 2**
    - » **CP9 Mus-StangSat CubeSat system to test data collect system between two cubesats**
      - **CP9 Mus being developed by CalPoly**
      - **StangSat is a Merritt High School CubeSat project**
  - **Options for three additional flights**



Nano Launcher SBIRs

- **Three NASA 2012 Phase I SBIR have been awarded under the Nano Launcher Technology topic**
  - **Garvey Space**
    - » **Alternative Hydrocarbon Propulsion for Nano / Micro Launch Vehicle**
      - **Modify design of flight proven 5K lbf LOX/ethanol engine to use propylene instead**
  - **Interorbital Systems**
    - » **Neptune modular rockets for breakthrough low-cost space access**
      - **A single CPM adapted as a rocket, such as the flight-ready Interorbital CPMTV, can be used as an ultra low-cost entry level rocket vehicle for educational programs**
  - **Ventions**
    - » **A High-Payload Fraction, Pump-Fed, 2-Stage Nano Launch Vehicle**
      - **The proposed nano launch vehicle is aimed at providing low-cost and on-demand insertion of NASA cube- and nano-satellites into LEO as primary payloads**



Future P-POD Task

- Development of a CubeSat Developers User Guide
- P-POD Power-On System
- Orbital Debris Request for Information
- Six U Carrier System
- ESPA Six U Mount
- Alternative Micro Switch
- RF Gasketing
- Purge System
- CubeSat Propulsion System

In Closing

Questions?