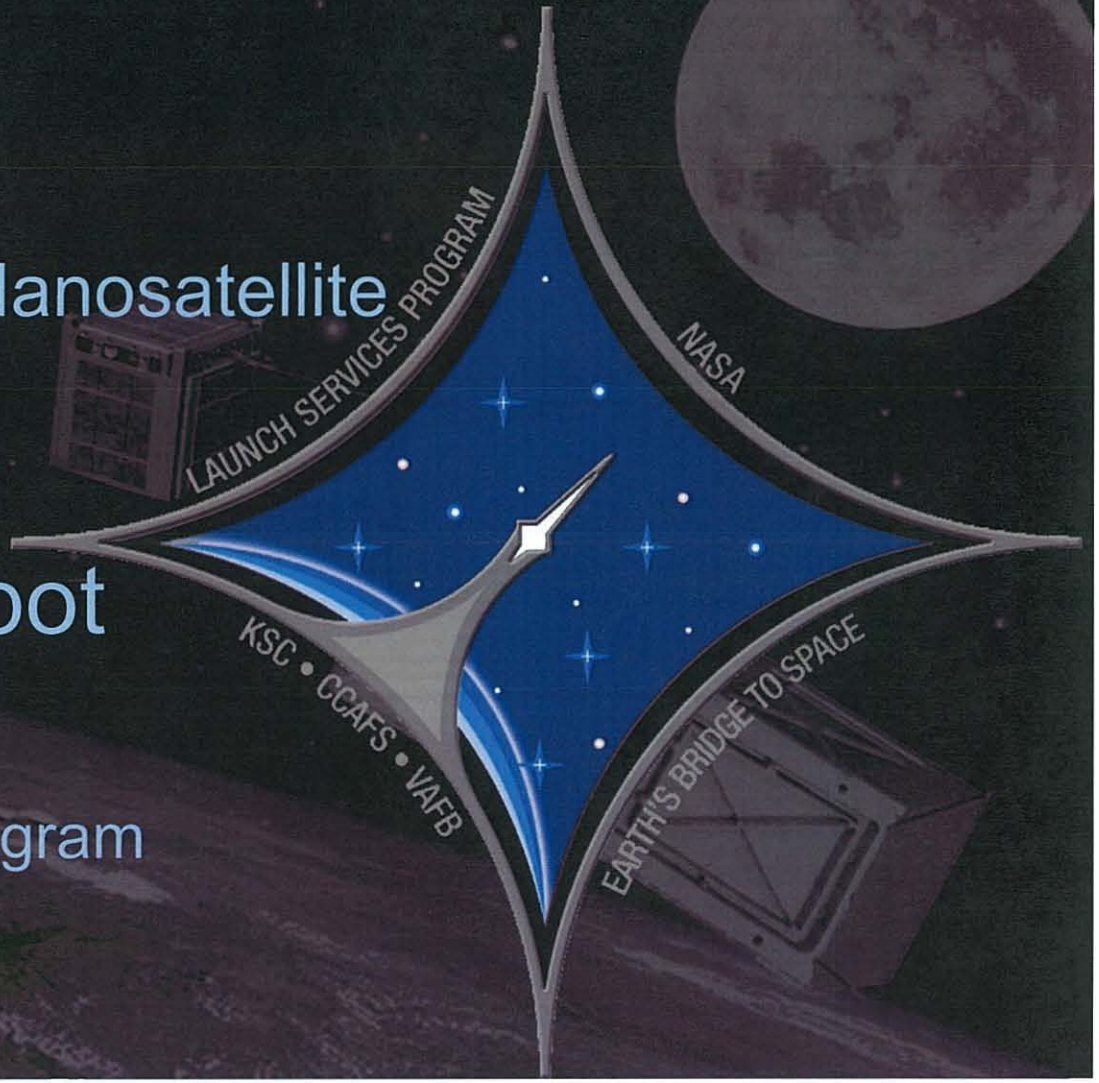
John F. Kennedy Space Center

2011 Calpoly CubeSat Workshop

ELaNa

Educational Launch of Nanosatellite



Garrett Skrobot

Mission Manager

Launch Services Program

NASA

John F. Kennedy Space Center

ELaNa

LAUNCH SERVICES PROGRAM

Educational Launch of Nanosatellite

"Science, Technology, Engineering, and Mathematics"

"Launching Education into Space"

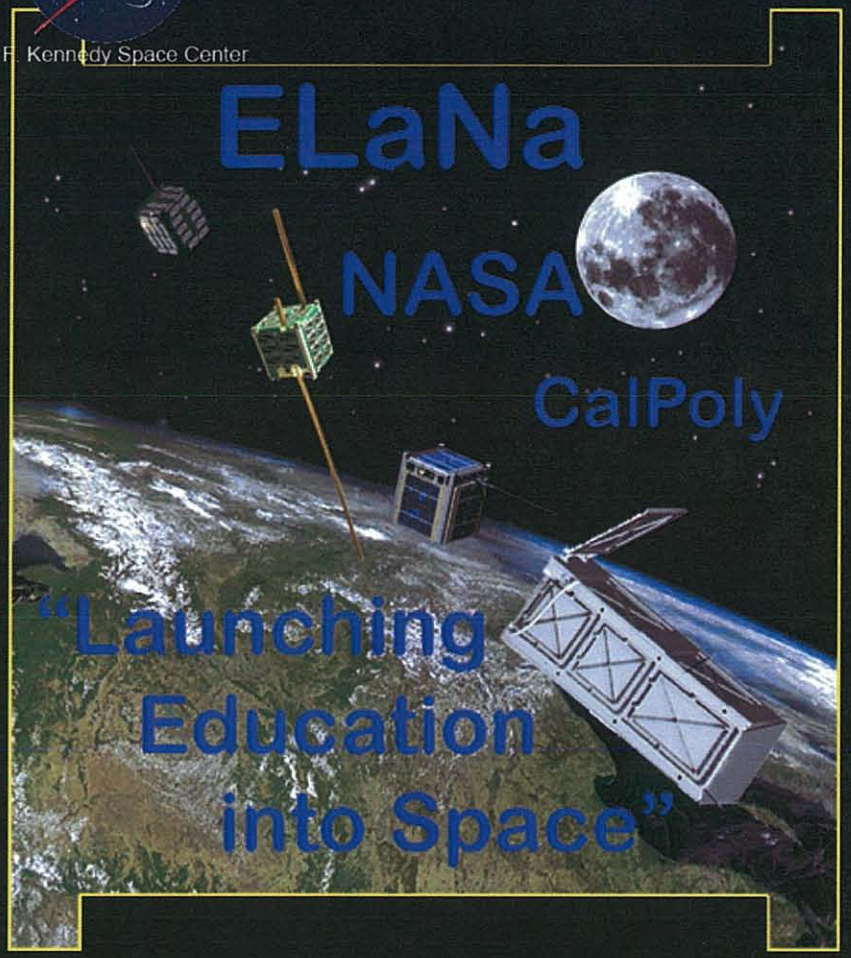
NASA

John F. Kennedy Space Center

ELaNa

NASA

CalPoly



"Launching Education into Space"

CUBESAT

California Polytechnic State University

PRIME

EXPLORER

SPACE SCIENCE AND ENGINEERING LABORATORY

MONTANA STATE UNIVERSITY

LAUNCH SERVICES PROGRAM

KySat™

COLORADO SPACE GRANT CONSORTIUM

H E R M E S

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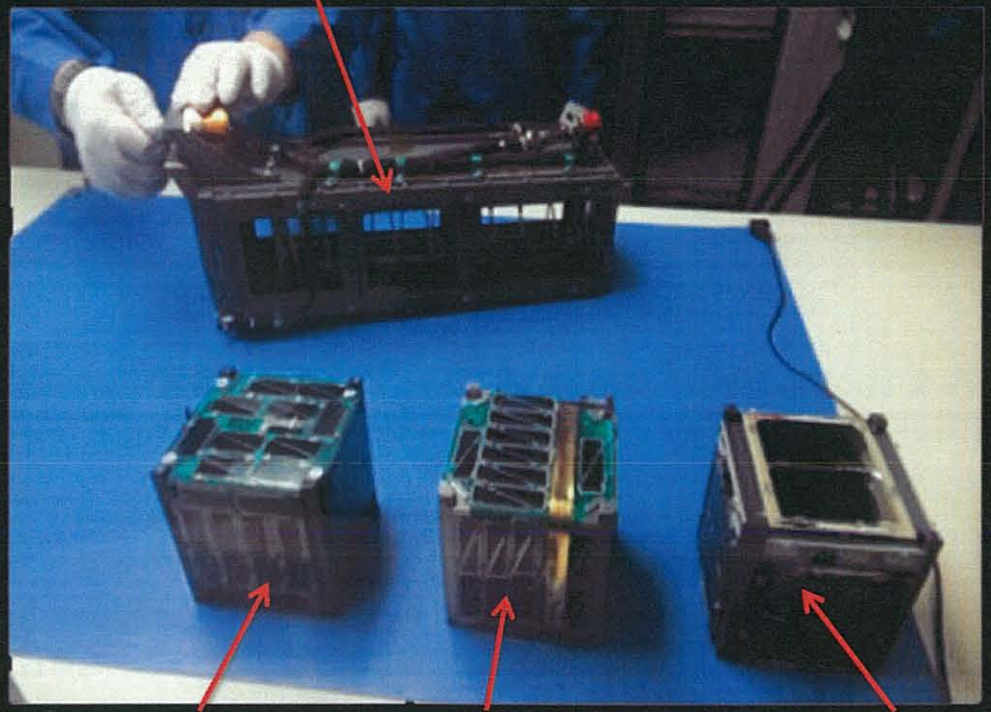
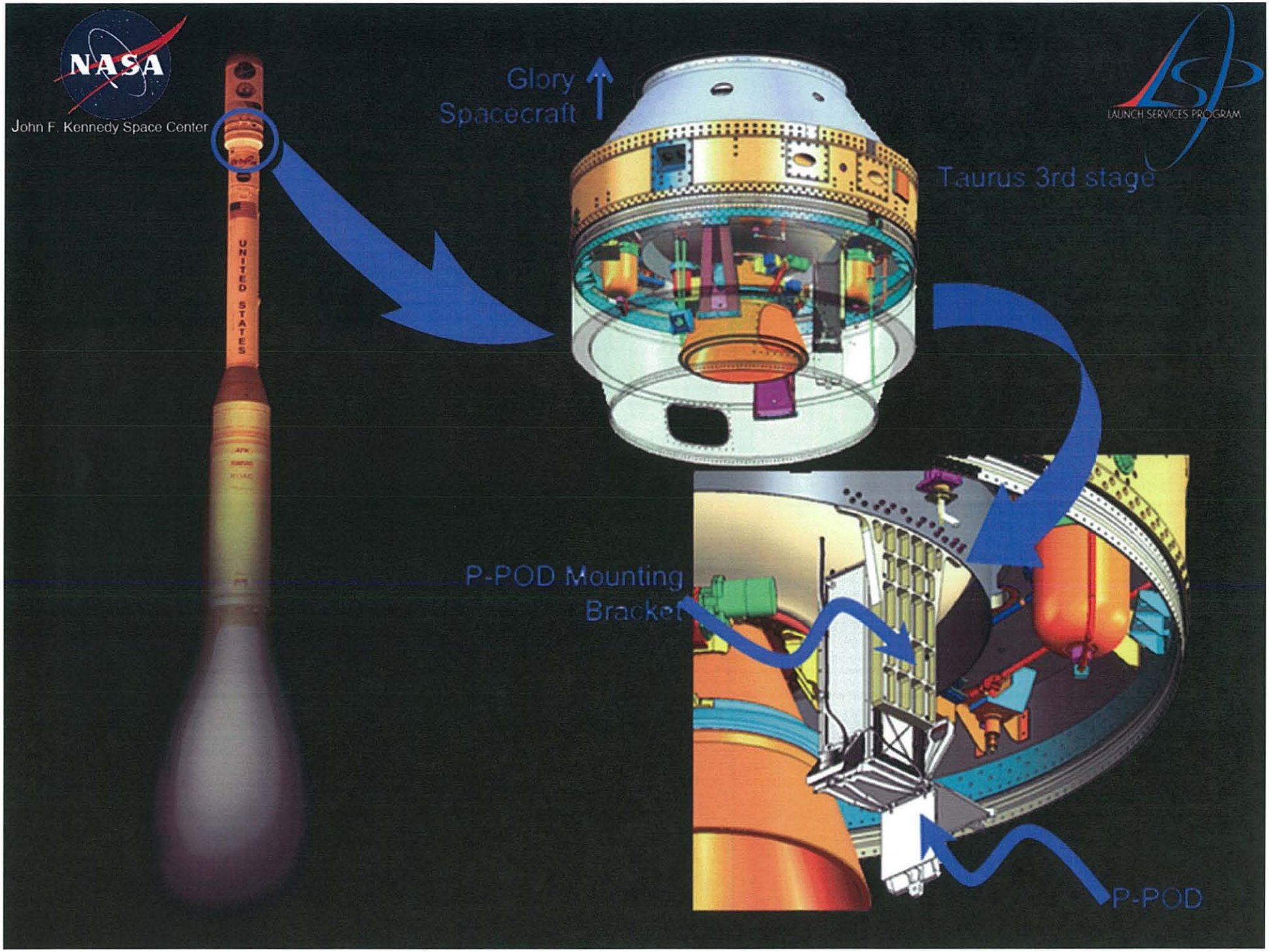
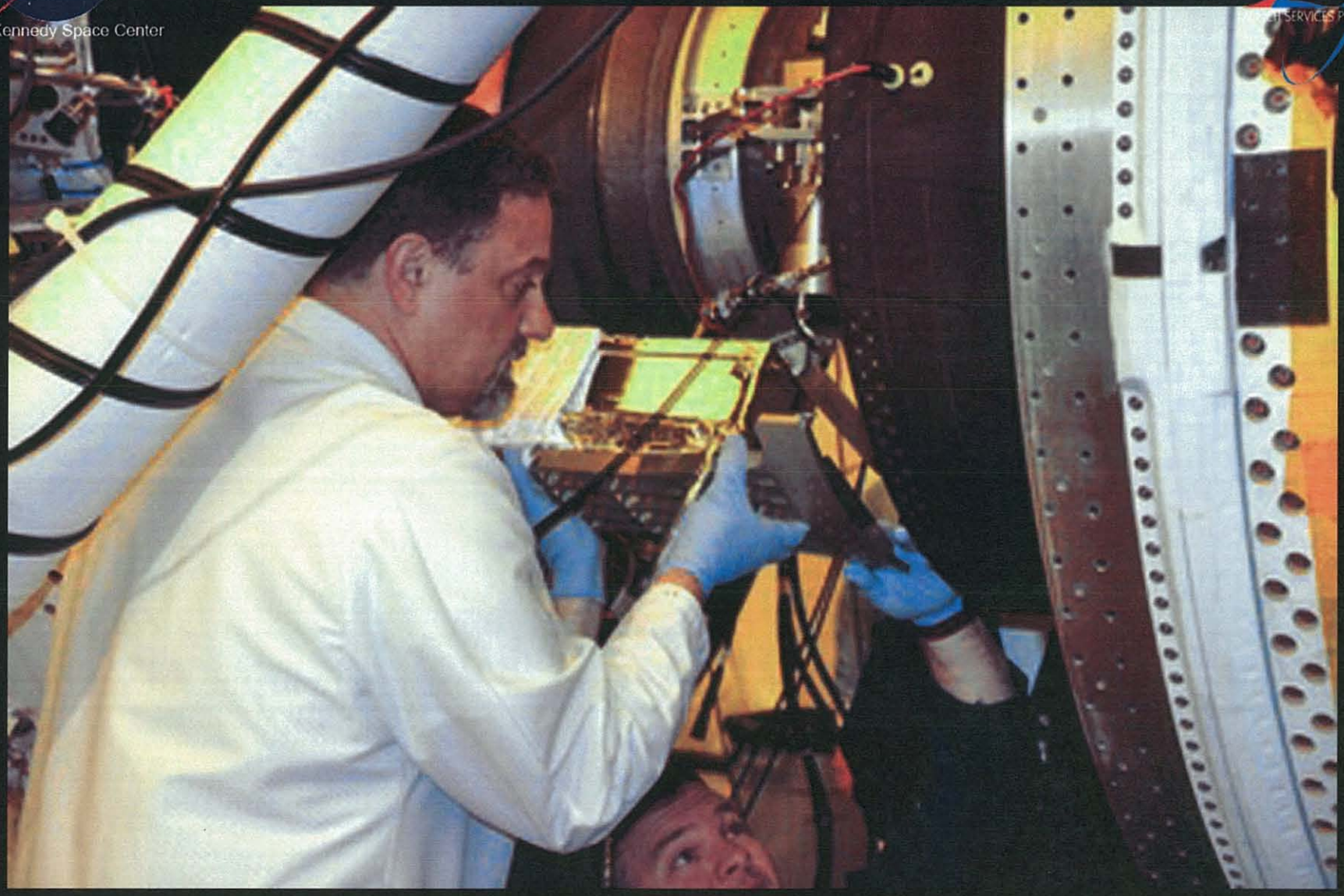
ELaNa I Flight P-POD



HERMES KySat Explorer 1 [PRIME]


NASA
John F. Kennedy Space Center
LAUNCH SERVICES PROGRAM
Glory Spacecraft
Taurus 3rd stage
P-POD Mounting Bracket
P-POD
UNITED STATES


NASA
John F. Kennedy Space Center
SERVICES PROGRAM

John F. Kennedy Space Center

LAUNCH SERVICES PROGRAM

Glory - ELaNa 1
Taurus XL T9

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LAUNCH SERVICES PROGRAM

Glory - ELaNa 1
Taurus XL T9

NASA

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Stage 2/3 Coast

Stage-2 Separation
T = 314.7 sec
h = 369.4 km
Vi = 6483 m/s
R = 1057 km

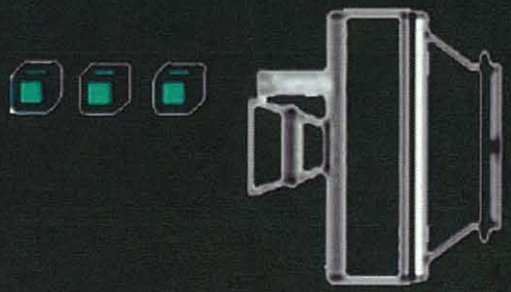
Stage-3 Burnout
T = 669.9
h = 640
Vi = 75 m/s
R = 63 km

Stage-3 Ignition
T = 5 7.7
h =
Vi =
R =

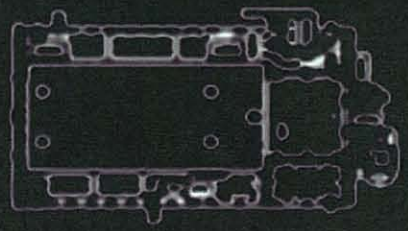
Glory Separation
T = 784.9 sec
h = 640.8 km
Vi = 7537 m/s
R = 3960 km

Cubesat Deployment
T = 794.9 sec
h =
Vi = 37 m/s
R = 029 km

CubeSats



Glory



This Happened!
The Cubes Separated

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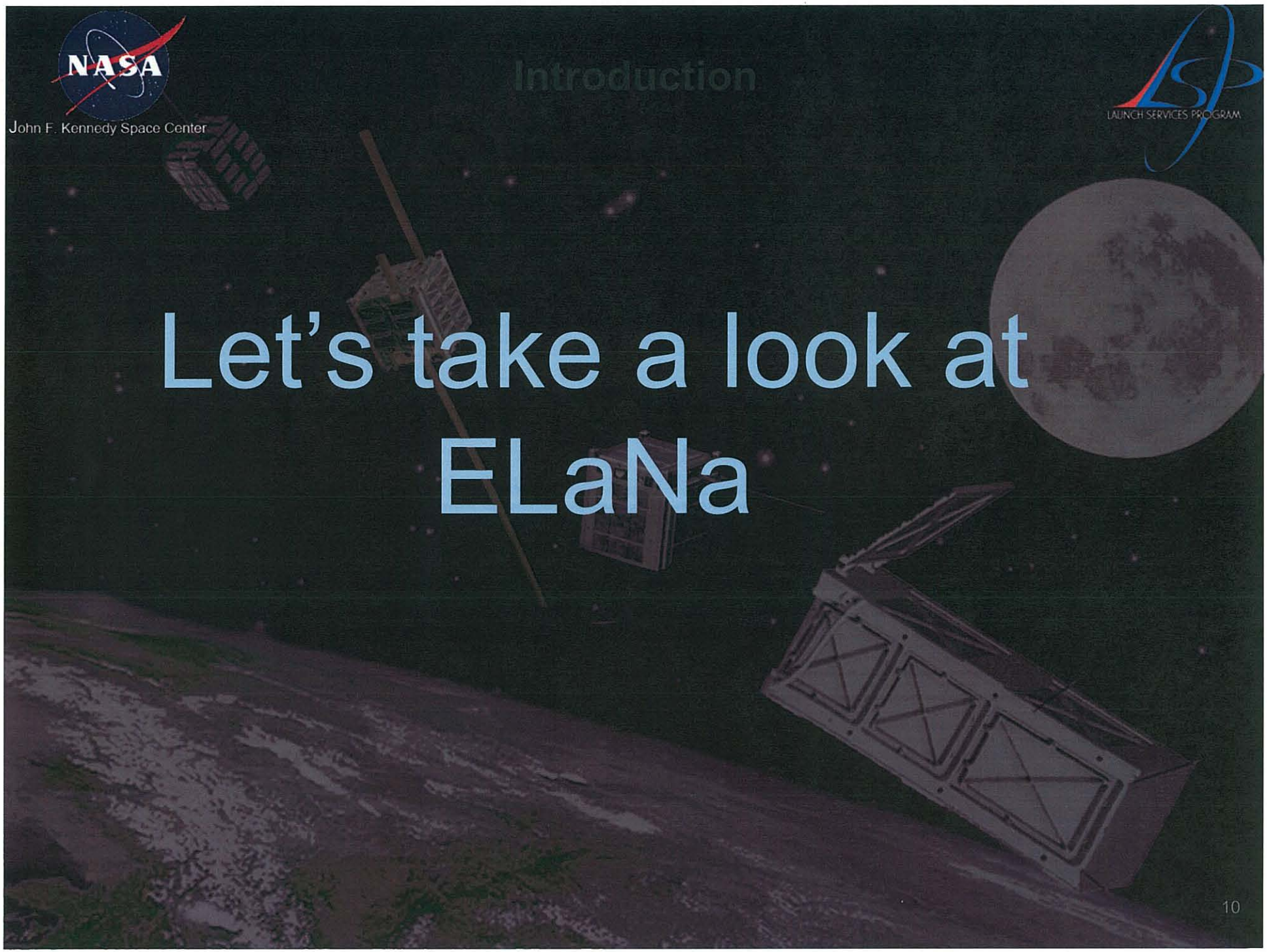
Let's take a look at ELaNa



NASA

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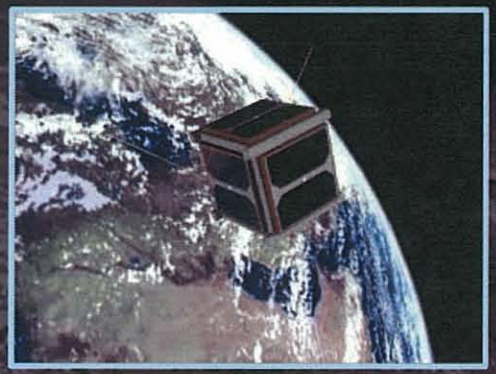
ELaNa

Nanosatellite



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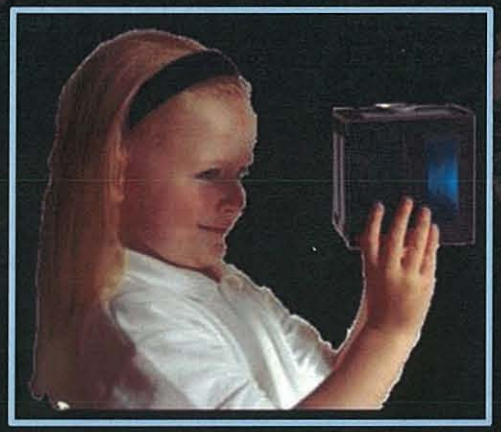
ELaNa

Launch

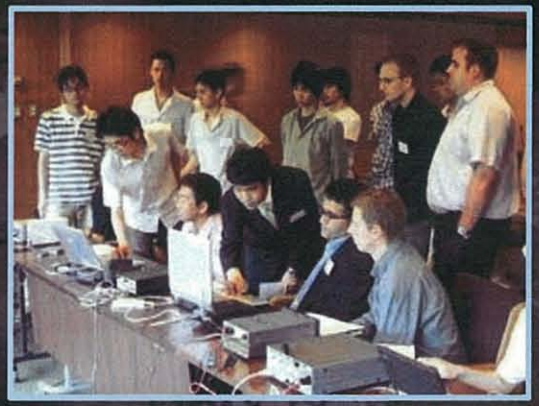
John F. Kennedy Space Center

LAUNCH SERVICES PROGRAM

ELaNa



Educational



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Was ELaNa I a Success?

First NASA Selected CubeSat mission → Annual Call for CubeSats

Approval to fly on Glory → Lead the way to launch on other NASA vehicle

The design and build of CubeSat → Lessons Learned applied to future mission

Educational experience of working through a NASA Integration cycle → Students are prepared to enter the aerospace workforce

What's Planned for the Future

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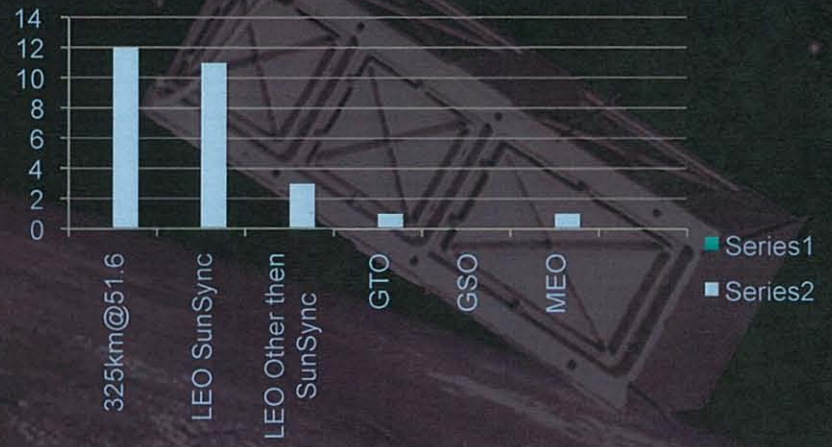
Number of CubeSats

First Selection	First Initiative	Second Initiative	Prior Selected	Total	First Flight	Still to Fly
4	12	20	1	37	3	34

CubeSat by Orbits

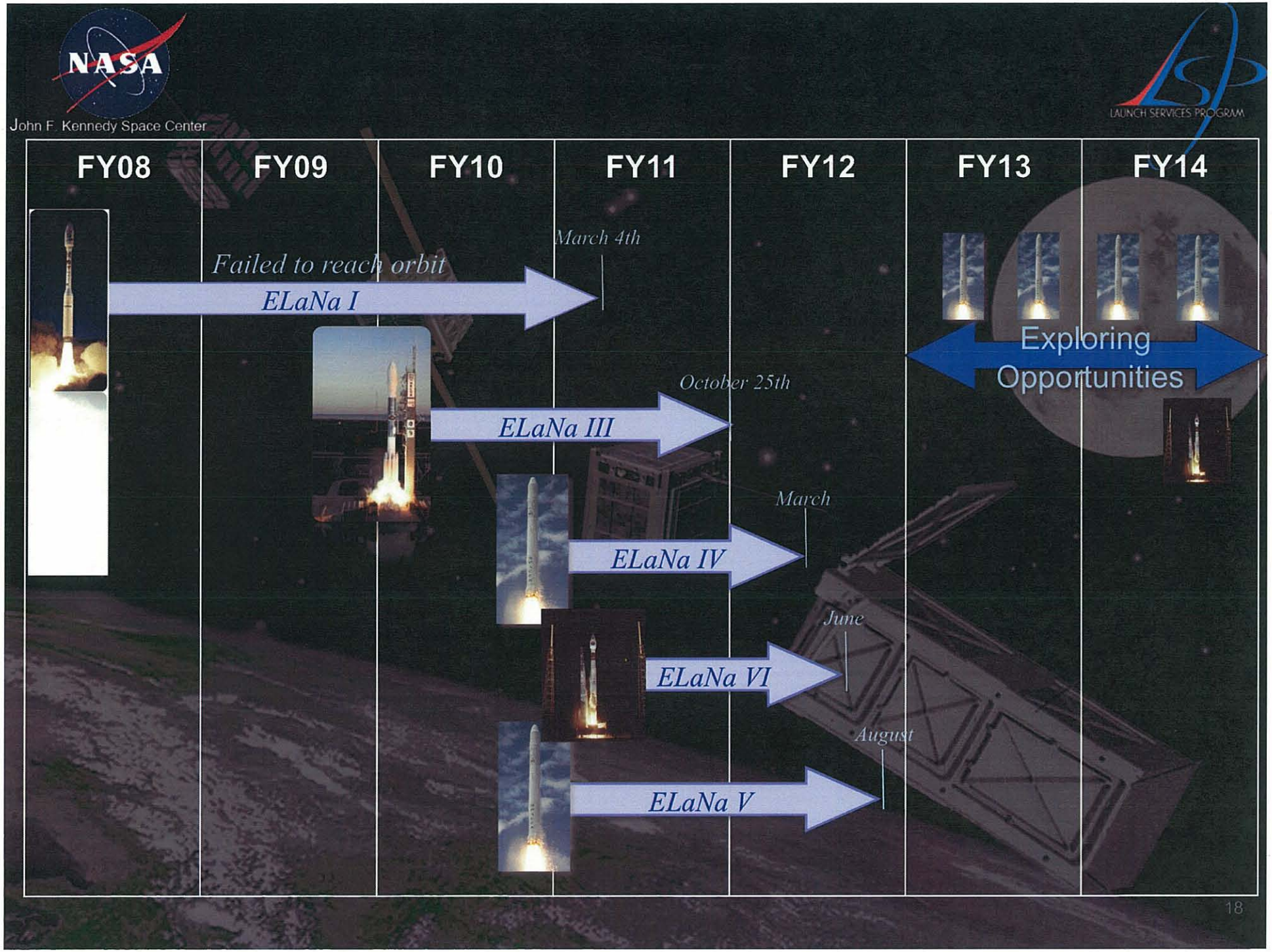
325km@51.6°	LEO SunSync	LEO other then SunSync	GTO	GSO	MEO
12	11	3	1	0	1

LEO is a Range of 350km to 650km



NASA CubeSat Carriers

Atlas V		Delta IV	Delta II	Taurus XL	Athena	Falcon 9	
Common	ABC	Common	Struts Section	Aft End	Unknown	CRS	Fairing
Studied	In Development	Studied	In Development	Flown	Studying	In Development	Studied


NASA
John F. Kennedy Space Center
LAUNCH SERVICES PROGRAM
FY08
FY09
FY10
FY11
FY12
FY13
FY14
Failed to reach orbit
ELaNa I
March 4th
ELaNa III
October 25th
ELaNa IV
March
ELaNa VI
June
ELaNa V
August
Exploring Opportunities
18

Don't rest on your laurels …don't dwell on failure

Let's Keep Moving Forward!