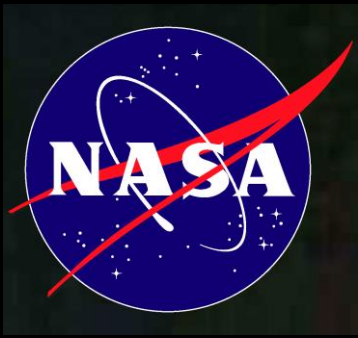


Future Launch Vehicles



Matt Steele
NARCON 2014

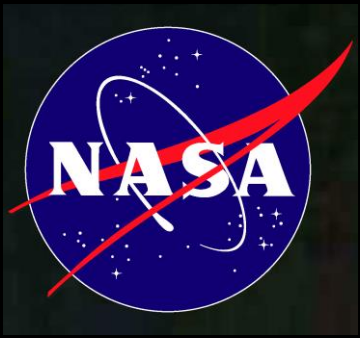


NASA's Space Launch System

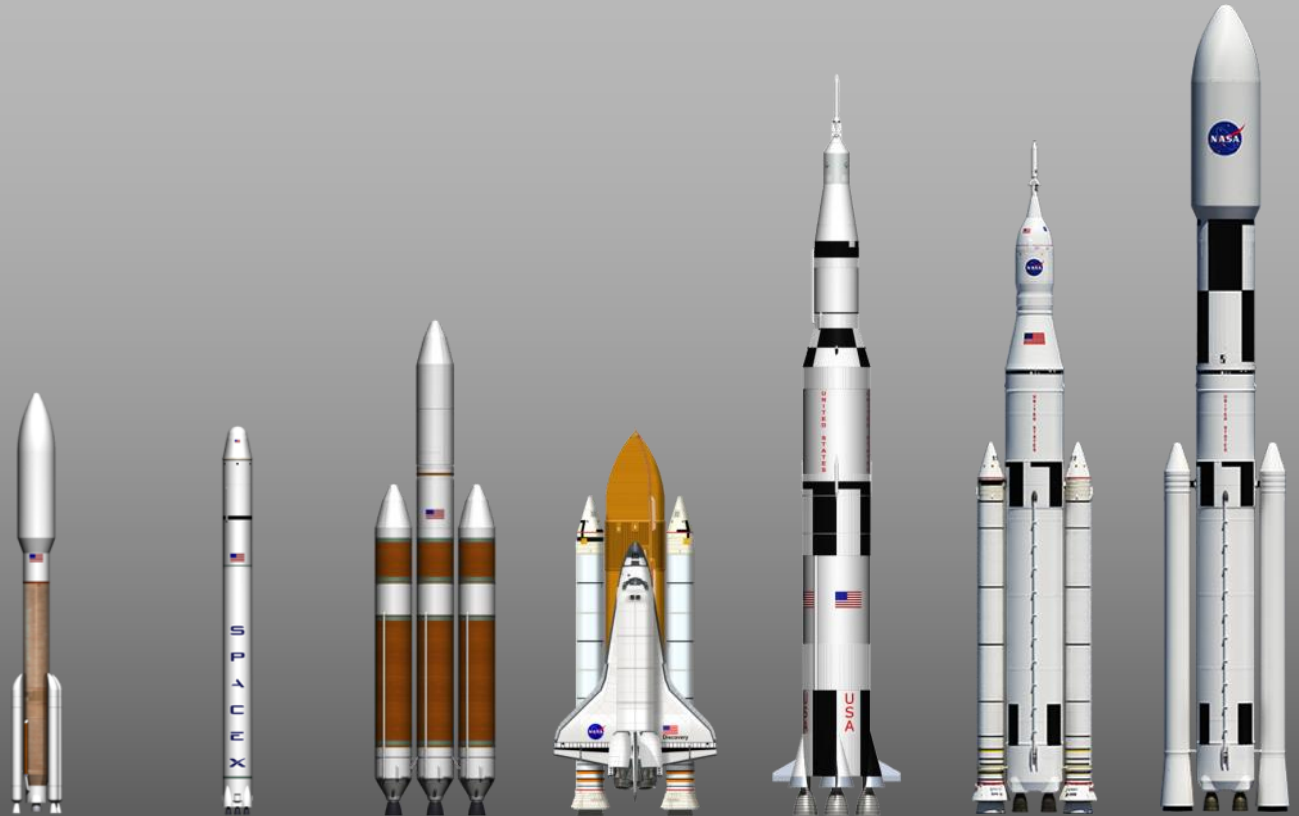


Launching Soon.

Building Today.



Bigger
Rocket =
Unrivaled
Mass,
Unrivaled
Volume



Enables missions
no other rocket can perform.



Proven
success,
Greater
power

Stage Adapter:

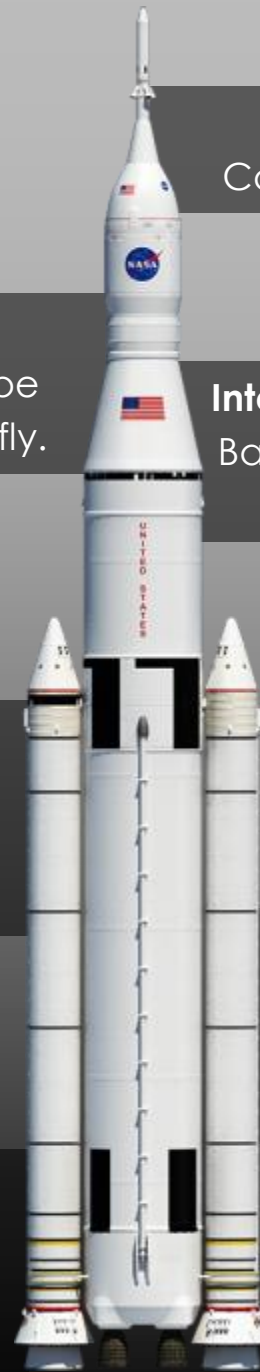
The Orion stage adapter will be the first new SLS hardware to fly.

Core Stage:

Newly developed for SLS, the Core Stage towers more than 200 feet tall

RS-25 Engines:

Space Shuttle engines for the first four flights are already in inventory



Orion:

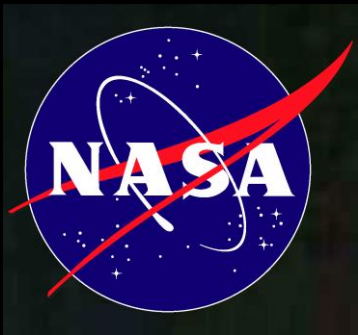
Carries astronauts into deep space

Interim Cryogenic Propulsion Stage:

Based on the Delta IV Heavy upper stage; the power to leave Earth

Solid Rocket Boosters:

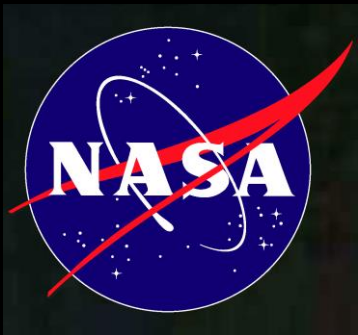
Built on Space Shuttle hardware; more powerful for a new era of exploration



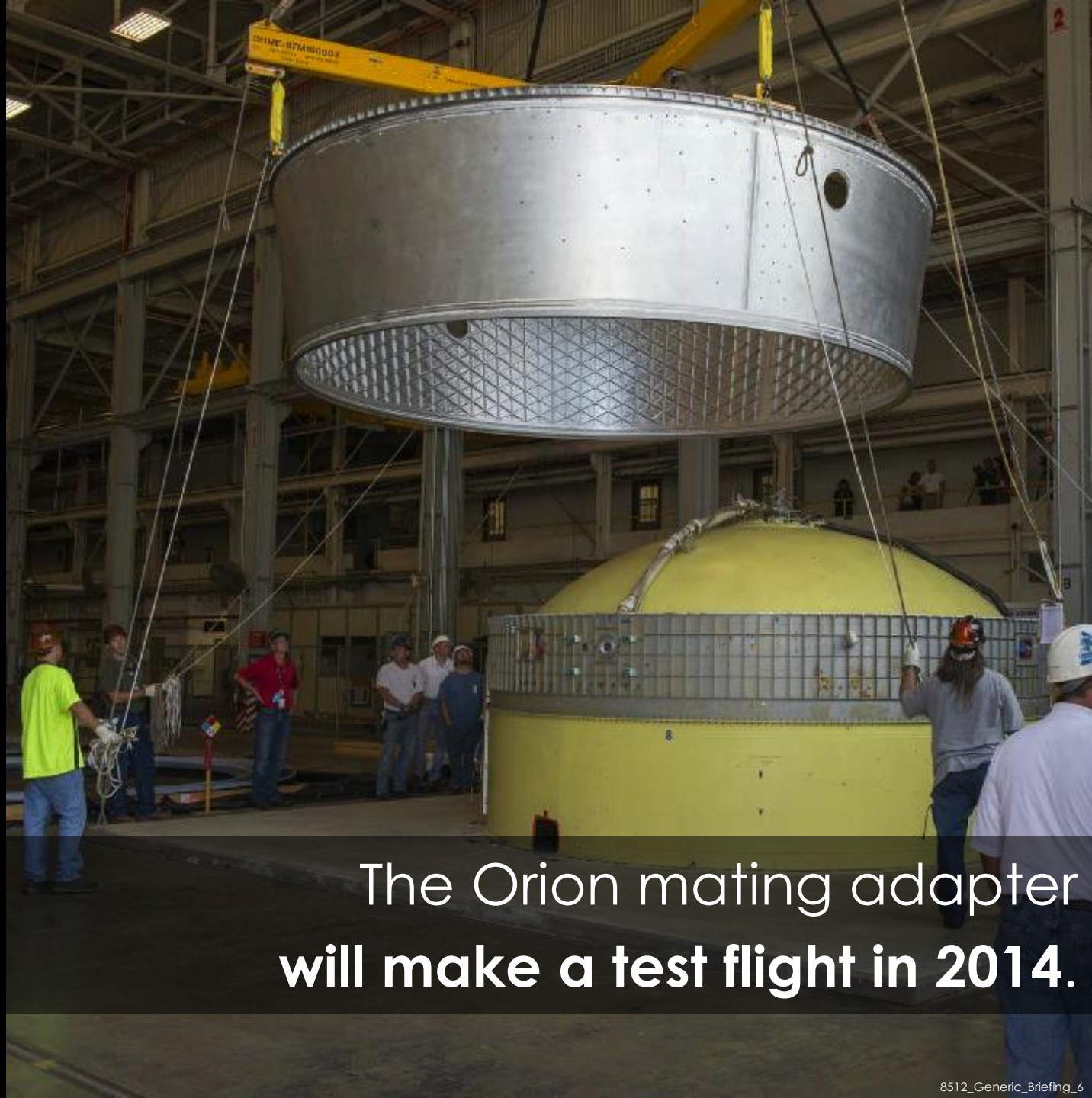
Core
Stage
is taking
shape



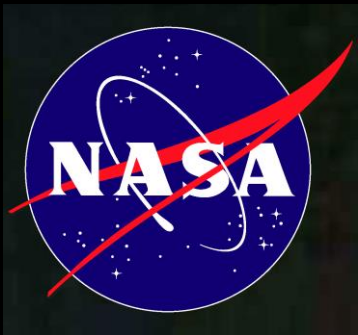
New tooling is installed at Michoud
and confidence welding has begun.



First
payload
adapter
hardware
is ready
to fly



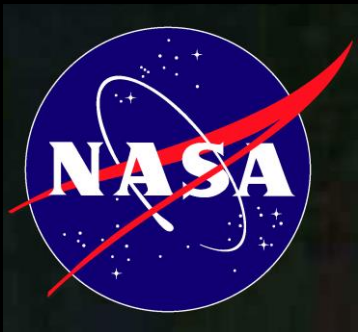
The Orion mating adapter
will make a test flight in 2014.



Testing is
soon for
RS-25
engines



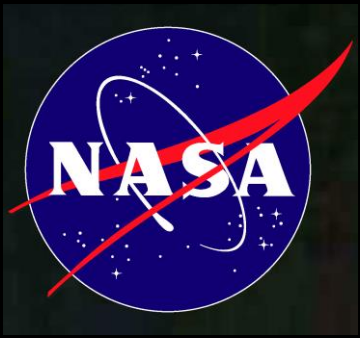
Test stand upgrades being made now
will support RS-25 test firings in 2014.



New
upgrades
are being
tested for
Solid
Rocket
Boosters



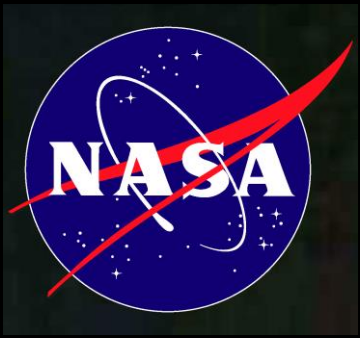
Three successful test firings demonstrated the five-segment motor.



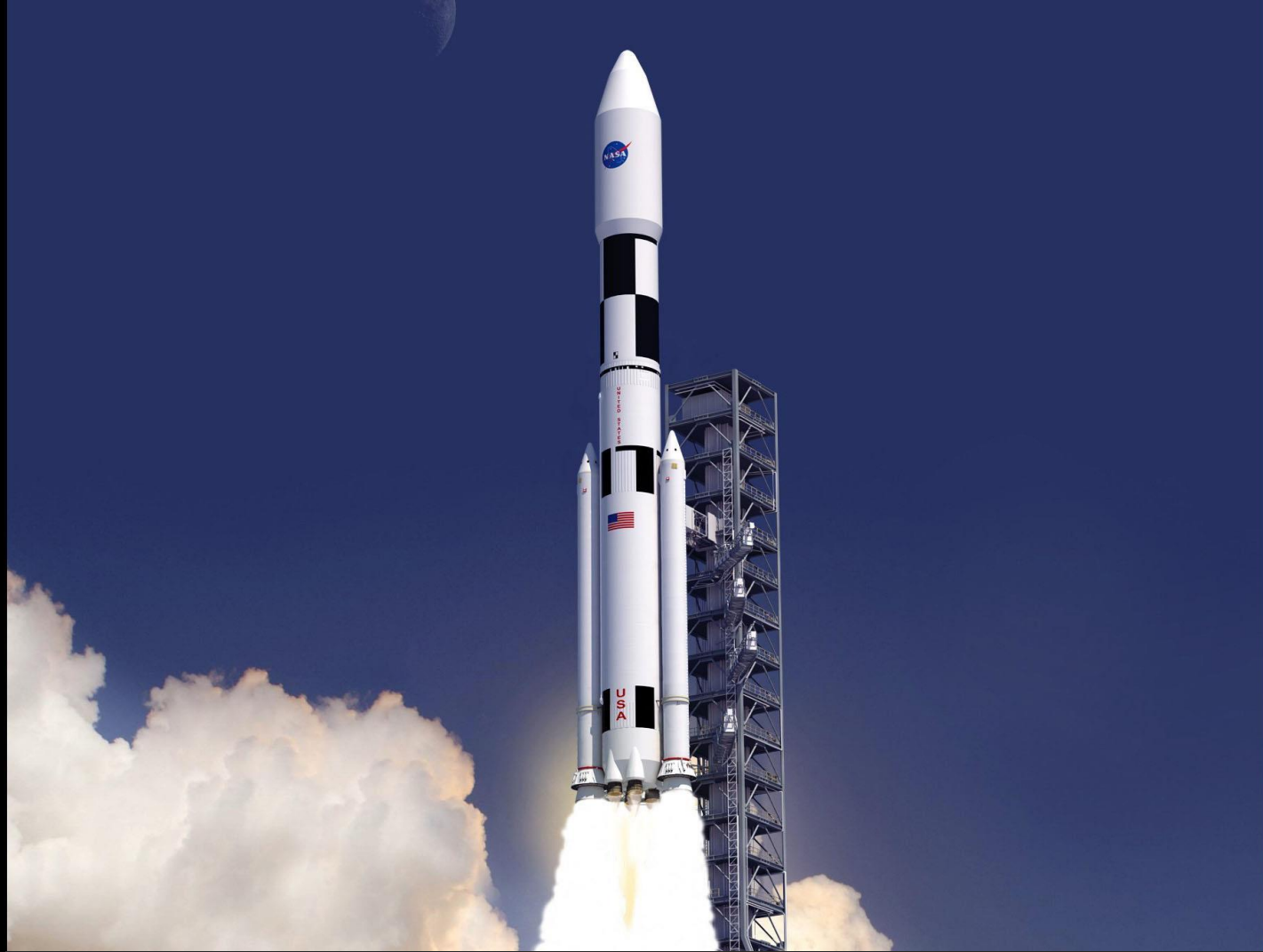
One team,
working
together



The SLS team is making great progress



SLS Cargo



True Heavy Lift Cargo Capabilities

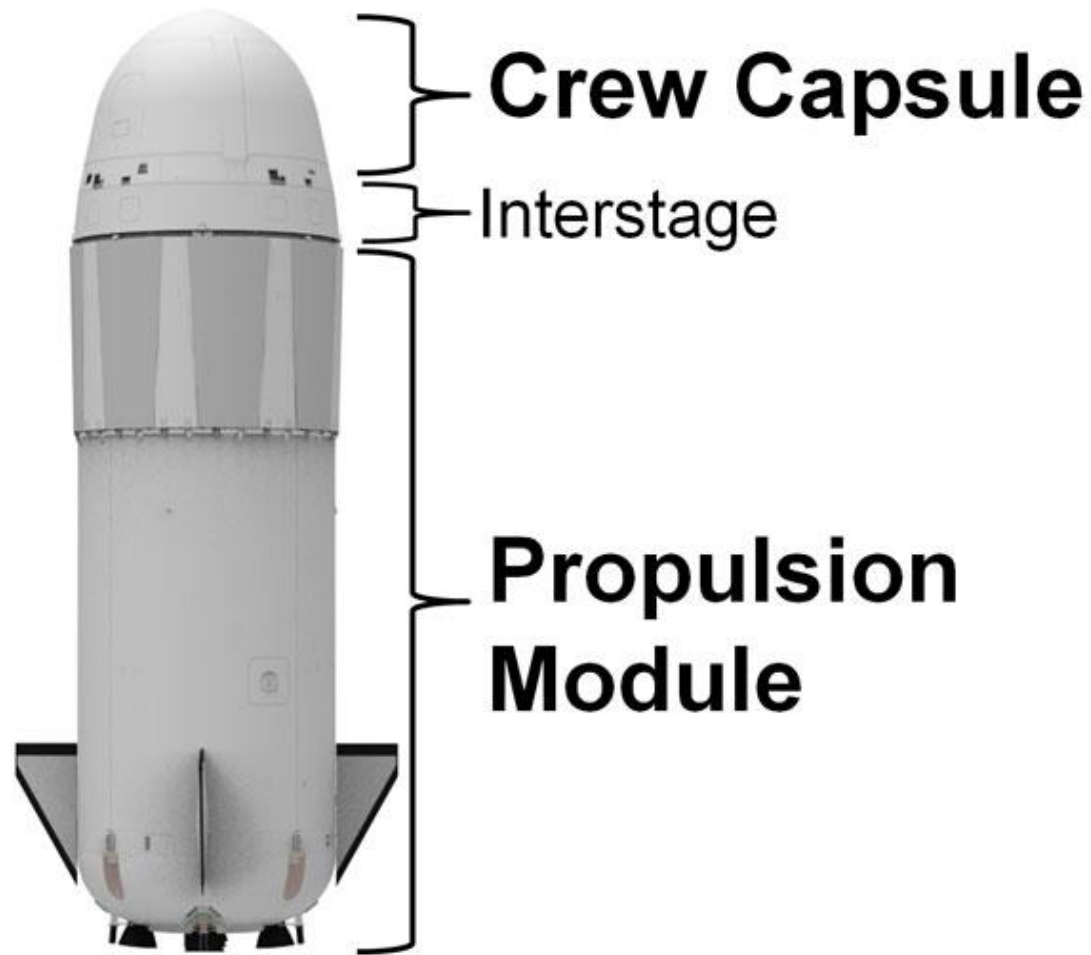


Air Launch System (ALS)

The Air Launch Vehicle (ALV) combines proven solid and liquid propellant technology in an air launched system



Blue Origin New Shepard



Funky, but Chic



Blue Origin Orbital Reusable Booster



Lowering the cost of spaceflight



Blue Origin

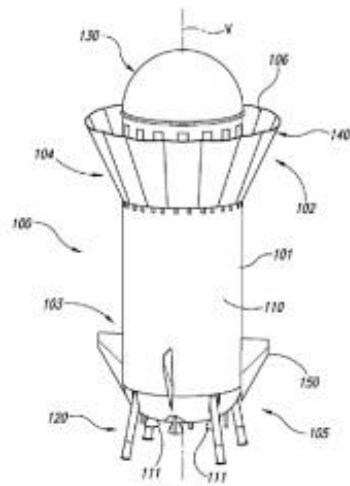


Fig. 1A

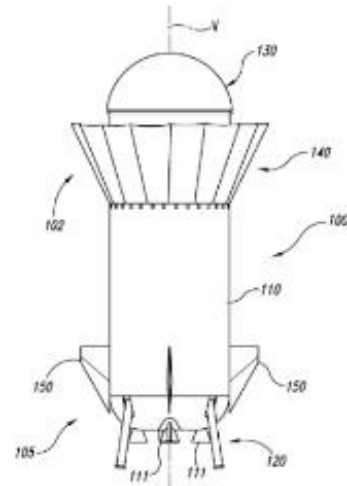


Fig. 1B

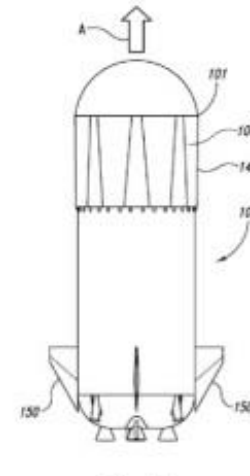


Fig. 2A

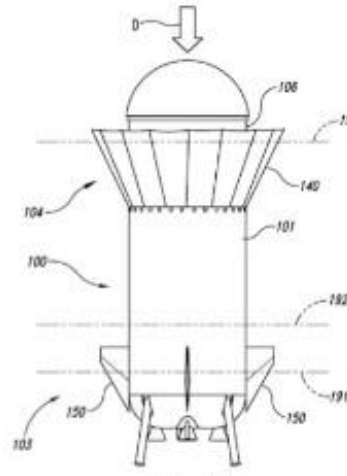


Fig. 2B

Patent for "Launch vehicles with fixed & deployable deceleration surfaces"



Space Ship 2



Book your place in Space



GALACTIC

Space Ship 2



Hybrid rocket engine



Space Ship 2



One hot rocket



Space Ship 2

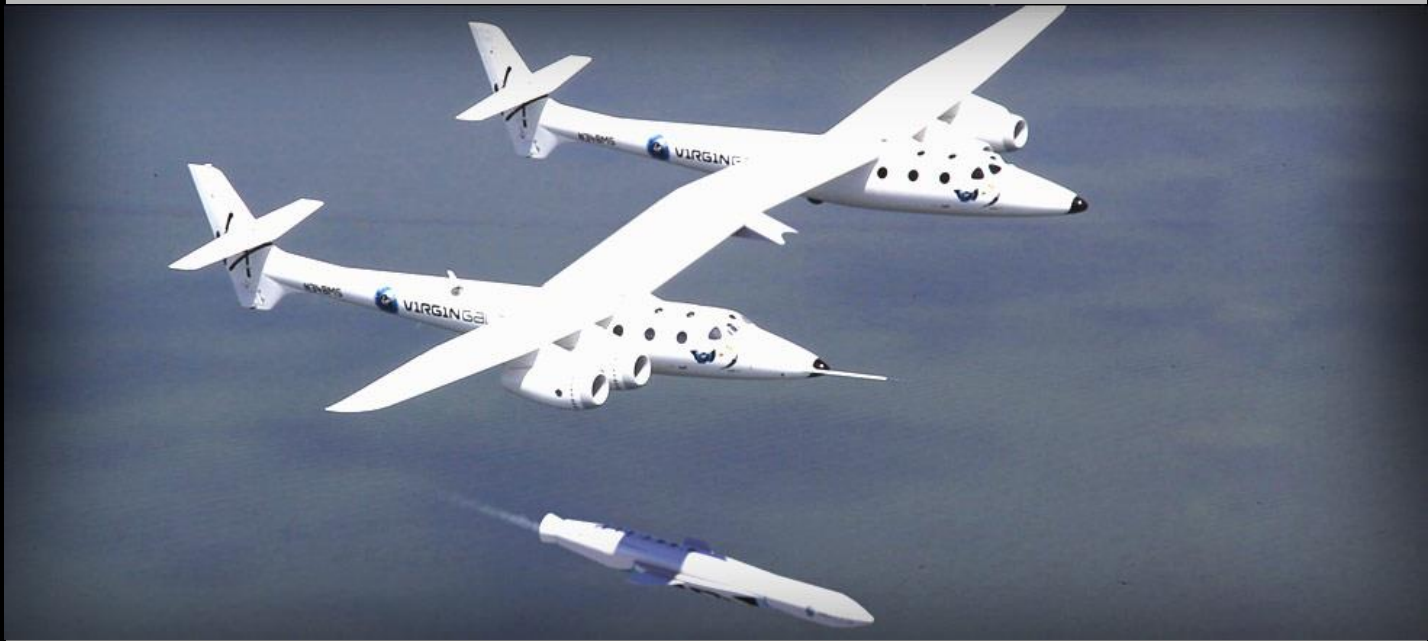


“Feather” Re-entry



GALACTIC

Launcher One



Affordable, dedicated ride to orbit
for smaller payloads



Launcher One



Furthering the space frontier



Soyuz 2.1v



A major departure from earlier Soyuz
rockets



Soyuz 2.1v



The first stage of the Soyuz-2-1v is a
single-chamber NK-33



Soyuz
2.1v



First flight on December 28, 2013

SPACEX










Falcon 9H



SpaceX claims the Falcon Heavy can lift more than twice the payload of the Delta IV Heavy



Falcon 9H

 FALCON HEAVY	 SPACE SHUTTLE	 PROTON M	 DELTA IV HEAVY	 TITAN IV-B	 ARIANE 5 ES	 ATLAS V 551	 JAPAN H2B	 CHINA LM3B
53,000 kg 116,850 lb	24,000 kg 53,790 lb	23,000 kg 50,710 lb	22,560 kg 49,740 lb	21,680 kg 47,800 lb	20,000 kg 44,090 lb	18,510 kg 40,810 lb	16,500 kg 36,380 lb	11,200 kg 24,690 lb

Only the Saturn V can lift more payload

Orbital

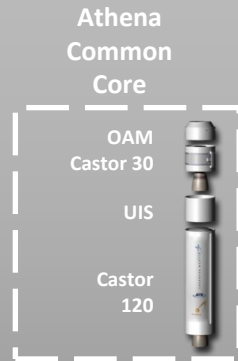
Abort
Test
Booster



Little Joe III



Athena



- PLF – Payload Fairing
- OAM – Orbit Adjust Module
- DM – Dual Mode (Bi-Propellant)
- UIS – Upper Interstage
- LIS – Lower Interstage
- CLIS – Conical Lower Interstage

Athena I



Model 92 PLF
(2.3m)

Athena II



LIS
Castor 120

Athena IIS-2/4/6

Model 120 PLF
(3.1m)



Orion 50SXLG



Model 165 PLF
(4.2m)



CLIS
Castor 900

Modular Systems Approach



Liberty



Space Shuttle
Height: 184.2 ft
Gross Liftoff Mass: 4.5M lb



Liberty
Height: 300.0 ft
Gross Liftoff Mass: 2.1M lb



Ariane 5
Height: 168.5 ft
Gross Liftoff Mass: 1.7M lb

Looking for love in all the wrong places



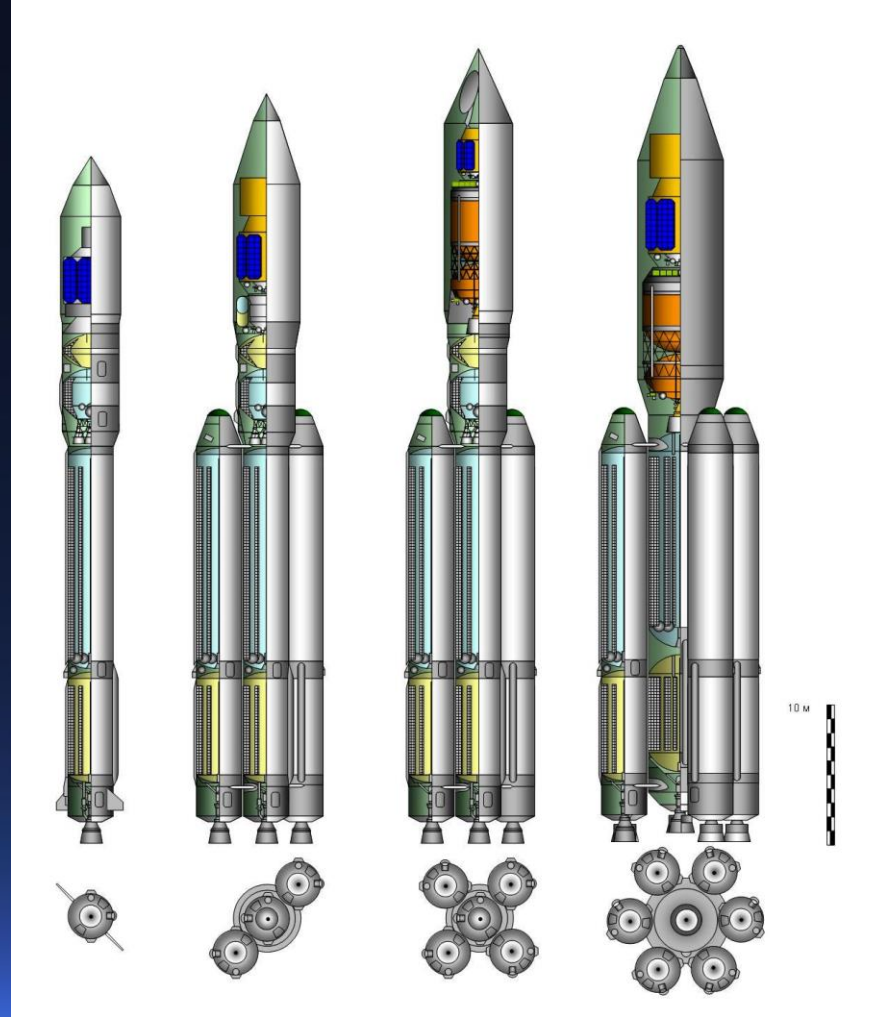
Angara



Family of launchers intended to
replace several existing launch
vehicles



Angara



Launch based on a common
Universal Rocket Module



S3



Shaping the future of commercial
space and academic space
research



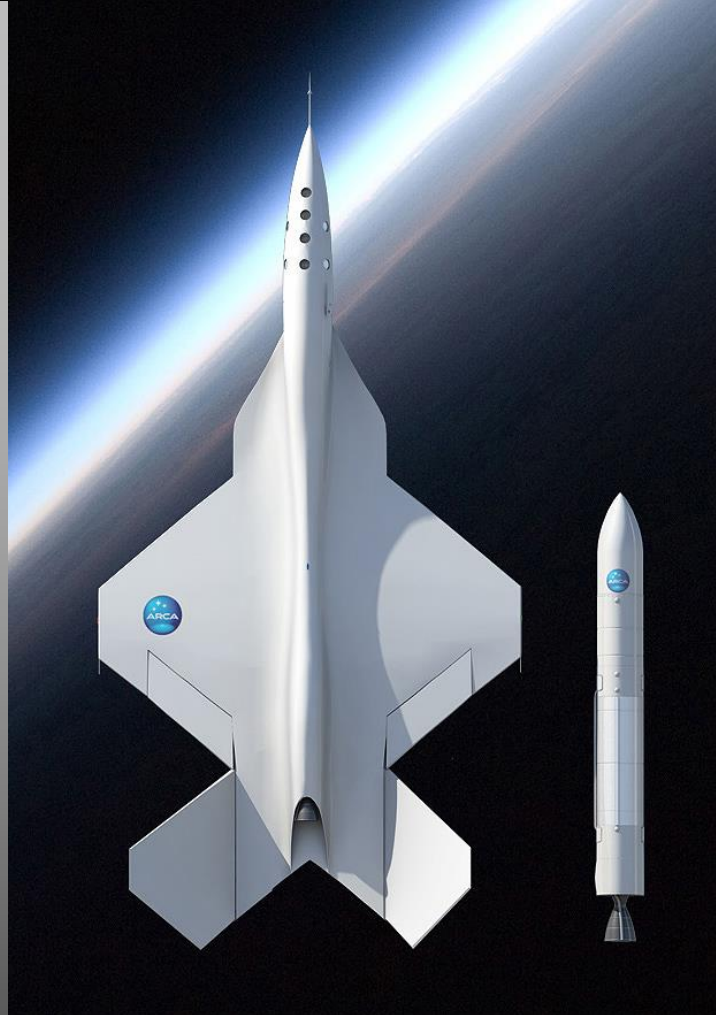
S3



Vision is to be the world leader in in-orbit delivery of small satellites



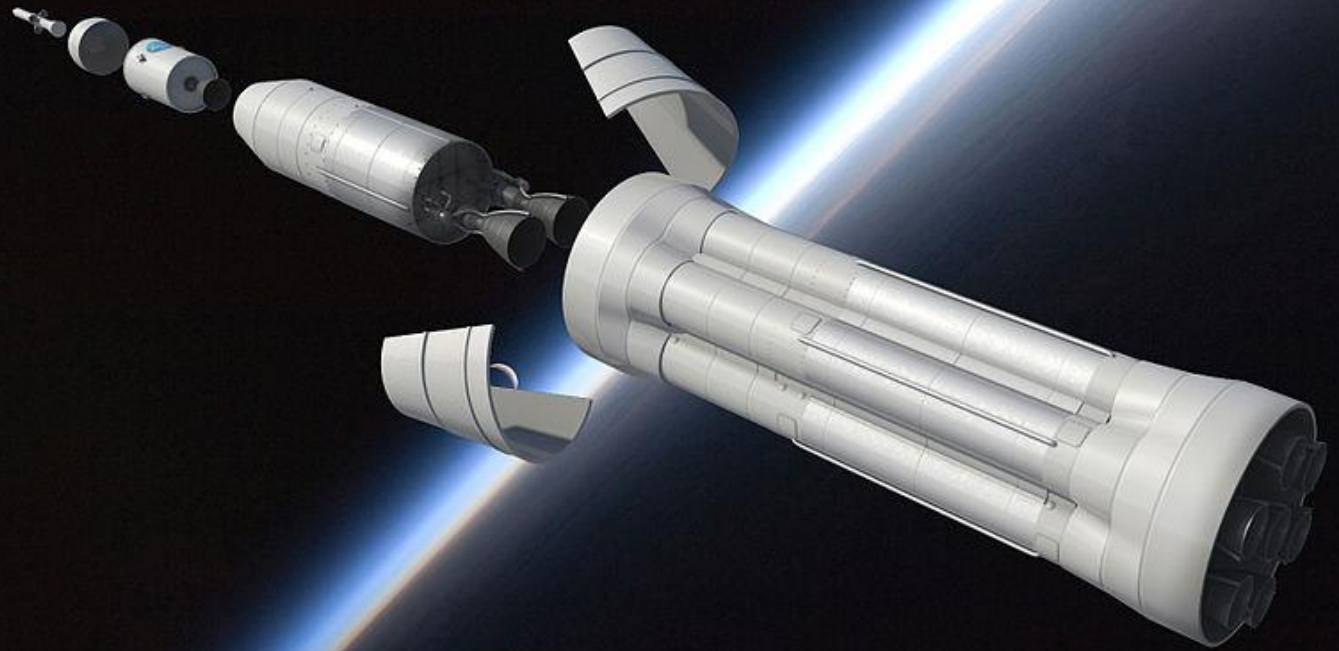
HAAS



Romanian IAR 111 supersonic plane
and Haas 2 rocket



HAAS



Super Haas Rocket

Orbital

Minotaur
C

Minotaur
VI



Meet the new boss
Same as the old boss