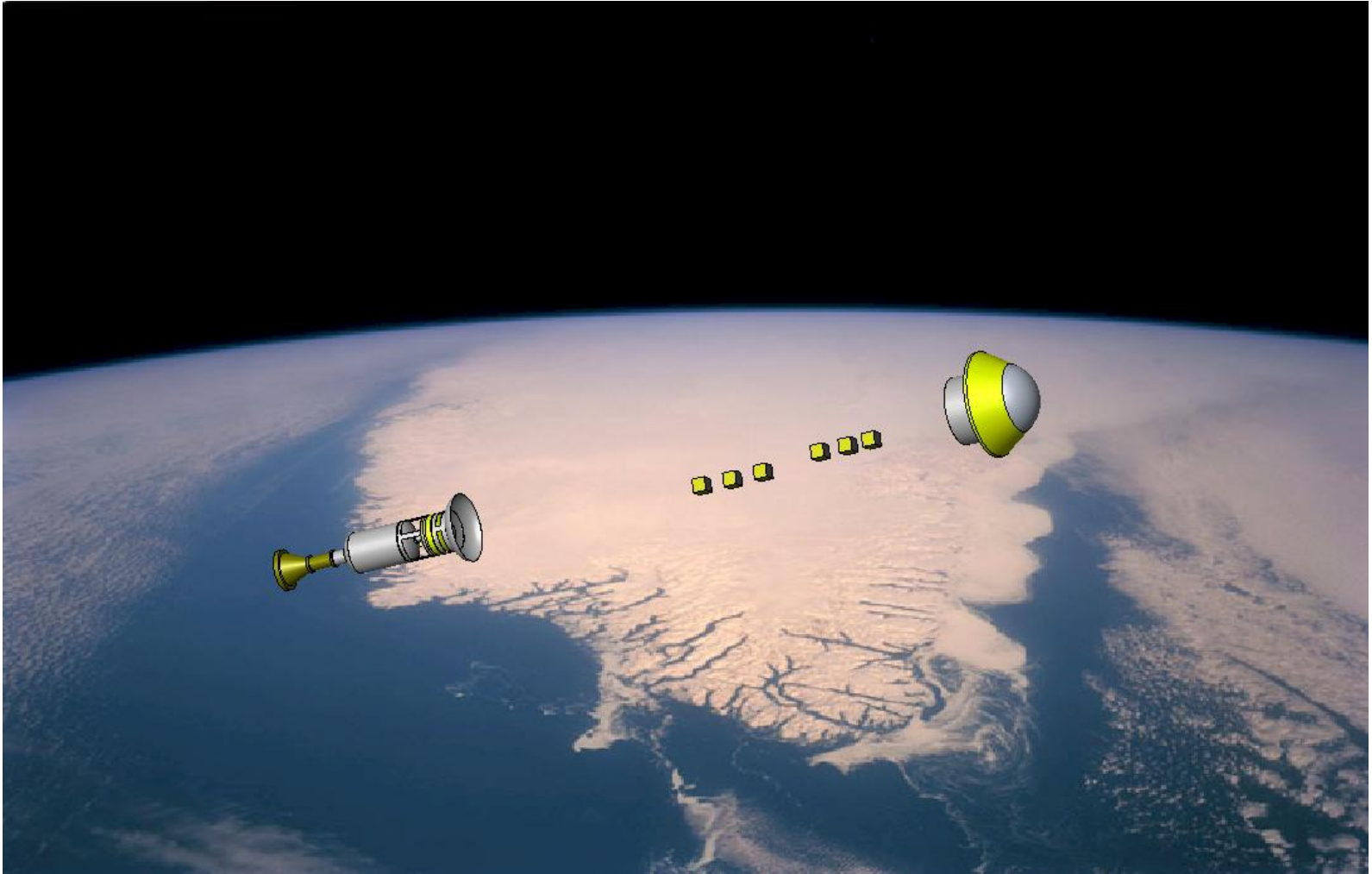


NEPTUNE 30

Micro Satellite Launch Vehicle



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Bipropellant Liquid Rocket Engines



Engineering



Manufacturing



Structures



Mechanisms



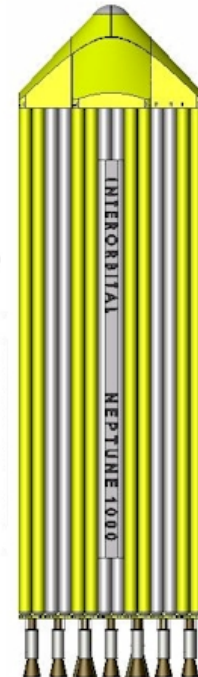
Guidance and Control



Static Test Facilities



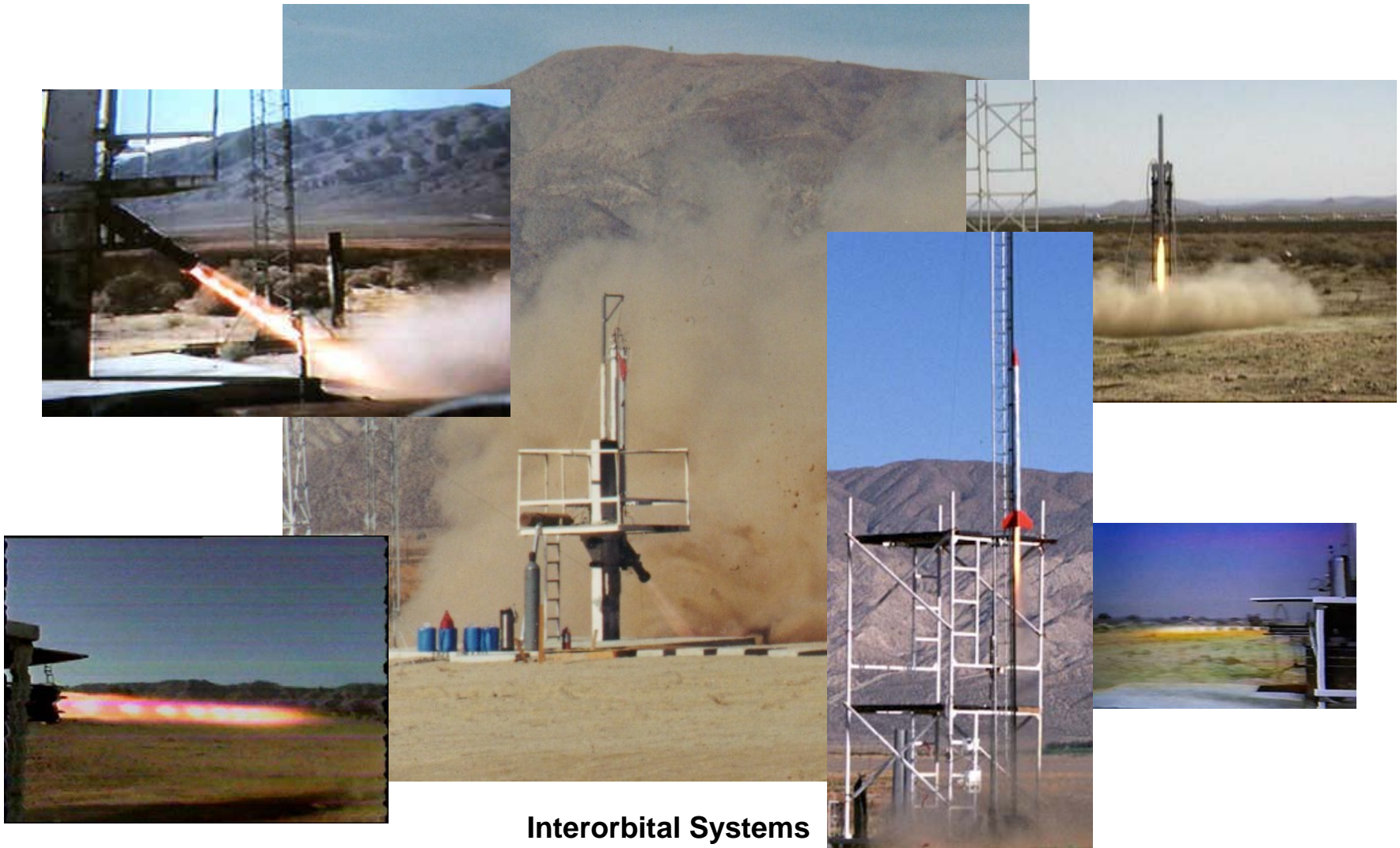
MicroSat Launcher



Lunar Lander Mission



Liquid Rocket Engine Tests





Orbital Launch Vehicles

- ▲ Sea Star TSAAHTO Micro Satellite Launch Vehicle (MSLV)
- ▲ Neptune TSAAHTO Manned Launch Vehicle
- ▲ Neptune TSAAHTO Cargo Launch Vehicle

Orbital Spacecraft

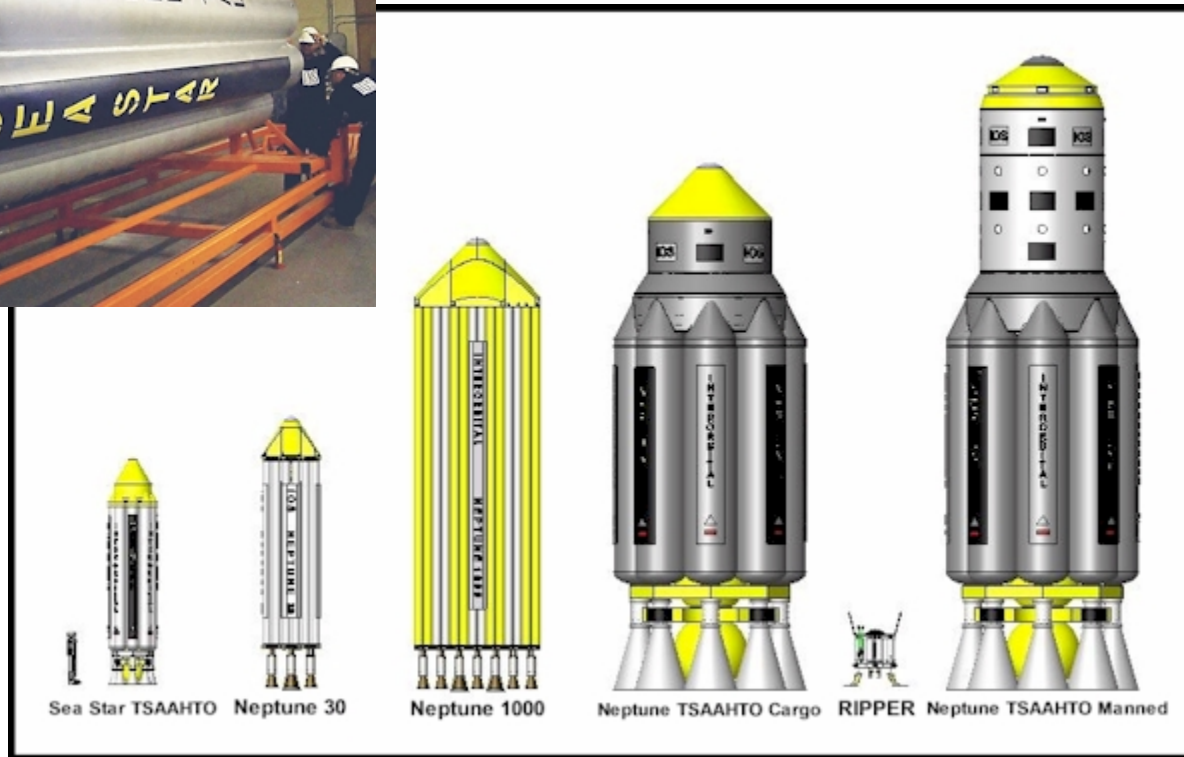
- ▲ Crew Module
- ▲ Robotic Orbital Supply System (ROSS)



Interplanetary Spacecraft

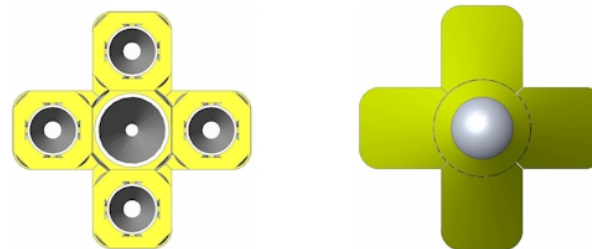
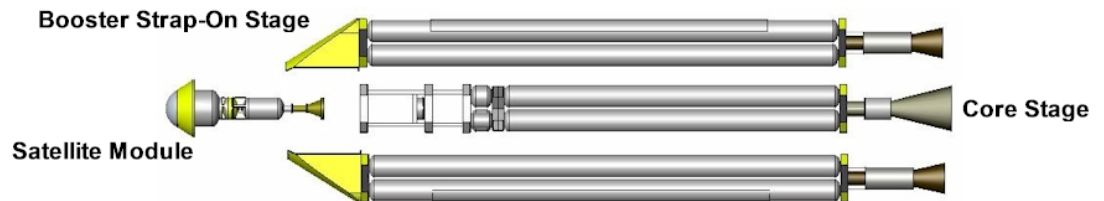
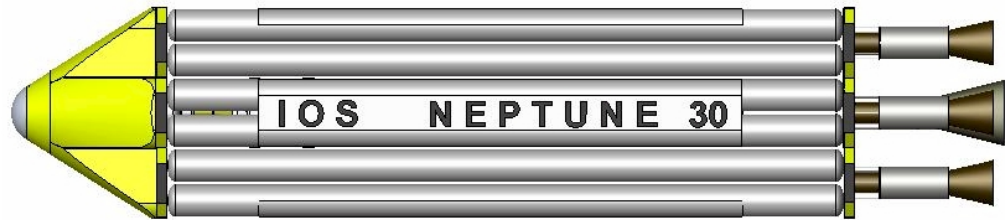
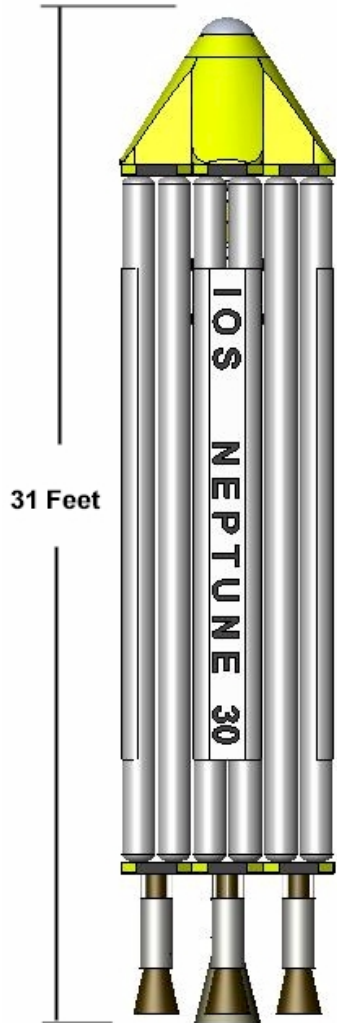
- ▲ Robotic InterPlanetary Prospector Excavator Retriever (RIPPER)







Modular = Simplicity = Reliability = Low Cost



Booster Thrust = 4 X 10,000 lbs = 40,000 Lbs SL

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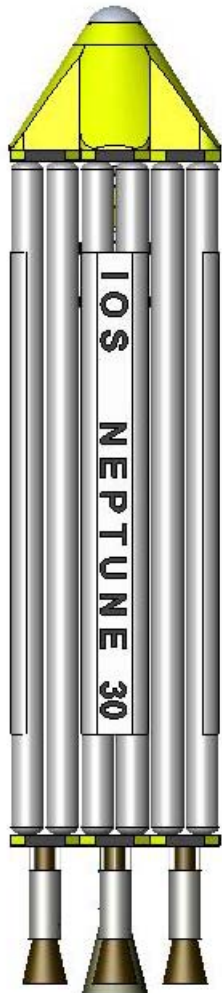
Stripped-Down and Powerful!

YES

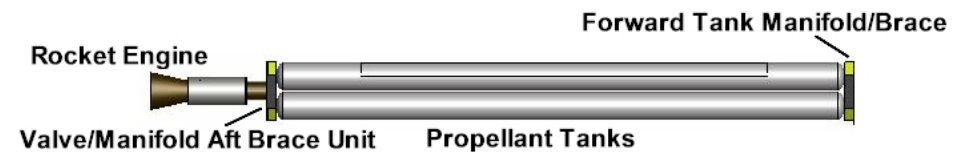
- Ablatively-Cooled Liquid Rocket Engines
- Blowdown Pressure-Feed
- Storable, High-Density, Hypergolic Propellants
- Steering by Differential Throttling
- Multiple Fixed Low-Thrust Rocket Engines
- Low Chamber Pressure
- Single Air Start of One Stage
- Modular Construction
- Floating Ocean Launch

NO

- Regen-Cooled Liquid Rocket Engines
- Turbopumps and Gas Generators
- Cryogenic Low Density Propellants
- Gimbaled Steering
- Single Gimbaled Rocket Engine
- High Chamber Pressure
- Multiple Air Starts of Many Stages
- Ullage Rockets
- Land Launch



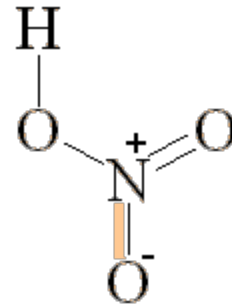
Common Propulsion Unit





Wernher von Braun: OTRAG

Lutz Kayser: OTRAG and R.Milliron: Interorbital



Hypergolic



Lutz Kayser: OTRAG



NEPTUNE 30: Pressure-Fed Propellants



- ▣ High-density (1.51) storable oxidizer: White Fuming Nitric Acid (WFNA)
- ▣ Storable fuel: Hydrocarbon X (proprietary)
- ▣ WFNA is corrosive but non-flammable and non-toxic
- ▣ Long-term Storage possible in the propellant tanks
- ▣ Hydrocarbon X is denser than kerosene
- ▣ Insulated storage tanks not required
- ▣ Orbital launch vehicle history (Diamant A rocket)



The pressure-fed Diamant A rocket succeeded in placing a satellite into orbit on its first try in November of 1965

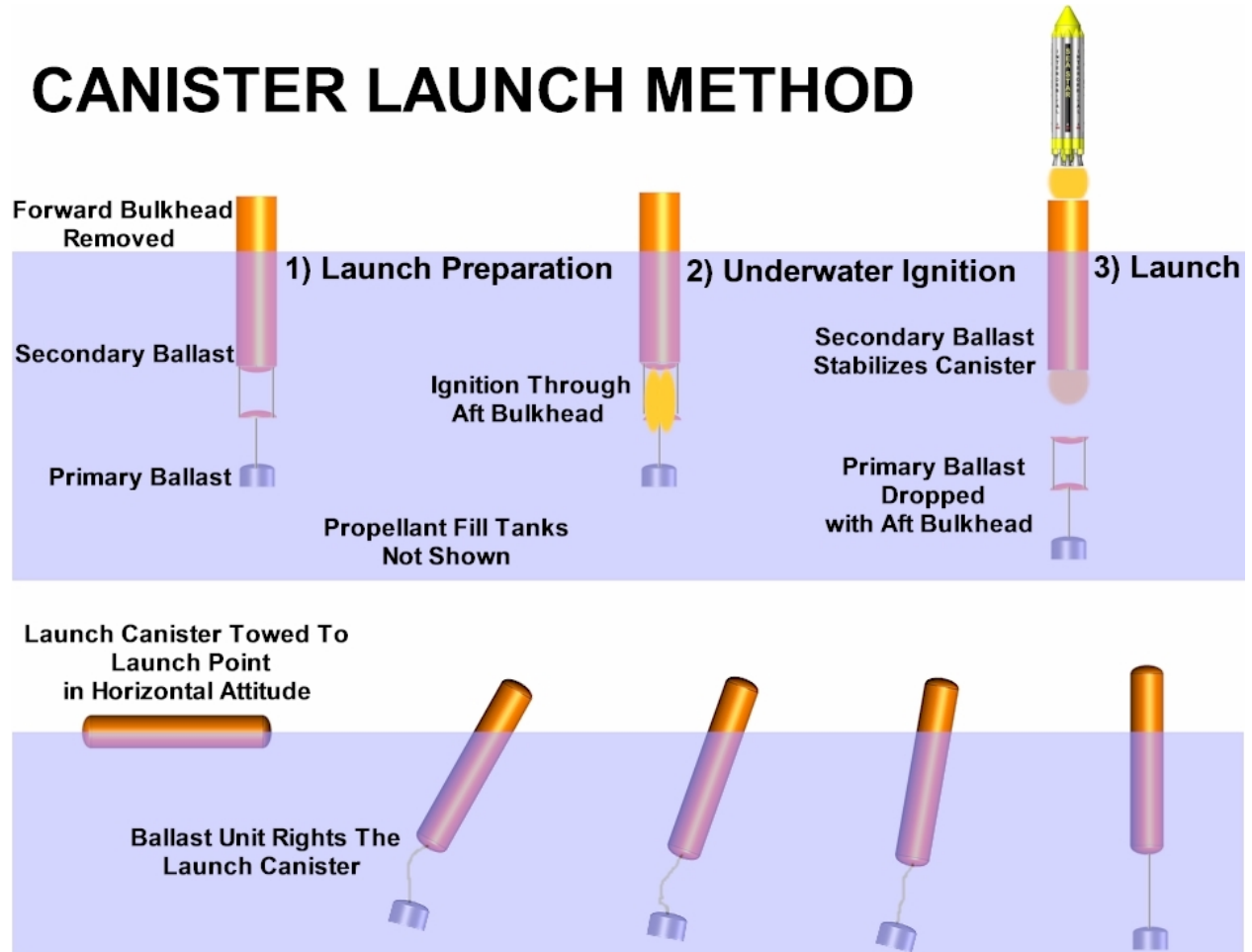
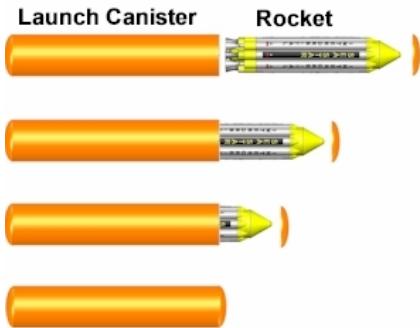
Saphir with Emerald Booster Stage

Excerpt of a Sea Star Booster/Sustainer rocket engine test (expansion to ambient) at IOS Alpha Test Site

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CANISTER LAUNCH METHOD





NEPTUNE 30: Advantages of Floating Canister Launch



▲ Launch Flexibility Advantage

Allows the customer to set the launch schedule

Safer for manned launches

Allows rocket to be positioned for any orbit

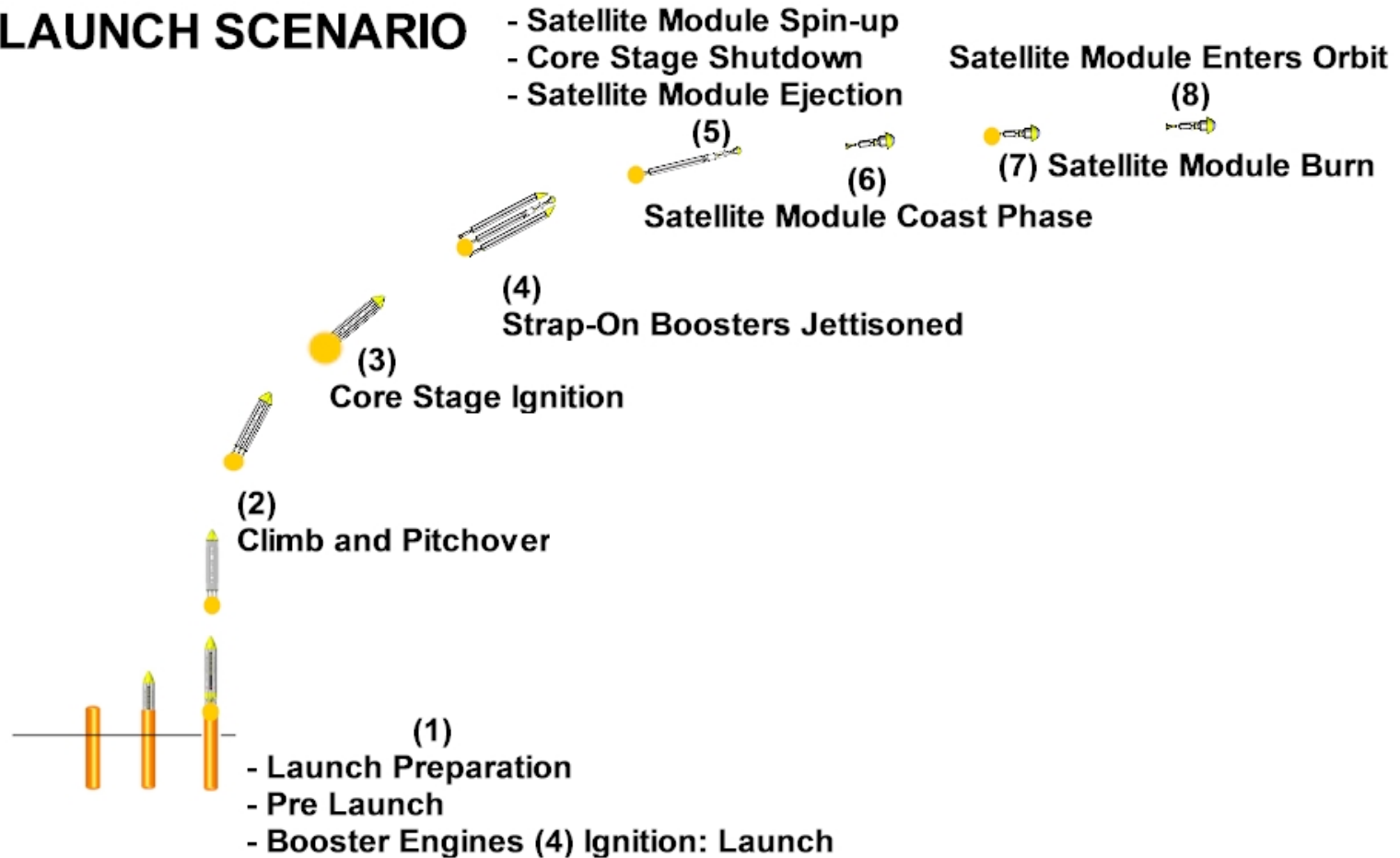
Doesn't set a limit on the size of a launch vehicle

Requires only a minimum of launch support hardware

The most cost-effective launch option



LAUNCH SCENARIO





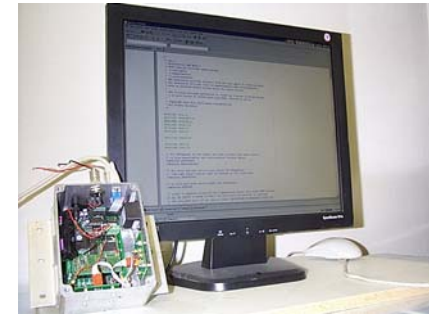
NEPTUNE 30: Key Hardware Built In-House



State of the Art Ultra Light Weight Tank Manufacturing Methods
Carbon Composite over a Proprietary Plastic/Aluminum Liner



Ablative Rocket Engine Components



Advanced Guidance Hardware and Software



Satellite Module Rocket Engine Test



Manned Space Flight Training Systems



Rocket Injectors, Valves Systems, and Other Metal Parts

Interorbital Systems

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SEA STAR TSAAHTO: Flight Demonstrator Construction





NEPTUNE 30: Primary Launch Site/Orbit

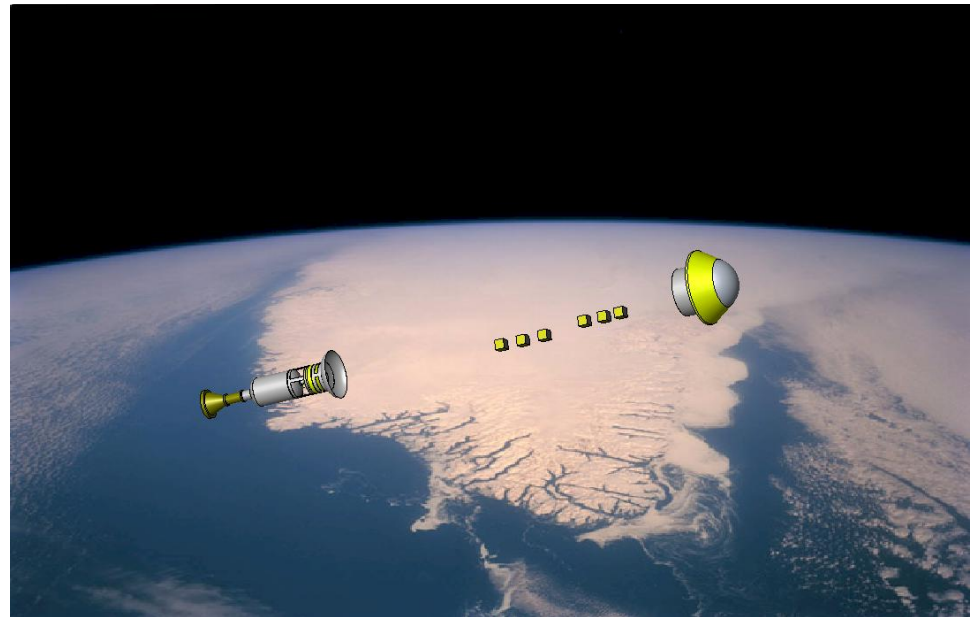


- ▲ **Pacific Ocean off the coast of Southern California**
- ▲ **135 to 175 miles west of Los Angeles on the open ocean**
- ▲ **Orbital Type: Polar or Sun Synchronous**
- ▲ **Orbital Altitude: 300 miles (484 kilometers)**
- ▲ **The launch site and orbit can be modified according to the customers requirements**



- ▲ Single payloads to polar or sun-synchronous orbit (LEO)
- ▲ Single Payloads to equatorial or Molniya orbits
- ▲ Multiple CubeSats to the above orbits (up to 12 at a time)

CubeSat Deployment





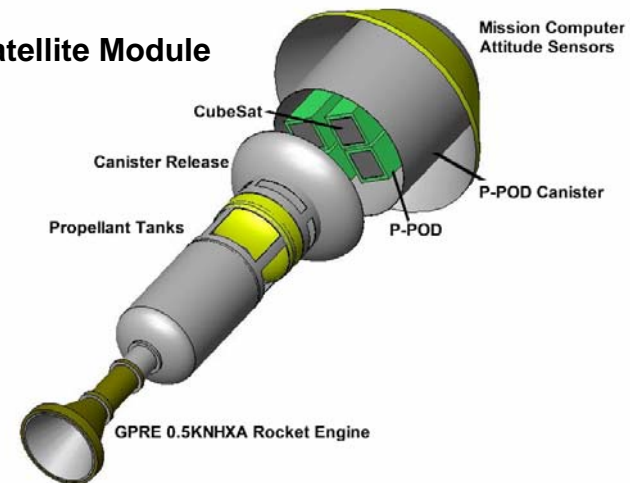
NEPTUNE 30: Payload Parameters



- ▲ The NEPTUNE 30 is ideally suited for CubeSat Launch. A unique spin-stabilized Satellite Module is designed to deploy up to 12 CubeSats. The stage includes four (4) P-pods, each housing three (3) CubeSats.
- ▲ Once the STM achieves orbit, a mechanical unit de-spins the stage. A programmed satellite release system will deploy the satellites in a sequence. Each P-pod release can be timed to separate all of the CubeSats to an optimum distance to minimize any electronic interference.
- ▲ The release program can be modified to suit most CubeSat missions. Nonstandard CubeSat configurations (2X CubeSat, etc.) can also be accommodated.

For other payloads, the maximum standard payload diameter for the NEPTUNE 30 is 28 inches. The maximum standard payload length for the NEPTUNE 30 is 56". Maximum payload weight (Polar) = 66-pound (30-Kg). Special mission-specific customization is possible, and available at additional cost.

CubeSat Satellite Module



DE-SPIN HARDWARE NOT SHOWN

Interorbital Systems

www.interorbital.com



BOOST-UP: Providing the Ride



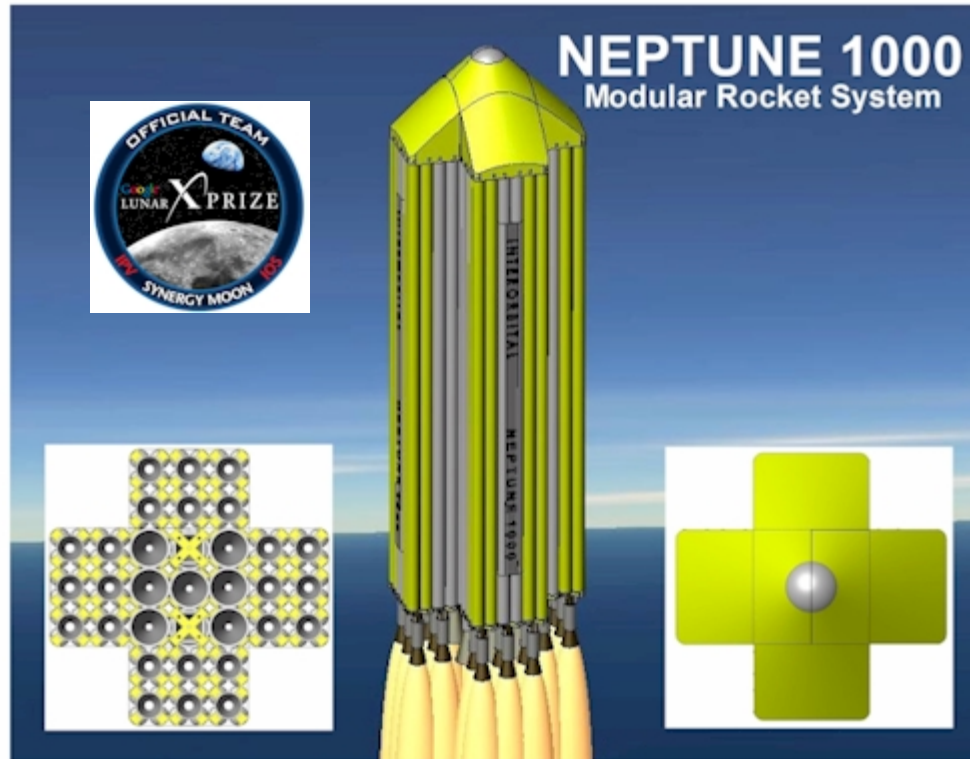
- ▲ ***BOOST-UP*: BROAD OPERATIONAL OPPORTUNITY FOR SPACE TRANSPORT OF UNIVERSITY PAYLOADS**
- ▲ Individual or company purchases multi-satellite *Sea Star* launch for \$500,000
- ▲ Gives away 15 or more individual launch opportunities to academic space science projects (approximate value \$35,000 per CubeSat) on each *Sea Star* flight
- ▲ Benefactor titles spaceflight donations with foundation, company, product, or his or her name; donates individual launches under own award program to one or more educational institution
- ▲ ***BOOST-UP*** involves international university CubeSat programs; satellite integration organizations; small sat manufacturers; government research or defense small sat programs to facilitate nomination and inclusion of student payloads for flight in Interorbital's program
- ▲ Patron gains unsurpassed level of prestige as a true space science enabler

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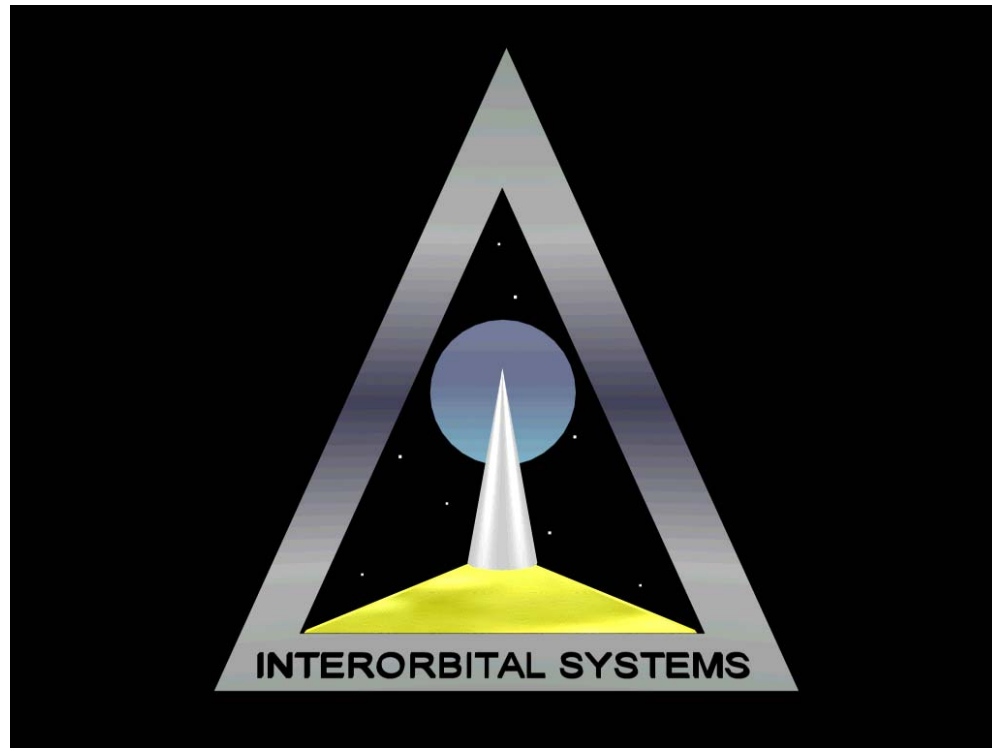


NEPTUNE 1000: Moon Rocket



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