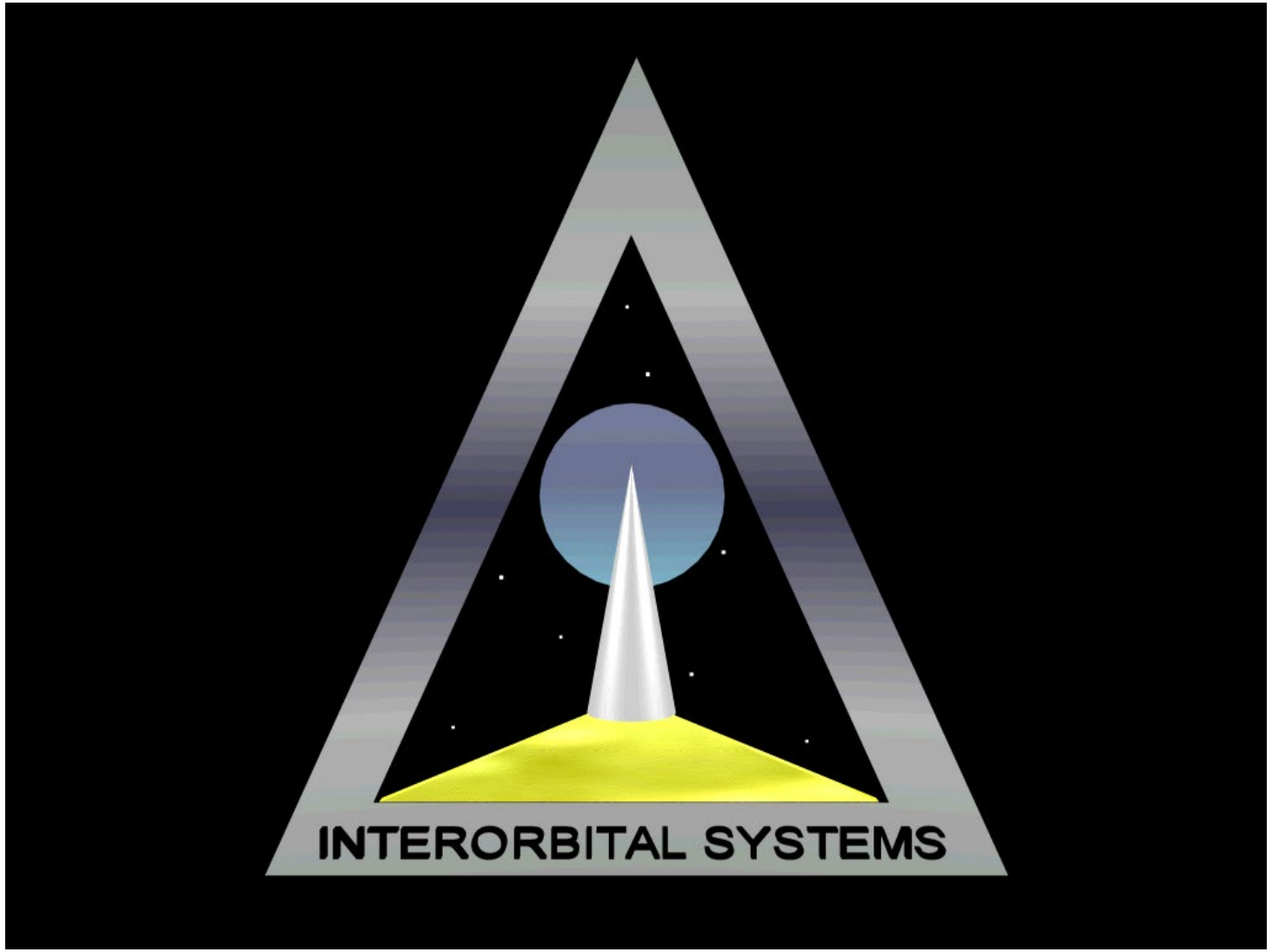

Interorbital Systems

www.interorbital.com

Interorbital Systems

Providing the World's Lowest-Cost Access to Space

INTERORBITAL SYSTEMS

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The Problem

(1) Rockets are currently too expensive for companies to generate a profit from the sales of their launch vehicles and launch services alone.

(2) There are simply not enough customers who can afford to buy the necessary number of launches for a rocket company to generate a profit.

(3) For this reason alone, none of the existing commercial launch vehicle companies or the currently funded companies developing new launch vehicles will ever become profitable without receiving government handouts, which are limited.

(4) Investing in those companies is a waste of time and money.

The Solution

(1) We at Interorbital have designed a radically simplified launch vehicle series with a cost-per-kilogram-to-orbit so low, no other launch company will be able to compete with us on a payload-to-payload basis.

(2) Interorbital's line of affordable launch vehicles will allow a wide range of new customers to enter the space industry and boost launch revenue to a level required for IOS to, unlike its competitors, *actually* become a profitable launch company.

Interorbital Systems has developed a series of ultra-low-cost orbital launch vehicles actually capable of generating a profit

Current Operational Orbital Launch Vehicles have a Narrow Payload Capacity Range

Results in a reduced customer base for each operational launcher which limits the maximum revenue the launcher can generate

Interorbital Systems is developing a modular launcher that allows the payload capacity to be increased or decreased by simply varying the *numbe*r of NEPTUNE Building Blocks in each launch vehicle variant. This means Interorbital will be able to satisfy the payload requirements for a majority of orbital-launch customers.

NEPTUNE-Series Modular Orbital Rockets

All the basic requirements for a series of low-cost **profit-generating** orbital launch vehicles are met by Interorbital's NEPTUNE-Series modular orbital rockets:

(1) A modular launch vehicle's payload capacity to orbit can be varied by increasing or decreasing the number of modules (called NEPTUNE Building Blocks) in the rocket assembly.

(2) All NEPTUNE Series Rockets have only two stages to further simplify the launch system

(3) The NEPTUNE Building Blocks can be integrated into the booster stage or the upper stage

(4) The NEPTUNE Building Blocks are manufactured in-house at the Interorbital Systems' facilities using various automated construction methods by a small A+ team.

(5) The NEPTUNE Building Blocks incorporate the most basic, radically simplified rocket propulsion hardware possible and are powered by high-density storable propellants.

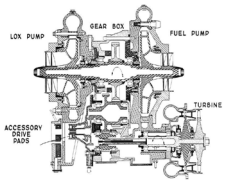
(6) NEPTUNE-Series modular rockets are designed to be launched from an ocean-going barge at sea.

NEPTUNE-Series Modular Orbital Rockets are expendable but cost far less to manufacture and launch compared to any of today's operational or in-development reusable or expendable orbital launch vehicles.

Current Operational Liquid-Propelled Launch Vehicles were designed for Maximum Performance Regardless of Cost

Maximum performance means increased complexity and lower profit per launch

Liquid Rocket Engine

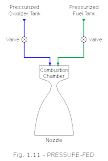


Turbopump

Propellant Tanks

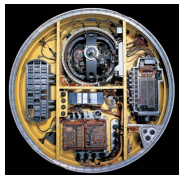
Pressure Regulator

High Pressure Tanks



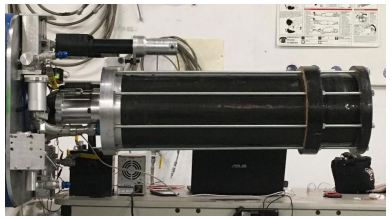
Pressurization System

Helium



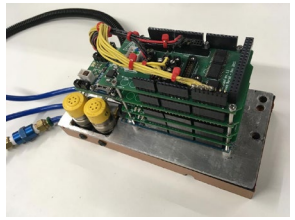
Controller

IOS's rocket designers have developed an efficient reliable modular building-block orbital launch system that eliminates the most expensive and complicated rocket components.



Gimballed Liquid Rocket Engine

Propellant Tanks

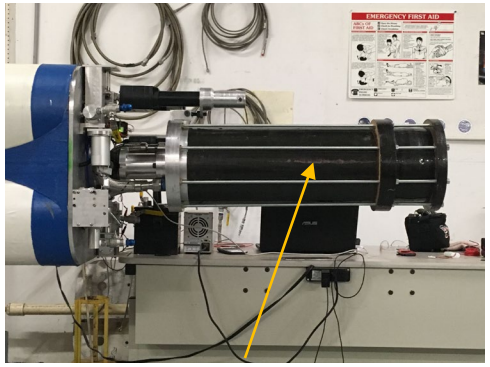


Controller

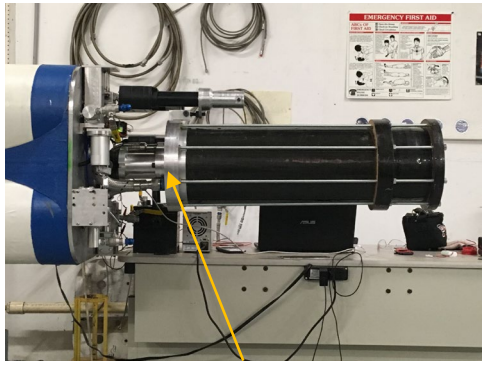
IOS modular NEPTUNE Building Blocks have only three primary components.

Automated Subtractive and Additive Manufacturing with CNC Machining, Filament Winding, and 3D Printing

One or more modular launch vehicles can be robotically produced per week by a small A+ work force to satisfy the demands of the expanded space-launch customer base



Filament-wound Ablative-cooled Rocket Engine Chambers

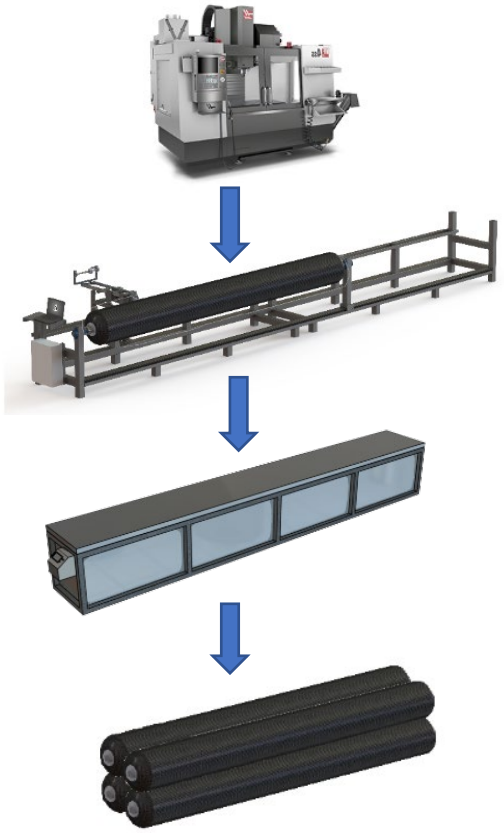


CNC Manufactured Aluminum Rocket Engine Components

Filament-wound Propellant Tanks with 3D printed fittings

Using both automated subtractive and additive manufacturing, nine or more NEPTUNE Building Blocks can be manufactured each day. A single N2TS launcher can be completed in one day, an N9TS launcher in three days, and an N36TS in 14 days

Automated NEPTUNE Building Block Tank Manufacturing



CNC Machine (CNCM)

A computer-controlled CNC machine makes aluminum engine components (ex: rocket engine injector)

Filament Winder (FW)

Four computer-controlled filament winders make four lightweight carbon-composite propellant tanks simultaneously

Curing Oven (CO)

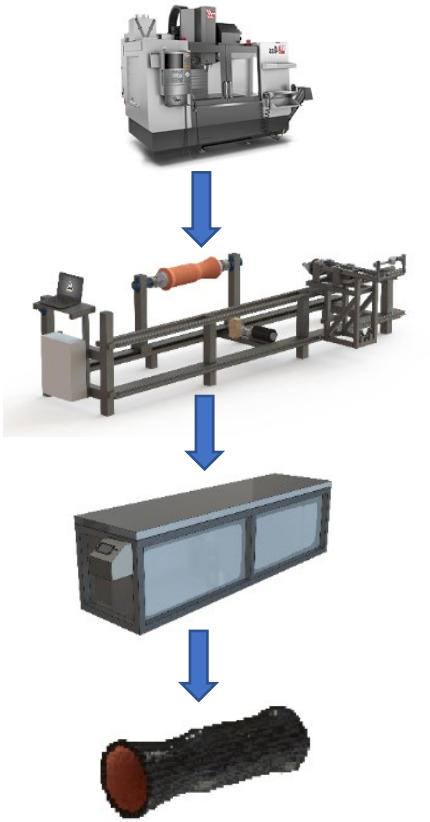
A computer-controlled oven cures the carbon composite tanks.

Tankage Assembly

The four carbon-composite tanks are bundled into the NEPTUNE Building Block in a special jig and pressure tested.

With 12 CNCMs, FWs, and COs, 36 tanks can be manufactured in 24 hours by six A+ manufacturing technicians

Automated Ablative-Cooled Rocket Engine Manufacturing



CNC Machine

A computer-controlled CNC machine makes aluminum engine components (ex: rocket engine injector)

Filament Winder

A computer-controlled filament winder makes a silica-phenolic rocket engine combustion chamber and nozzle

Curing Oven

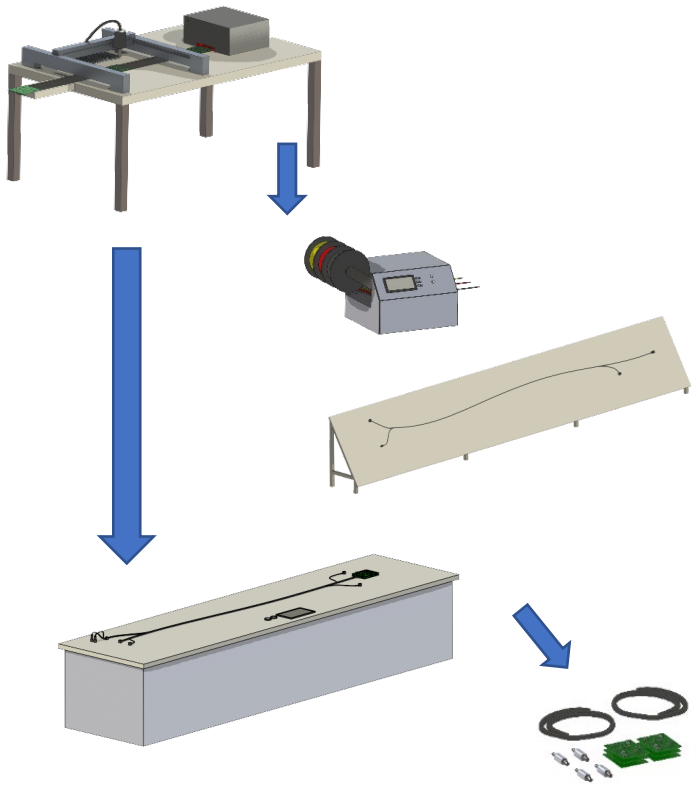
A computer-controlled oven cures the silica-phenolic rocket engine combustion chamber and nozzle.

Rocket Engine Assembly

A rocket engine is assembled from the individual components

A rocket engine can be completed in as little as 8 hours by two A+ manufacturing technicians

Automated Electronic Control System Manufacturing



Control Board Manufacturing

An automated assembly line consisting of solder applicator, pick-and-place machine, and reflow oven

Wire Harness Manufacturing

A simple jig with automated wire cutting/stripping machines are used to quickly and consistently manufacture the wire harness.

Electronic Testing Bench

Automated testing of electronic assemblies

Electronic Package

The tested and certified electronics are integrated into the NEPTUNE Building Block

Electronics systems can be completed in as little as five hours by two A+ manufacturing technicians

Automated CNC-Machined and 3D Printed Control Hardware are Combined with Off-the-Shelf Components

3D Printer

3D prints control hardware components

Off-the-Shelf Components

Examples are the gimbal, gimbal actuators, ball valves, and threaded rod

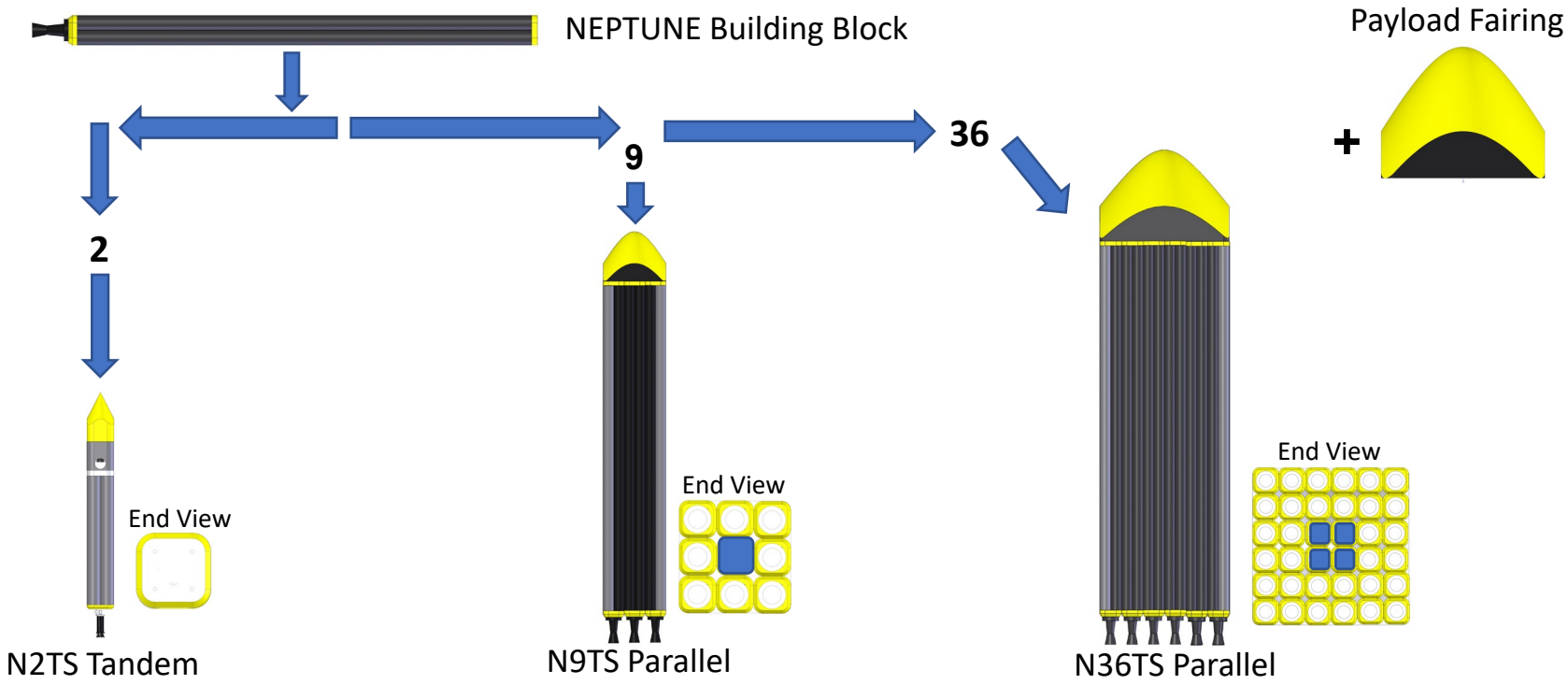
Functional Rocket Components

Examples are the gimbal system, main valves, cold-gas ACS, and propellant fill systems

Rapidly manufactured control hardware and off-the-shelf components can be quickly integrated into the NEPTUNE Building Blocks

Building Modular IOS Two-Stage Launch Vehicles

The NEPTUNE Series Modular Launch Vehicles



NEPTUNE series modular launchers are assembled from multiple NBBs by stacking them or arranging them in parallel (side-by-side). For parallel staging, Stage 2 (in blue) is nested inside the Stage 1 ring.

Cost-Effective Rapid Rocket-Assembly Problem Solved

A simple rocket system combined with automated component manufacturing methods and efficient assembly-line practices results in a rapidly-produced launcher affordable to the largest customer base. This combination of factors yields the highest revenue possible for an orbital-launch vehicle

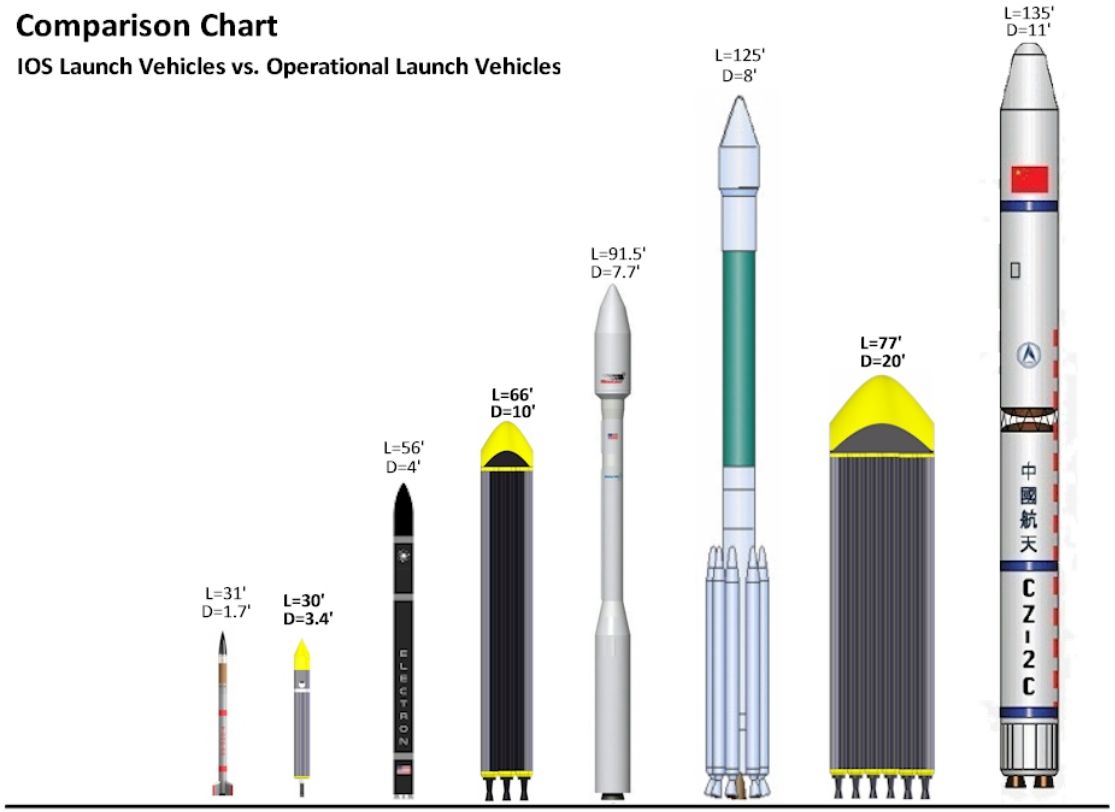
Combining these Cost-Cutting Measures with Ocean Barge Launch will result in the Lowest-Cost Launch-to-Orbit on the Planet

Existing spaceports charge up to $5,000,000 per launch. Ocean barge-launch can cost as low as $50,000, a substantial savings. Maximizes profit! Lowers launch costs!

Market Research: Operational Competitors

Comparison Chart

IOS Launch Vehicles vs. Operational Launch Vehicles



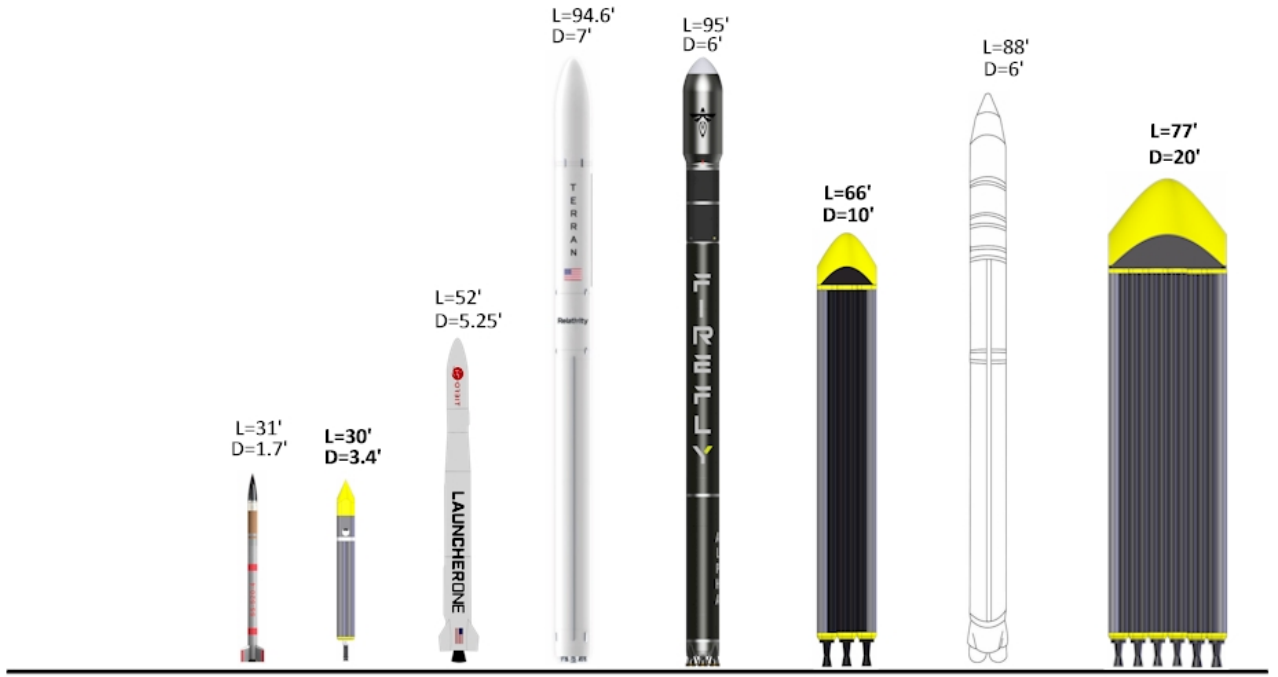
Country	Japan	**USA**	New Zealand	**USA**	USA	USA	**USA**	China
Launch Vehicle	SS-520-5	**IOS N2TS**	Electron	**IOS N9TS**	Minotaur C	Delta II	**IOS N36TS**	CZ-2C
Payload LEO (Kg)	3	**30**	200	**1,250**	1,320	3,000	**3,200**	3,500
Launch Cost	$3M	**$350K**	$6M	**$6M**	$50M	$51M	**$12M**	$30M
Cost/Kg	$1M	**$11.7K**	$30K	**$4.8K**	$37.8k	$17K	**$3.75K**	$8.6K

IOS = INTERORBITAL SYSTEMS **D = Diameter (feet)** **L = Length (feet)** **LEO Altitude = 500 km** **LEO Inclination = 28 degrees**

Market Research: In-Development Competitors

Comparison Chart

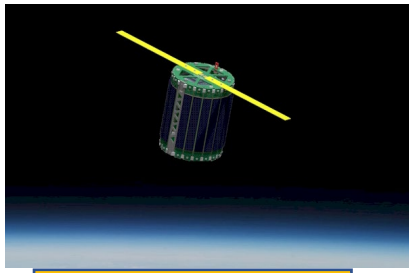
IOS Launch Vehicles vs In-Development Launch Vehicles



Country	Japan	**USA**	USA	USA	USA	**USA**	USA	**USA**
Launch Vehicle	SS-520-5	**IOS N2TS**	Virgin Orbit	Relativity T1	FireFly Alpha	**IOS N9TS**	ABLSpace	**IOS N36TS**
Payload LEO (Kg)	3	**30**	450	900	1,000	**1,250**	1,200	**3,200**
Launch Cost	$3M	**$350K**	$12M	$10M	$15M	**$6M**	$12M	**$12M**
Cost/Kg	$1M	**$11.7K**	$27K	$11.1K	$15K	**$4.8K**	$10K	**$3.75K**

IOS = INTERORBITAL SYSTEMS D = Diameter (feet) L = Length (feet) LEO Altitude = 500 km LEO Inclination = 28 degrees

What are some of the things we've done so far?



Delivering Satellite Kits since 2009 with more than $2 Million in sales

Awarded SBIR NASA Contract in 2011

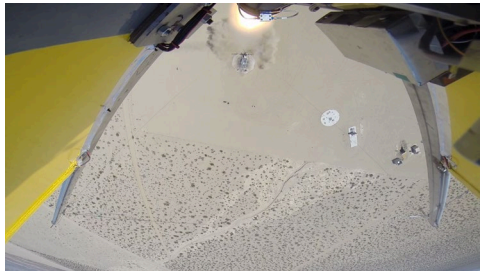
Full launch manifest with over150 satellite customers

Introduced updated satellite kits (2.0) in 2019

Custom-built carbon-composite filament-winding machine

Developed 6 liquid rocket engines

Two private rocket engine test sites at Mojave Spaceport



Successful rocket launches; both booster and upper-stages of NEPTUNE 2 flown

Upcoming Suborbital Tests & Orbital Missions

2020 – NEPTUNE 2 (N2) Pre-Orbital Test Launch

Wayfinder II, a 3U CubeSat and hosted–payload platform designed and integrated by Boreal Space, NASA Ames Research Park. It carries a mission called SHRINE. SHRINE stands for the Stanford, Hakuto, Raymix, Inventor, NUS Experiment. Five Boreal Space, NASA Ames Research Park. It carries a mission called SHRINE. SHRINE stands for the Stanford, Hakuto, Raymix, Inventor, NUS Experiment. Suborbital flight, followed launch on by first IOS orbital mission.

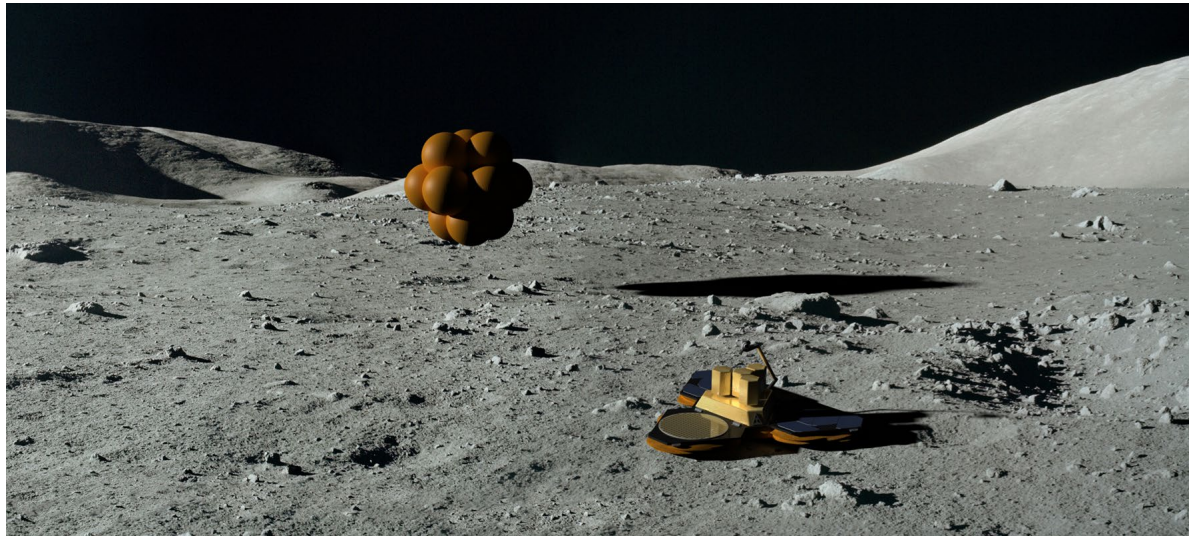
2020/2021- NEPTUNE 2 (N2) Inaugural Orbital Launch

Up to 30 Small-Sats on Board

Upcoming Interplanetary Missions

2021/22: Project LUNAR BULLET—Lunar Direct. Lunar Impactor. A collaboration between Ed Belbruno's Innovative Orbital Design and Interorbital Systems. RANGER-style MOON impact mission. Excess payload space available: 0.5 kg (soft-landing). As the rocket nears Luna, and before the Lunar Bullet impacts the Moon, the secondary payload (IOS LunarStation) will be ejected and will soft-land on the Lunar surface using a retro rocket and airbags.

2021/22 IOS LunarStation: First Soft-Landing on the Moon by Private Corporation



•2022/23: Lunar Sample Return Mission

•2023: Begin Construction of Lunar Research Station at Lunar South Pole; begin first space tourism flights

•2023/24 VENUS Atmospheric Mission; Continuing Moon Missions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