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INTERORBITAL SYSTEMS

N-Series Rocket Systems and Small Satellites

Presenter: Randa Milliron, CEO

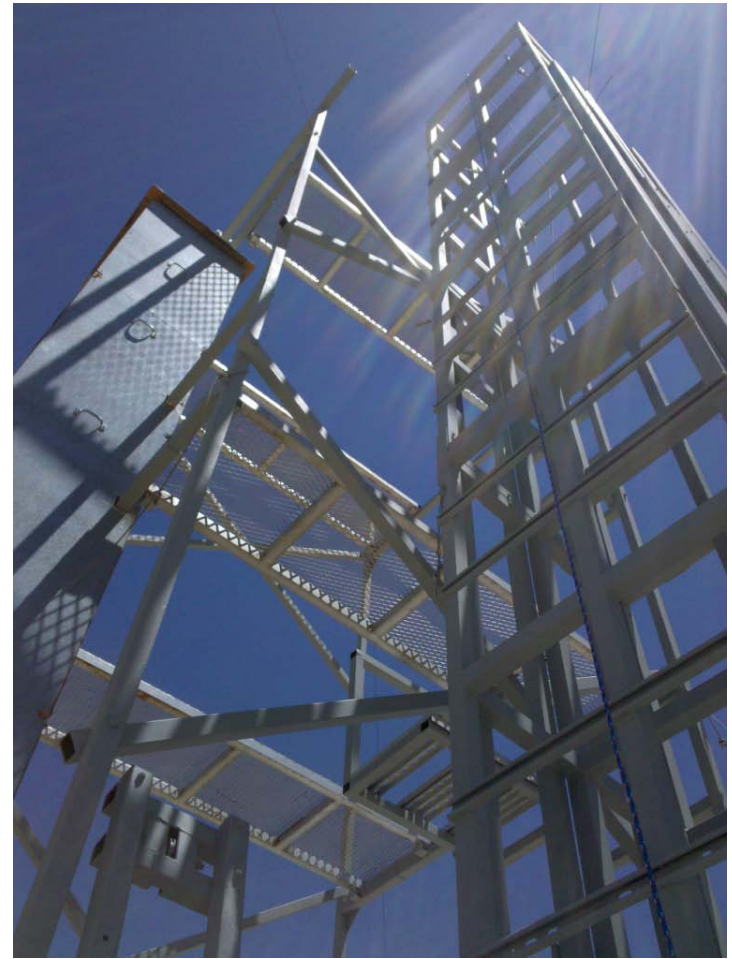


Interorbital Systems

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- R&D and manufacturing : Mojave Spaceport
- Two rocket engine test sites: Mojave Spaceport
- Low-altitude Flight Test Area: MTA
- Orbital Spaceport (ocean): Worldwide





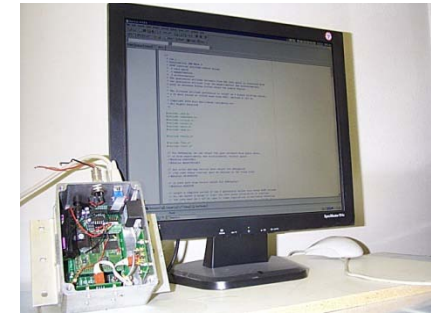
KEY ROCKET HARDWARE BUILT IN HOUSE



Advanced Composites including state-of-the-art lightweight propellant tanks



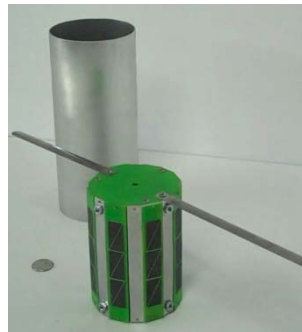
Ablative Rocket Engines and Components



Advanced Guidance Hardware and Software



Modular Rocket Components



Small Satellites: TubeSat and CubeSat Kits



Rocket Injectors, Valves Systems, and Other Metal Components

Interorbital Systems

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IOS UNIQUE ROCKET TECHNOLOGIES



- **NEPTUNE Modular Rocket System (three- and four-stage)**
 - Assembled from multiple Common Propulsion Modules (CPMs)
 - Parallel- and tandem-staging options
 - Radically reduced rocket system development costs
 - Can be customized for a wide range of payloads
 - Ideal design for assembly-line mass production

- **Environmentally Safe, Storable, High-Density Hypergolic Propellants**
 - White Fuming Nitric Acid (WFNA) and Turpentine/Furfuryl Alcohol
 - Instantaneous chemical ignition eliminates need for an ignition system

- **Low-Cost Propellant Tank Technology**
 - Proprietary acid-resistant tank liners and tank ends
 - State-of-the-art carbon composite tank reinforcement technology

- **Blowdown Propellant Feed**
 - Eliminates the need for turbopumps or a separate pressurant system

- **Unique Rocket Engine Injector**
 - Automatically maintains propellant jet flow rate in blowdown mode
 - Maximizes specific impulse over a wide pressure input range

- **CPM Engine is Ablatively Cooled and Gimballed**
 - Ablative engines allow lighter propellant tanks
 - Gimballing allows rapid attitude correction in a rough-sea environment

- **Canister Ocean Launch**

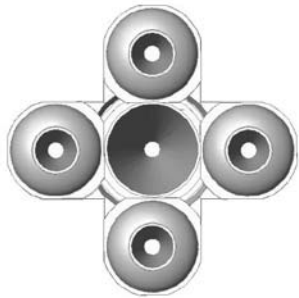


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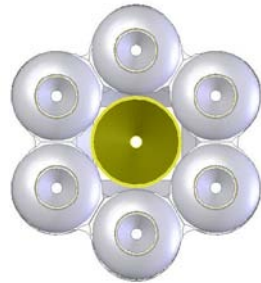
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- Basic building block of the N-Series Rockets
- Bi-propellant storable, hypergolic liquid rocket system
- Blowdown propellant feed
- State-of-the-art , all-composite propellant tanks
- Single gimballed rocket engine
- CPMs clustered together in multiples to meet mission requirements for both small and large payloads



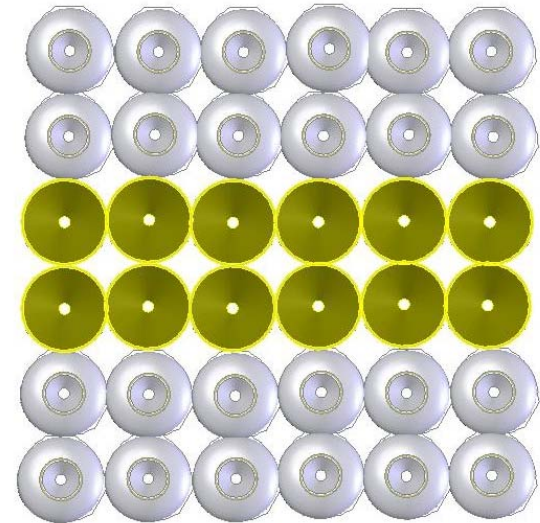
N5
5 CPMs
Three stages
Payload: 30 kg



N7
7 CPMs
Three stages
Payload: 50 kg



N9
9 CPMs
Three stages
Payload: 100 kg



N36
36 CPMs
Three stages
Payload: 1,000 kg

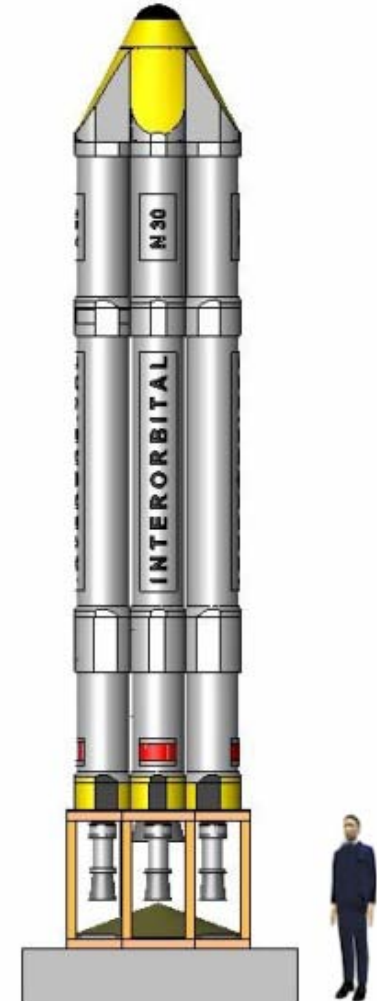


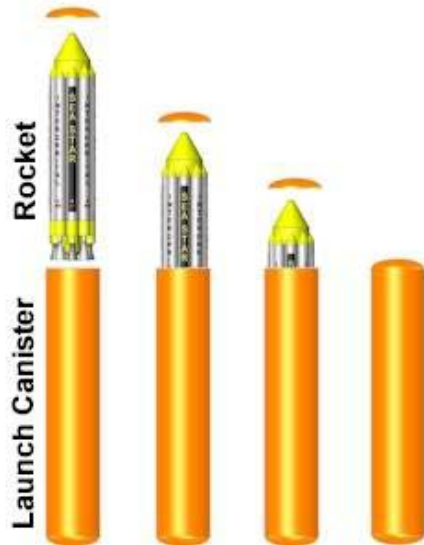
Three-Stage Launch Vehicle with Parallel and Tandem Staging

- Five (5) Common Propulsion Modules (CPMs)
- Stage 1: 4 CPMs with parallel staging
- Stage 2: 1 CPM
- Stage 3: Kick stage with solid motor (tandem staging)
- Length: 31.5 feet (10.3 m); Maximum diameter: 6.2 feet (1.89 m)
- GLOW: 20,000 pounds (9.070 kg)
- Payload: 66 lbs (30 kg) to a 192 mile (310 km) polar orbit

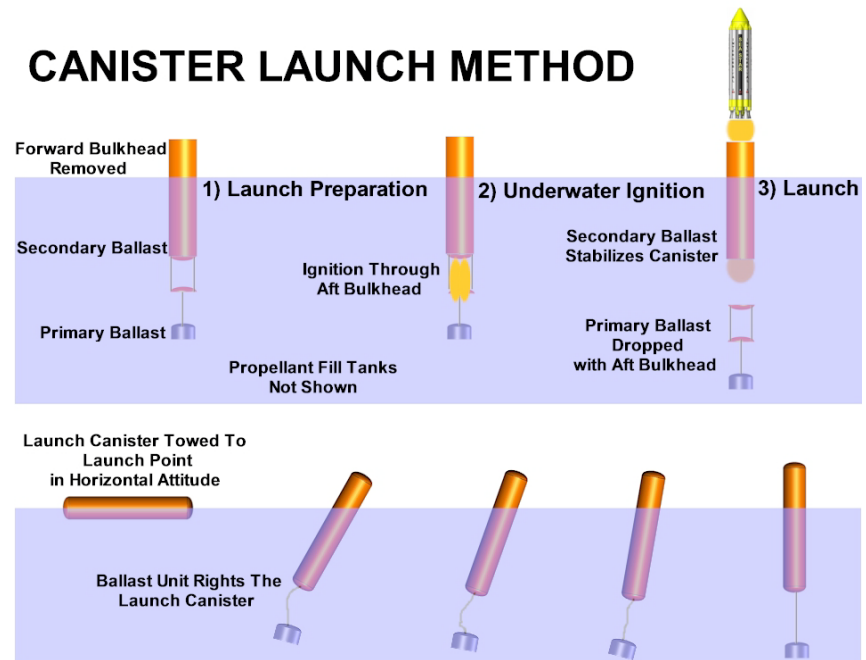


Stage 3





CANISTER LAUNCH METHOD





Ultra Lightweight Propellant Tank Technology

- Acid resistant propellant tank liner
- Carbon-composite exterior shell
- Low-tech construction method
- Ideal for mass production



Solid Rocket Motor Technology

- Orbital kick-motor applications
- Long burn times with low thrust
- Soft ride for payload
- Ideal for mass production



CPM MOBILE ROCKET LAUNCHER





N5: DEDICATED SMALL-SATELLITE LAUNCHER



Standard Orbit

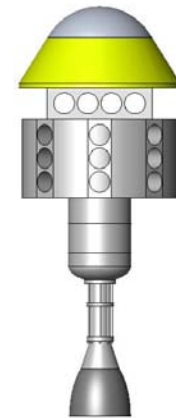
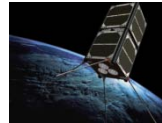
Circular Polar

310 Km (higher altitudes available)

Estimated 1.5- to 3-month decay to reentry



- **TubeSat Payloads (32)**
- **CubeSat Payloads (18)**
- **Combined TubeSat and CubeSat Payloads (variable)**
- **Single small satellite (up to 30 Kg)**



Max Payload Size: 60 cm X 80 cm (square or round cross section)

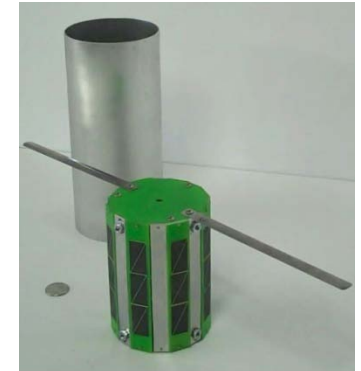
Customized orbits are available

FEATURES

- PCB Gerber Files
- Spectrolab TASC solar cells
- A Li-ion battery pack (3.7 V 5200 mAh)
- Microcomputer (NetMedia BasicX-24 or Arduino Mini)
- Transceiver (Radiometrix)
- Antennas
- Fasteners
- Complete instructions and assembly guide



IOS CubeSat Kit



TubeSat with Sample Ejection Cylinder





CubeSats

UC Irvine, UCISAT1

FPT University, Vietnam, F-1 CubeSat

Nanyang Technological University, Singapore

Google Lunar X PRIZE(GLXP) Team PLAN B (Canada)

GLXP Team EuroLuna, Romit 1 (2-Unit CubeSat from Denmark)

NASA Independent Verification and Validation (IV&V) Facility, 1 CubeSat & 2TubeSats

King Abdullah University, Saudi Arabia (KAUST)(2 IOS CubeSats;1TubeSat; 1 suborbital payload)

Pakistan's I CUBE-1 Islamabad Institute of Science and Technology

**Denmark's GLXP Team Euroluna: *Romit 1*
2U (2-Unit) Cubesat**





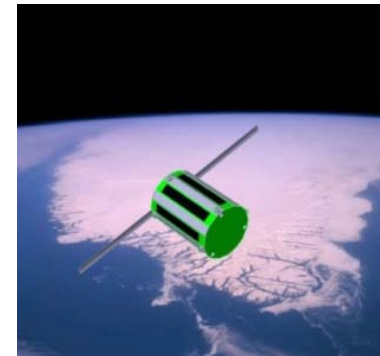
N5: MISSION I & II LAUNCH MANIFESTS 2012



TubeSats

Morehead State University (Kentucky Space) (TubeSat and 2 suborbital payloads)
InterAmerican University of Puerto Rico
University of Sydney (Australia) (2) *i-INSPIRE (initial-INtegrated SPectrograph, Imager & Radiation Explorer)*
Aslan Academy (Private LA High School) STEM Program
Project Calliope (Space Music Project)
Universidad de Puerto Rico / Marcelino Canino Canino Middle School, STEM micro-meteoroid impact study
GLXP Team SYNERGY MOON Space-Qualifying Rover Team Astronomska Udruga Vidulini's (AUV) Comms
GLXP Team Part-Time Scientists / Fluid & Reason Software (2) (US/Germany)
Naval Postgraduate School (3) (TubeSats as ad-hoc orbital communication nodes) and 2 suborbital payloads
Defense Science and Technology Lab (DSTL) United Kingdom
Austrian Arts Group mur.at with MURSAT: Earth-as-Art Project
United States Military Academy at West Point (2)
Brazilian Space Institute/ 108 5th-7th Grade Students, Ubatuba, Sao Paulo, Brazil STEM Program
Mexican Satellite Project ULISES Sat from PLAY Festival's Arts/Soccer Opera from Space
TriVector Services (Huntsville) TRACsat – TriVector Radiation and Attitude Control Satellite
The Golden iPod: Voyager revisited; Earth to Sky, spaceweather.com, Bishop, CA STEM Program
La Despensa (The Pantry) Advertising Agency/Iniciativas en Idiomas (Madrid, Spain)
NASA Independent Verification and Validation (IV&V) Facility (2)
Galaxy Global, 1 TubeSat, donated to NASA Educational Program
Institute of Advanced Media Arts and Sciences/The Science Project, Inc., Japan (7)
AKQA Advertising, San Francisco
Universidad de Chile
University of Sao Paulo, Brazil (2)
David Lawrence K-8 School, North Miami, Florida

- Fifteen additional projects pending





NEWS AND UPCOMING MISSIONS



IOS selected for NASA Small Business Innovative Research Award

CPM TV: Common Propulsion Module Test Vehicle

Low-altitude suborbital test flights Summer 2012 FAA Class 3 Waiver

Olav Zipser High-Altitude Jump Record Attempt from SR 145 CPM



NASA NanoSat Challenge/ IOS Satellite Missions I & II, 2012

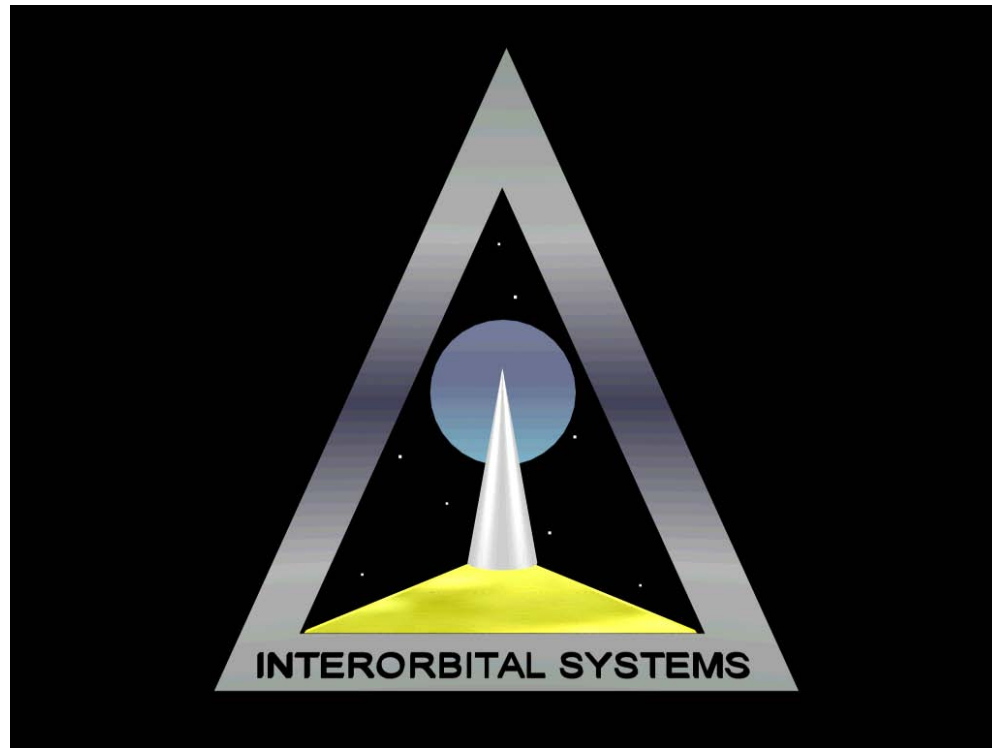
Google Lunar X PRIZE Lunar Missions 2013-14

Orbital Expeditions Space Tourism Flights 2013-14



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