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Spaceport Vision

- What is a Spaceport from a Futurist's Perspective?
- Spaceport Performance—How Are We Doing?
 - (Relative to Other Earthbound Transportation Modes and Amongst Existing Space Launch Sites)
- A Vision of Space Launch Operations...
for You & Me
- Caution: To Achieve the Vision, There WILL be
Catastrophes



What is a Spaceport?

A vital architectural element in a new age of spaceborne commerce

- Development of commercially viable spaceports is still in its relative infancy
- Need to conceive revolutionary spaceport architectures



Artwork by Pat Rawlings/SAIC for the Vision Spaceport Project



Global Shipping

Benchmarks at the Eve of the New Millennium

LEADING SEAPORTS OF THE U.S.

Total Volume of Foreign Trade (Metric Tons)*

(1) Houston-TX	92.3 Million
(5) NYC/N.J.	50.8 Million
(9) Long Beach-CA	32.7 Million

*Source U.S. Bureau of Census, "U.S. Waterborne Exports & General Imports, Annual 1997" (Issued July 1998)



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LEADING AIRPORTS OF THE WORLD

Total Volume of Cargo (Metric Tons)**

(1) Memphis-USA	2.4 Million
(4) Hong Kong	1.7 Million
(7) Frankfurt-GER	1.5 Million
(14) Amsterdam	1.2 Million

**Source Airports Council International-ACI, On-line Traffic Data: (<http://www.airports.org/traffic/index.html>); Prelim., 18 Mar 99



Channel Express

LEADING SPACEPORTS OF THE WORLD

Total Cargo Mass Loaded & Unloaded (Metric Tons)***

Cape Can./KSC	~200
Baikonur	?
Korou	?

***Source No known international trade sources that publish worldwide spaceborne cargo traffic from spaceports

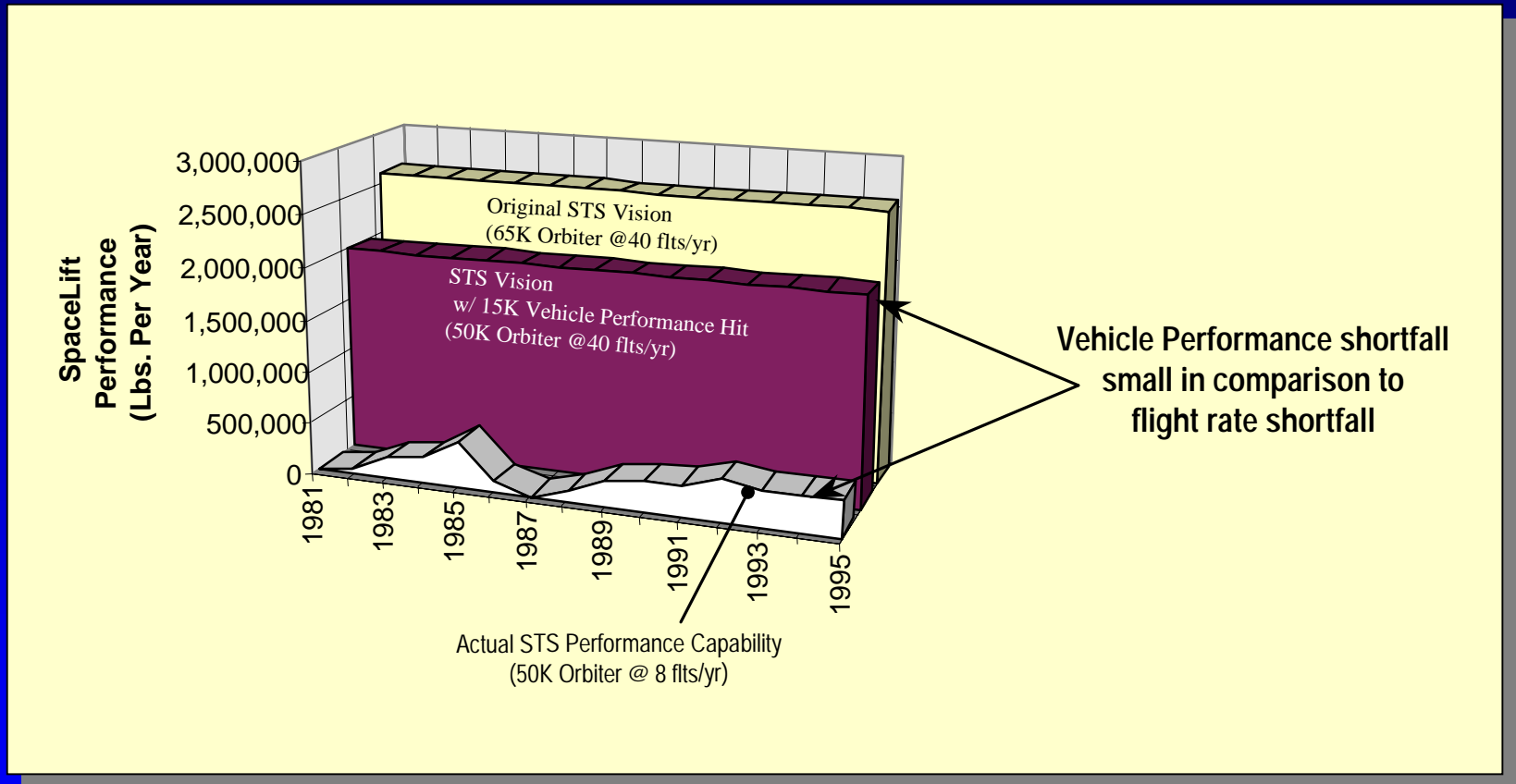


NASA Photo

Space Transportation Performance

Shifting the Emphasis (continued)

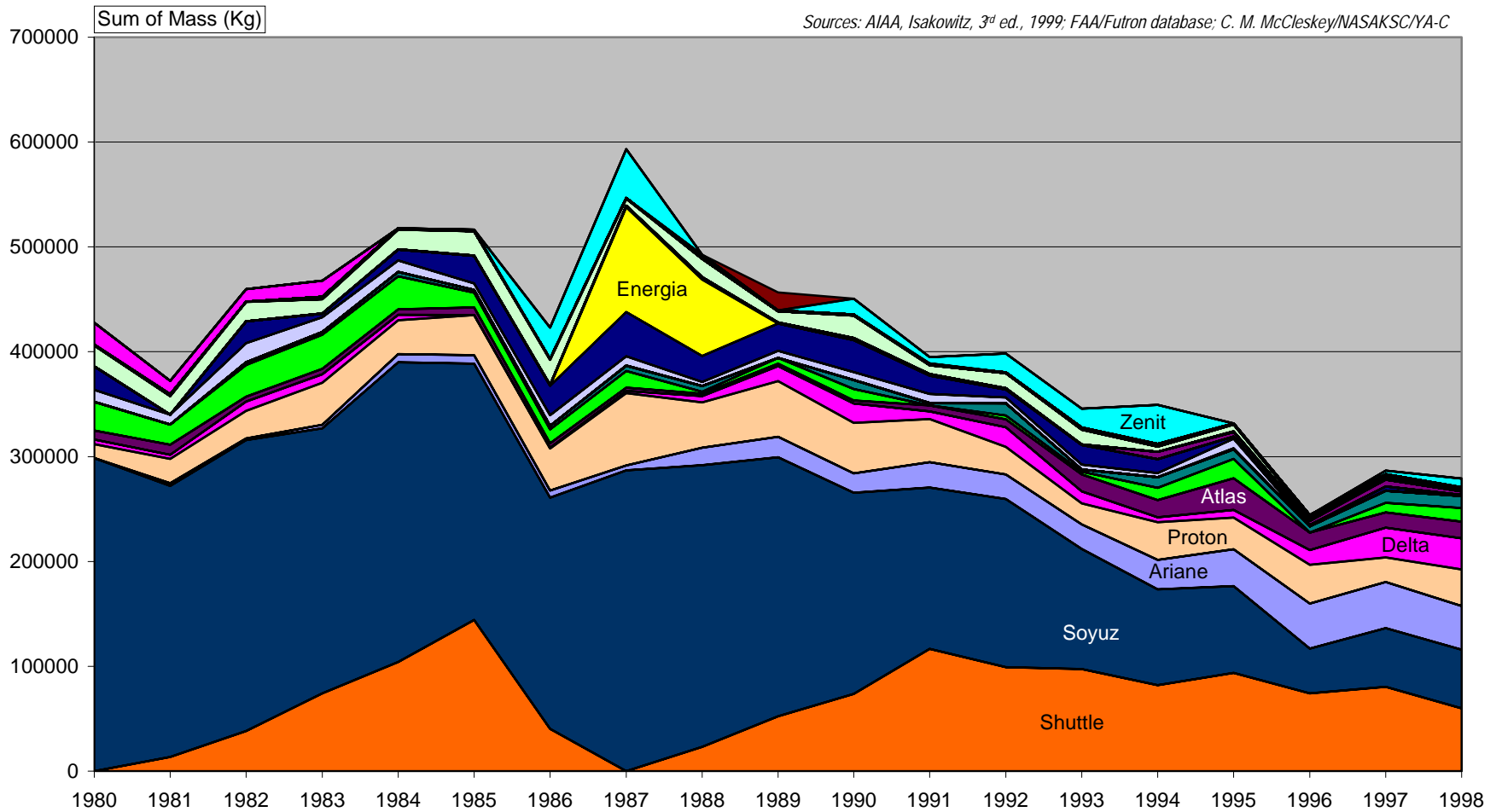
Vision Spaceport Strategic Planning Tool -- 1.0 Release



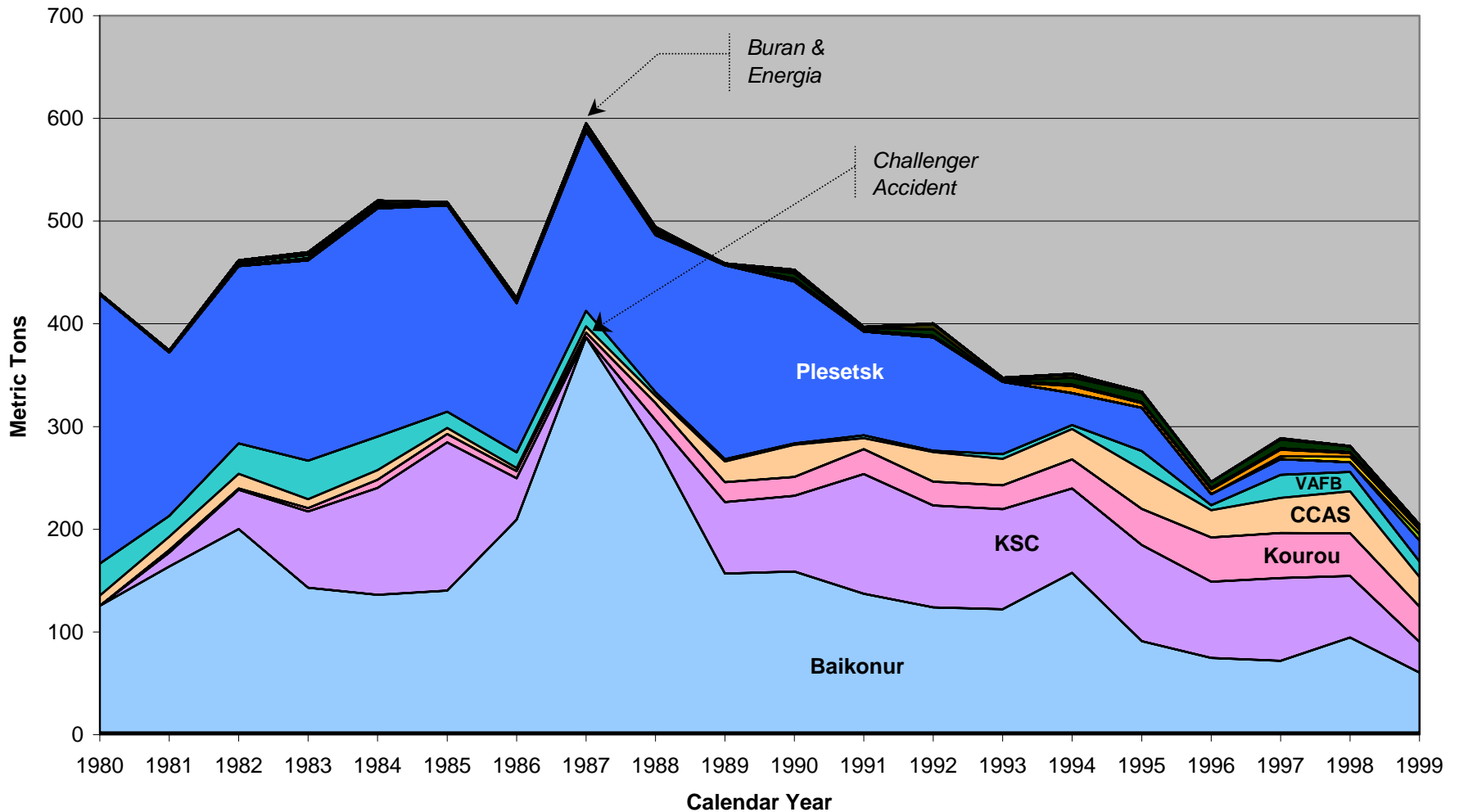
Example Throughput Performance
(In terms of Annual Payload Mass Delivered to Space)

Spacelift Throughput Trend

In Terms of Payload Mass (kg) from Earth to Space

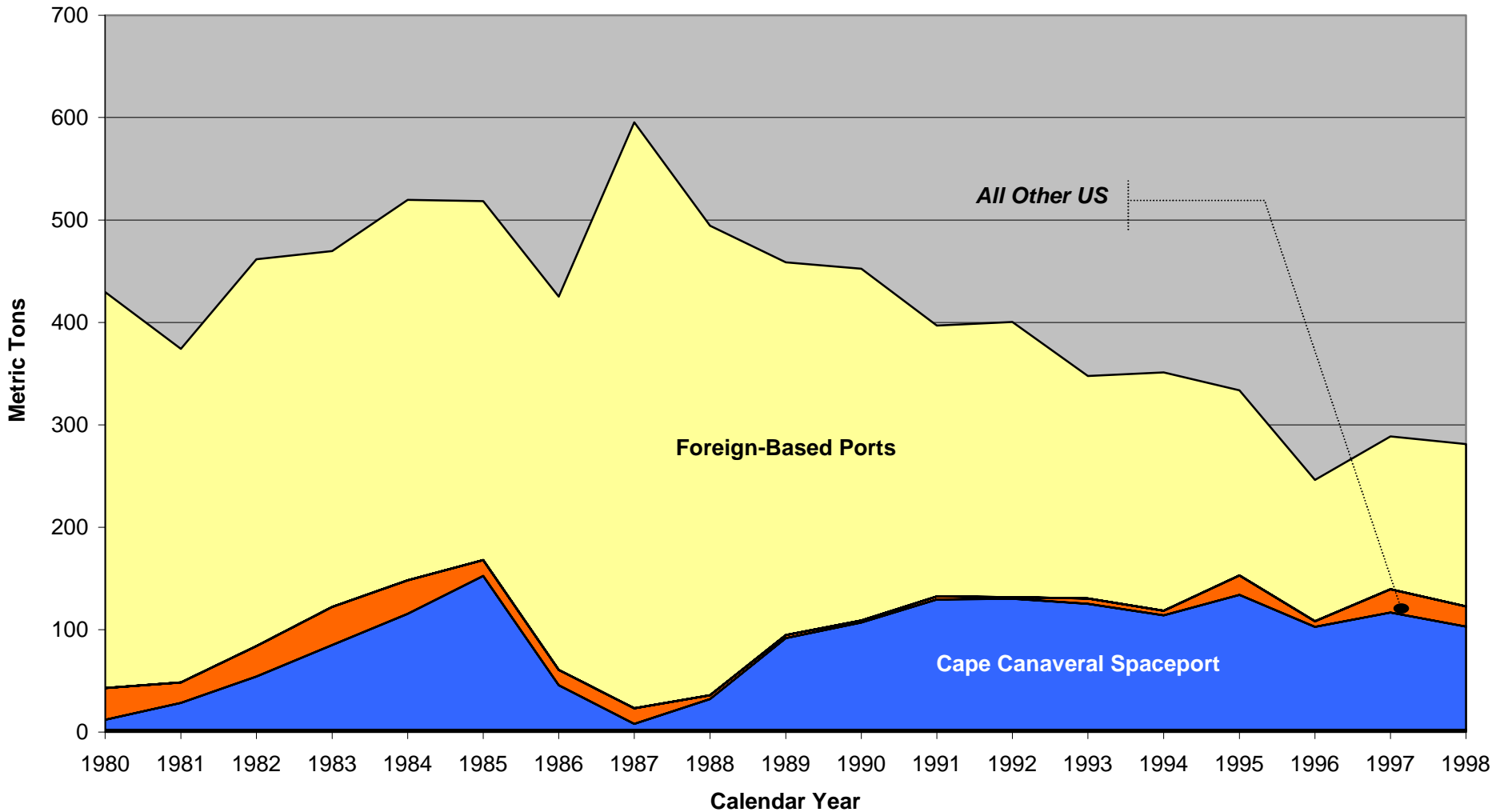


Global Payload Mass Delivery to Space



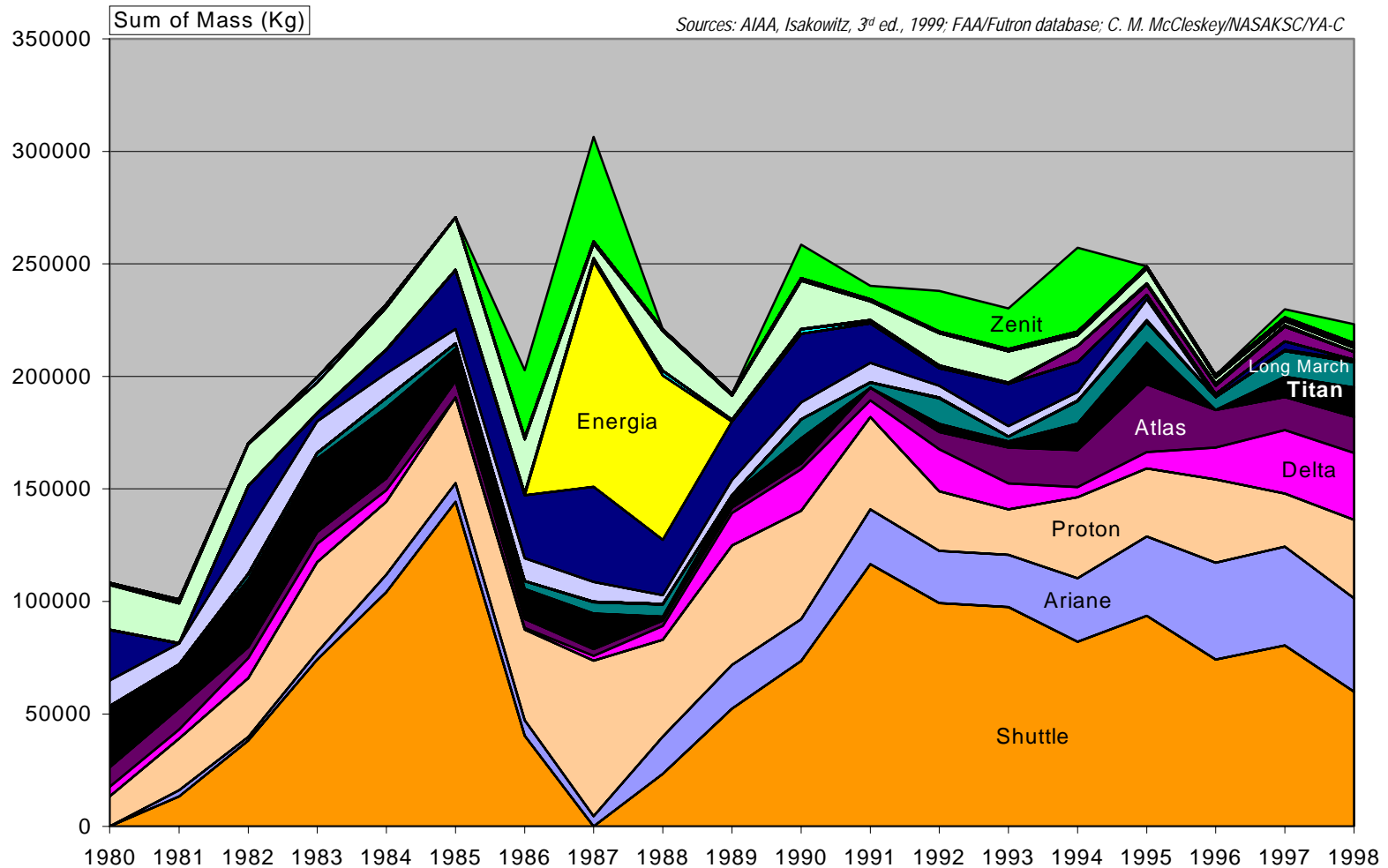
Payload Mass Delivery to Space

US Domestic & Foreign

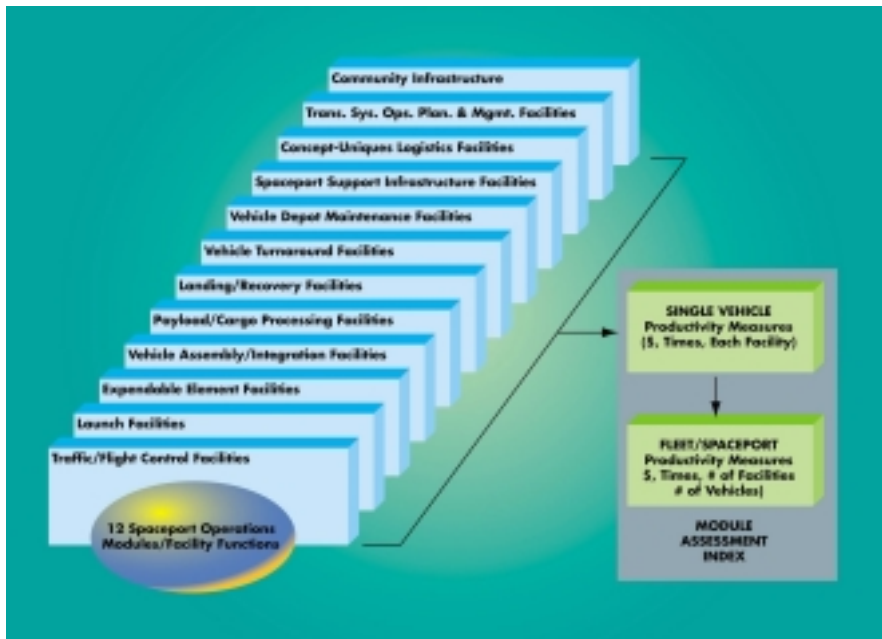


Spacelift Throughput Trend

In Terms of Payload Mass (kg) from Earth to Space
(without Soyuz Downsizing Influence)



VISION SPACEPORT MODEL IMPLEMENTATION



The core model is based on 12 generic spaceport “modules.”

Model users describe their space transportation system concept through a set of three interviews:

- *Vehicle Concept Definition*
- *Ops Concept Definition*
- *Business Case Assumptions*

Individual Elements

Command, Control, Communication | Mechanical | Thermal | Operations | Guidance, Navigation & Flight Control

General | **Propulsion** | Internal Interfaces & Integration | Power | Guidance, Navigation & Flight Control

Datab |
 External Tank |
 SRB

Main Propulsion System Definition

Number of engines: 3 | Type: Staged Combustion

Fuel: Liquid Hydrogen | Fuel Quantity: 0 Lbs

Oxidizer: Liquid Oxygen | Oxidizer Quantity: 0 Lbs

Auxiliary Propulsion System Definition

Number of engines: 2 | Type: Gas Generator

Fuel: Hydrazine | Fuel Quantity: 7000 Lbs

Oxidizer: N2O4/RFNA | Oxidizer Quantity: 10000 Lbs

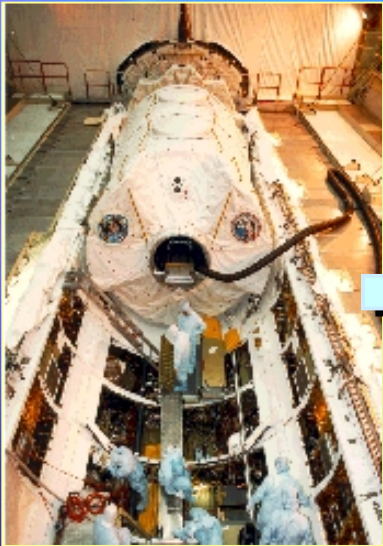
Reaction/Attitude Control System Definition

Number of thrusters: 40+ | Type: Bi-Propellant

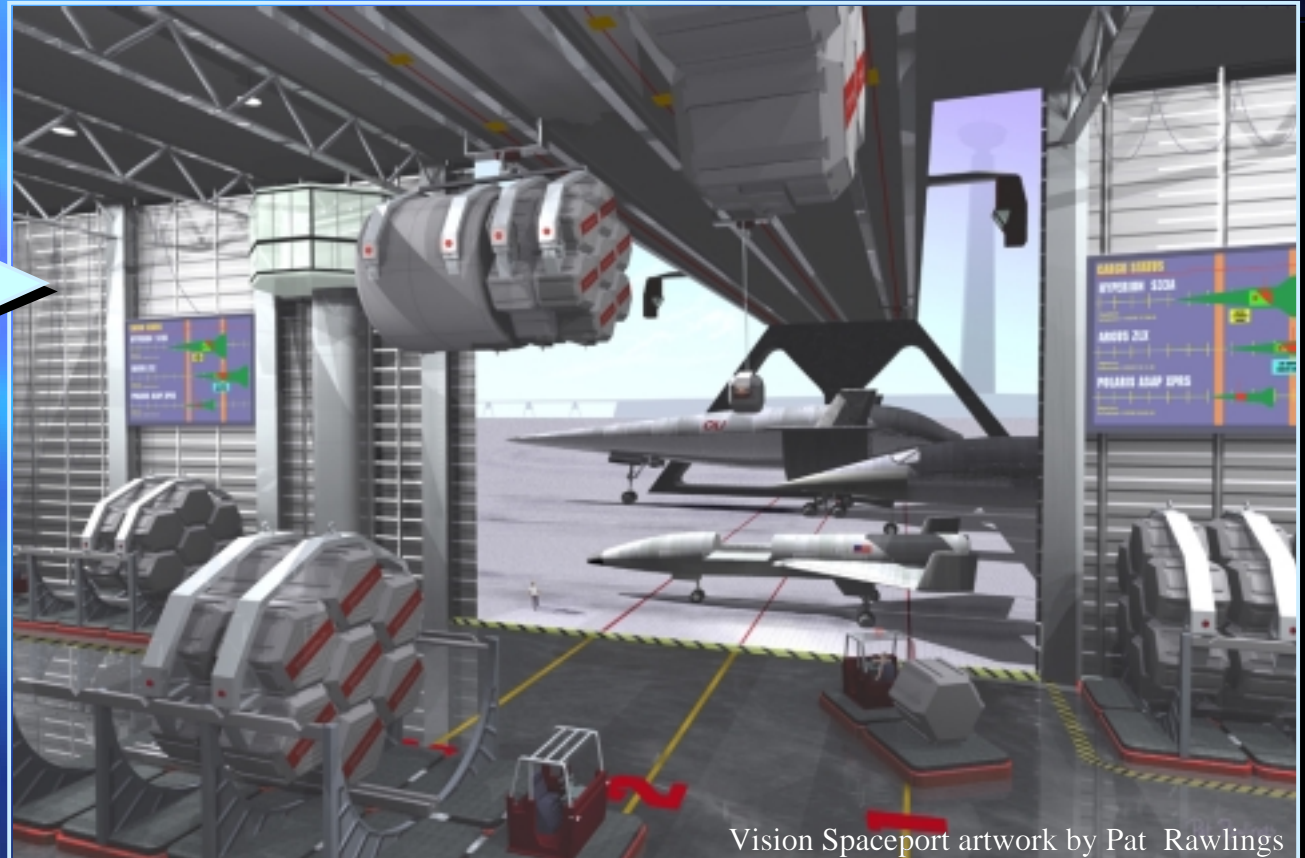
Fuel: Hydrazine | Fuel Quantity: 700 Lbs

Oxidizer: N2O4/RFNA | Oxidizer Quantity: 1000 Lbs

From Payload Integration to Space Cargo Shipping & Receiving



Payload Integration



Vision Spaceport artwork by Pat Rawlings

Highly automated, responsive and affordable shipping & receiving

A New Vision for Space Traffic & Flight Control



Today's 'Firing' Room



Vision Spaceport artwork by Pat Rawlings

Tomorrow's Space Traffic & Flight Control Center

Ultimately... Space for Anyone



Drama of Today's Spaceflight



Vision Spaceport artwork by Pat Rawlings

Investing in Opportunities for a Spacefaring People



Spaceports in Upcoming Millennium

New Spaceport Architectural Concepts Needed...

- Able to integrate functions of launch, landing, traffic/flight control, cargo/passenger services, propellant logistics (supply, distribution, loading and conditioning), etc., into a reliable, affordable and responsive space transportation capability

...To respond to new market development requirements:

- **Shipping Costs:** Reduced an two orders of magnitude
- **Safety:** Increased from by several orders of magnitude
- **Responsiveness:** Need weekly/daily launch capability



Spaceport Concepts & Technologies

Example Spaceport Concepts Needing New Technologies

- Multimodal Shipping & Receiving complexes
- Cogeneration (Polygeneration) of launch propellants with other needed utility services (e.g., electricity and water)
- Advanced Space Traffic & Flight Control

Kennedy Space Center--A Spaceport Technology Center

Spaceport Synergy Team-Govt/Ind./Academia Research

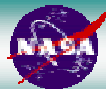
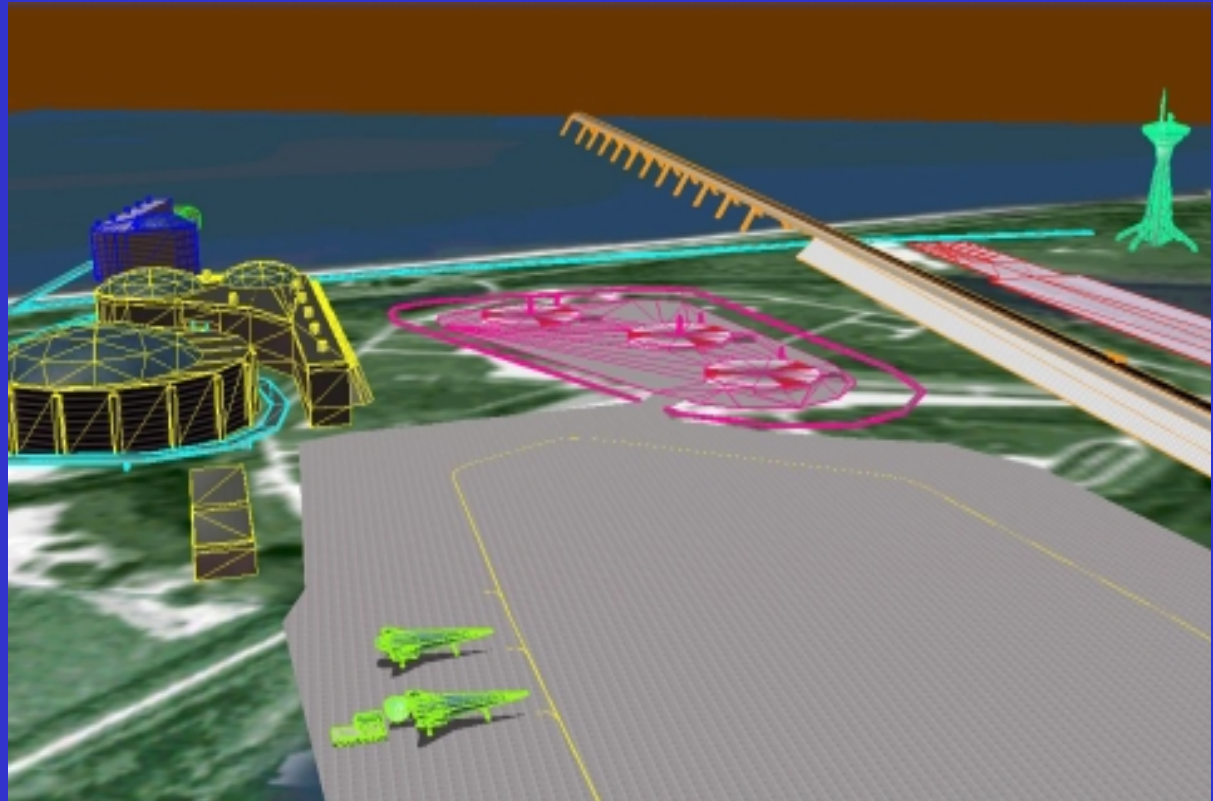
Spaceport Architectures

Key to Achieving a National Vision

Our Mission:

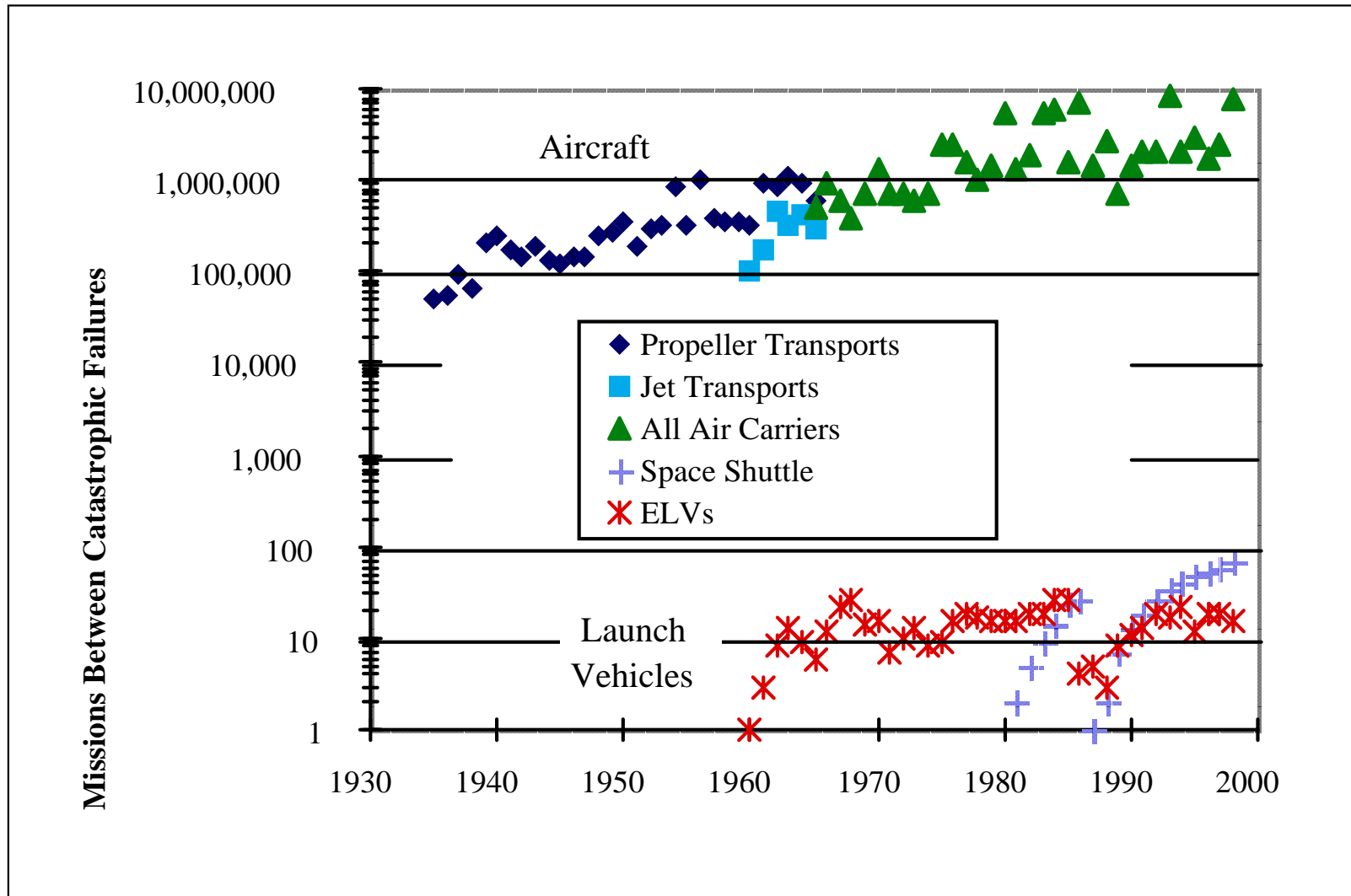
Stimulating the creation of affordable space transportation

Accomplishing the mission through collaborative research and use of concept & technology assessment tools





Aircraft Based on FAA Airworthiness Design Criteria Are Much More Reliable Than Launch Vehicles



Existing Testbeds

A Few Examples



777 Systems Integration Lab



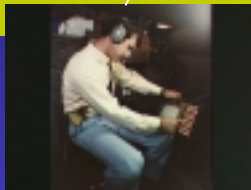
Wind Tunnels (ARC)



Dryden Flight Research Center



White Sands Missile Range



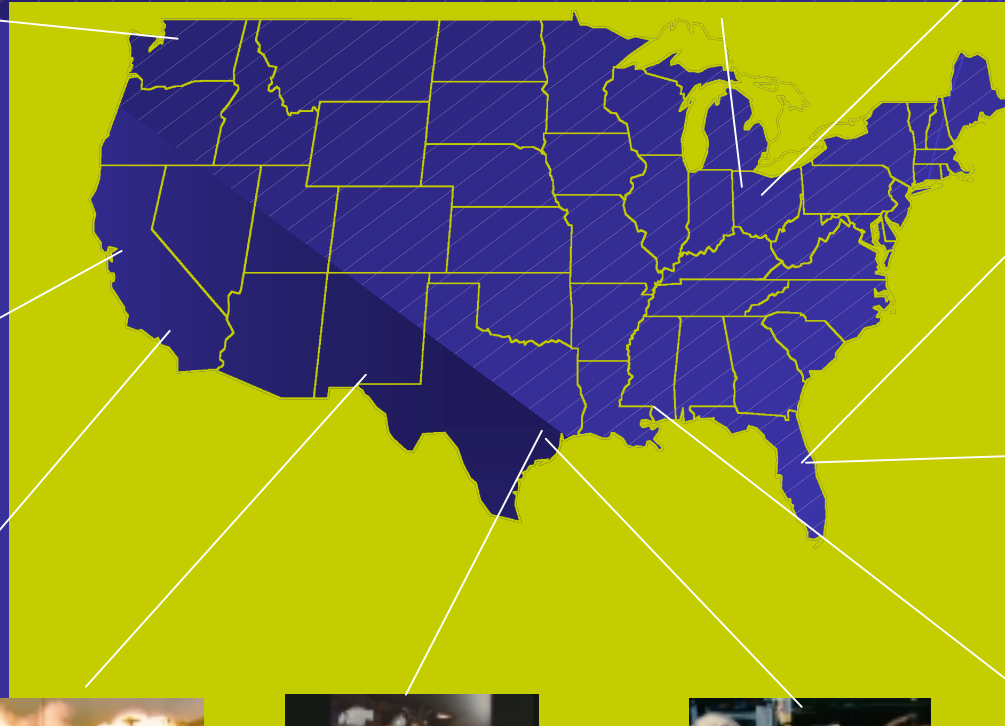
STS Avionics Engineering Lab (JSC)



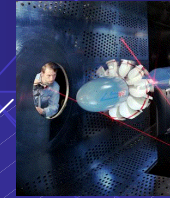
Shuttle Avionics Integration Lab (JSC)



Component Test Facility/Test Stands (SSC)



Wright-Pat Flight Control Lab



Wind Tunnels (GRC)



Cryogenics Testbed (KSC)



Eastern Test Range

Testbed Stages

