



Aiming Towards Viable Business Models of Global Hypersonic Point-To-Point Cargo Transportation

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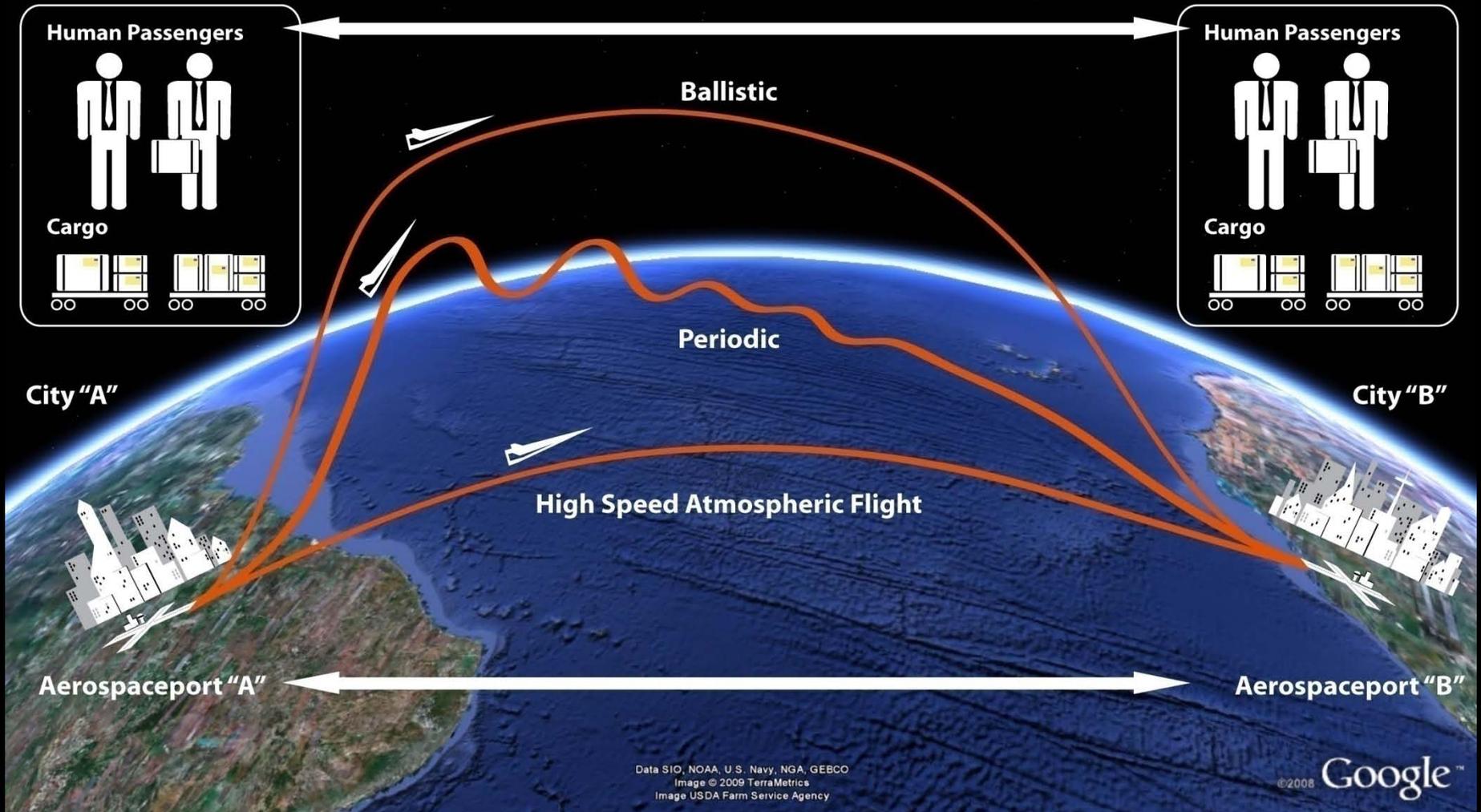
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Acknowledgement:

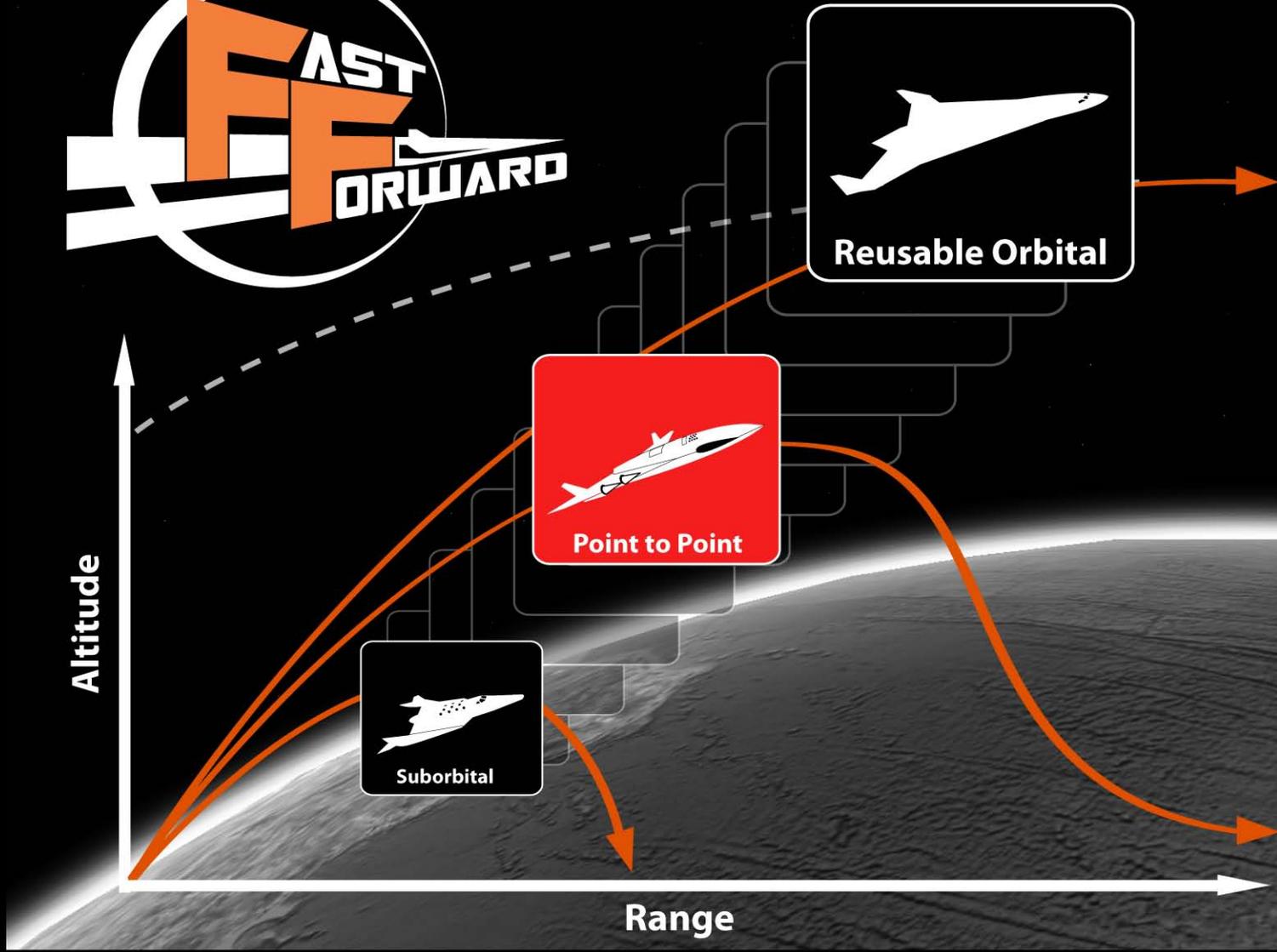
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Global High Speed Point-to-Point (PTP) Cargo/Passenger Travel



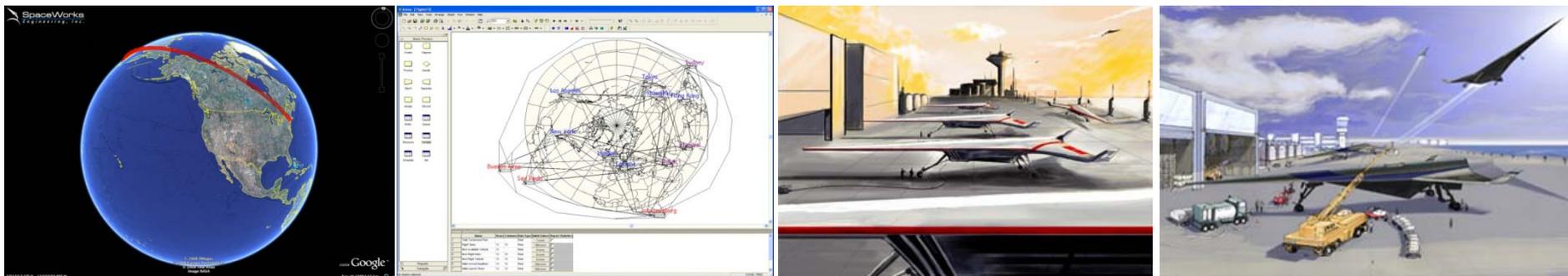
Evolution from Today to Tomorrow Through PTP Transport



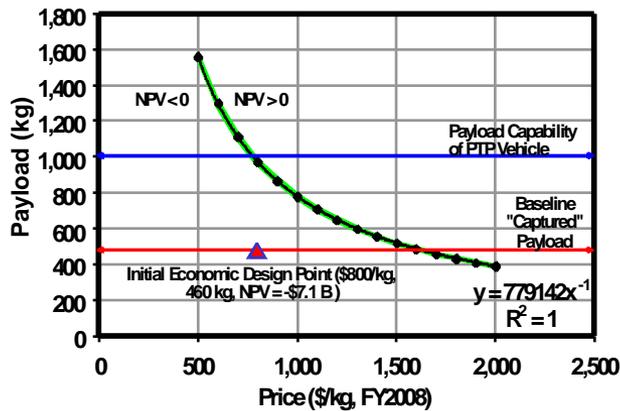
The High Speed PTP Trade Space



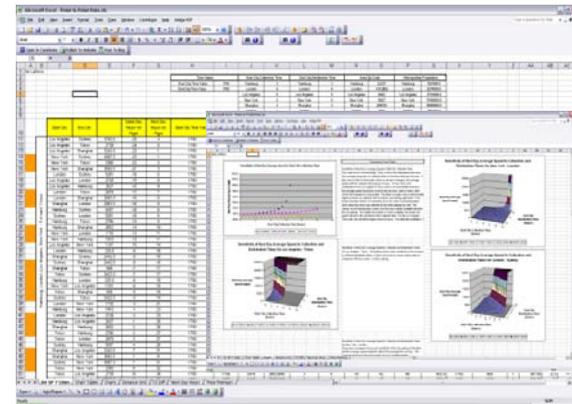
- **FastForward is an ad-hoc study group** consisting of major aerospace contractors, emerging new space companies, spaceports, key federal government agencies, and academic representatives
 - All-volunteer effort formed in October 2008
 - 20 organizations represented (by invitation)
 - Hosted by SpaceWorks Commercial (Atlanta, GA USA)
- Our focus is on pre-competitive analysis and assessment of **future global high speed point-to-point passenger and cargo services**
- Our group produces technical papers and white papers on topics of PTP transportation for use by our members and the community at-large
- Members meet regularly by telecon, supports a range of conference and panels, and use virtual collaboration tools to conduct business and exchange ideas



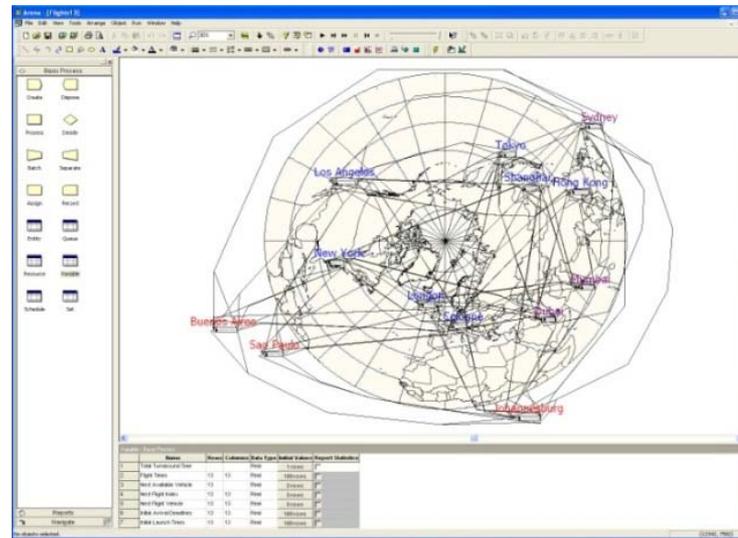
What is the FastForward Study Group?



Financial Analysis for Notional PTP Service



GHoST Calculator of City Pair Vehicle Delivery Capabilities



Discrete Event Simulation Model of City Pair Delivery Time and Fleet Routing

SpaceWorks Commercial: Current PTP Modeling/Simulation Analysis Areas

Case Study:
Supersonic versus Hypersonic
Point-To-Point Global Cargo Delivery
Operator Logistical and Financial Analysis

| | | |
|------------------|---|--|
| |  |  |
| Flight Velocity | 4,700 km/h | 2,205 km/h |
| Range | 12,000 km | 8,890 km |
| Payload | 1,000 kg | 1,143 kg |
| Development Cost | \$4.46 B | \$2.5 B |
| Acquisition Cost | \$323 M | \$80 M |
| | Hypersonic Concept Vehicle (HCV) SEI Mach 18-20 Concept Design | Supersonic Concept Vehicle (SCV) Gulfstream Quiet Supersonic Jet ("Whisperer") |

Supersonic (SCV)

| | Tier 1 Routes | Tier 2 Routes | Tier 3 Routes | |
|-------------------------------------|---------------|---------------|---------------|---|
| Feasible Route Counts (origin city) | Los Angeles | 2 | 2 | 2 |
| | New York | 2 | 2 | 4 |
| | London | 2 | 4 | 4 |
| | Cologne | 2 | 4 | 5 |
| | Shanghai | 1 | 4 | 4 |
| | Hong Kong | 0 | 3 | 3 |
| | Tokyo | 1 | 4 | 4 |
| | Mumbai | 0 | 5 | 6 |
| | Dubai | 0 | 5 | 6 |
| | Sydney | 0 | 3 | 3 |
| | Buenos Aires | 0 | 0 | 2 |
| | Sao Paulo | 0 | 0 | 2 |
| | Johannesburg | 0 | 0 | 5 |
| Total | 10 | 36 | 50 | |

Hypersonic (HCV)

| | Tier 1 Routes | Tier 2 Routes | Tier 3 Routes | |
|-------------------------------------|---------------|---------------|---------------|----|
| Feasible Route Counts (origin city) | Los Angeles | 5 | 5 | 7 |
| | New York | 4 | 5 | 7 |
| | London | 5 | 7 | 10 |
| | Cologne | 5 | 7 | 10 |
| | Shanghai | 4 | 7 | 8 |
| | Hong Kong | 3 | 6 | 7 |
| | Tokyo | 4 | 7 | 7 |
| | Mumbai | 0 | 6 | 7 |
| | Dubai | 0 | 6 | 7 |
| | Sydney | 0 | 4 | 6 |
| | Buenos Aires | 0 | 0 | 6 |
| | Sao Paulo | 0 | 0 | 5 |
| | Johannesburg | 0 | 0 | 9 |
| Total | 30 | 60 | 96 | |

Sample Candidate Vehicles and Feasible Route Comparison

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Hypersonic (HCV) Financial Case:

NPV=0 @1000 kg/flight

rounded FY2008 US\$, assuming a 2.1% inflation rate, any errors due to rounding

Supersonic (SCV) Financial Case:

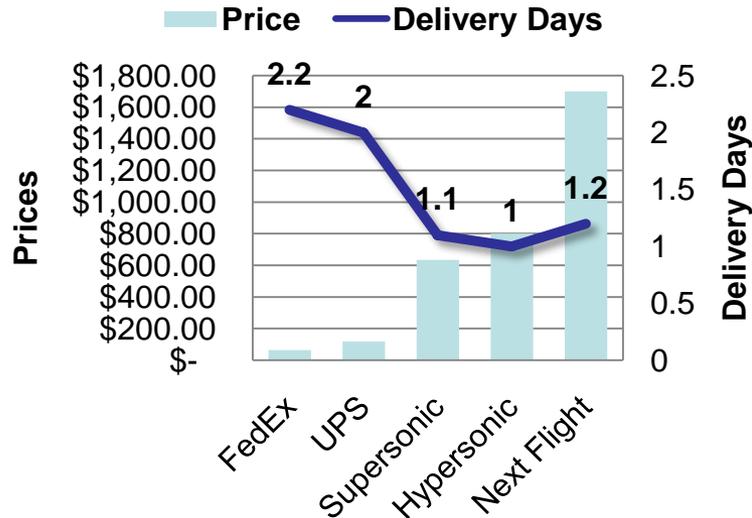
NPV=0 @954 kg/flight

rounded FY2008 US\$, assuming a 2.1% inflation rate, any errors due to rounding

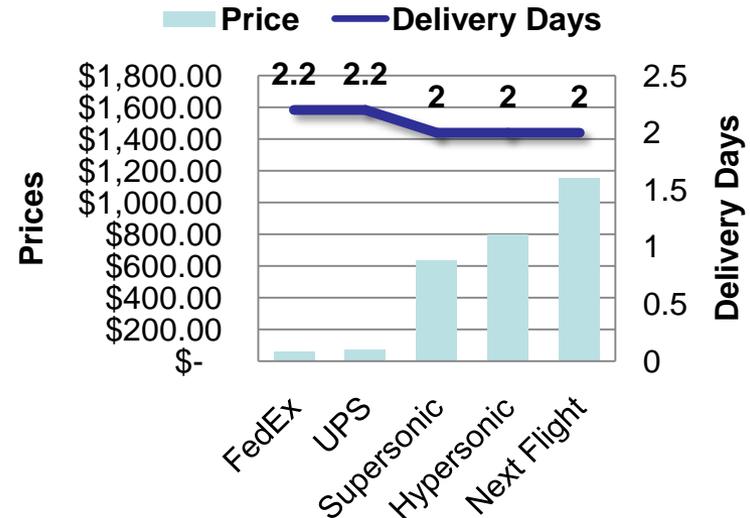
| Item | Value |
|----------------|------------|
| WACC | 15.82% |
| Payload/Flight | 1,000.0 kg |
| Price | \$779.1/kg |

| Item | Value |
|----------------|------------|
| WACC | 13.04% |
| Payload/Flight | 954.0 kg |
| Price | \$516.8/kg |

New York - Cologne



Los Angeles - Tokyo



Supersonic operator is more competitive on routes it supports

Price Comparison for Global City-Pairs