
FAST
FORWARD

SpaceWorks Commercial: Comparison of Supersonic & Hypersonic

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Notional Hypersonic Vehicle (NHV)
- Flight Velocity: 4,700 km/h
- Range: 12,000 km
- Payload: 1,000 kg
- Development Cost: $4.46 B
- Acquisition Cost: $323 M

Aerion Supersonic Business Jet (SBJ)
- Flight Velocity: 1,909 km/h
- Range: 7,800 km
- Payload: 1,143 kg (12 pax equivalent)
- Development Cost: $1.4 B
- Acquisition Cost: $80 M

SAI Quiet Supersonic Transport (QSST)
- Flight Velocity: 2,205 km/h
- Range: 7,408 km
- Payload: 1,143 kg (12 pax equivalent)
- Development Cost: $2.5 B
- Acquisition Cost: $80 M

Gulfstream Quiet Supersonic Jet (QSJ "Whisperer")
- Flight Velocity: 2,205 km/h
- Range: 8,890 km
- Payload: 1,143 kg (12 pax equivalent)
- Development Cost: $2.5 B (Estimated)
- Acquisition Cost: $80 M

We began by using the GHoST Calculator tool to find viable city-pairs

- Already apparent: supersonic serves fewer routes

Feasible Route Counts (origin city)	Tier 1 Routes	Tier 2 Routes	Tier 3 Routes
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

Gulfstream Quiet Supersonic Jet

- Flight Velocity: 2,205 km/h
- Range: 8,890 km

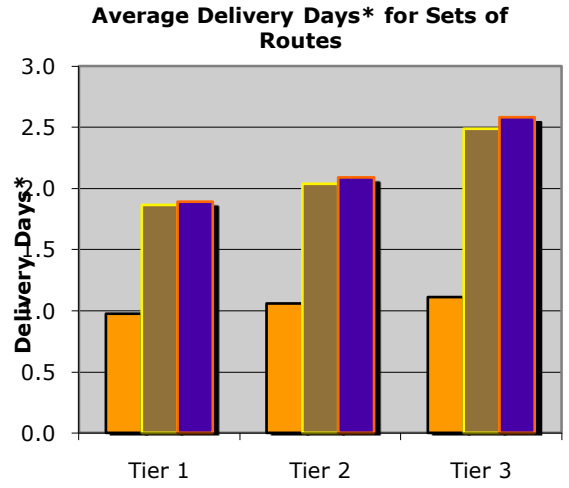
Feasible Route Counts (origin city)	Tier 1 Routes	Tier 2 Routes	Tier 3 Routes
Los Angeles	5	5	7
New York	4	5	7
London	5	7	10
Cologne	5	7	10
Shanghai	4	7	8
Hong Kong	3	6	7
Tokyo	4	7	7
Mumbai	0	6	7
Dubai	0	6	7
Sydney	0	4	6
Buenos Aires	0	0	6
Sao Paulo	0	0	5
Johannesburg	0	0	9
Total	30	60	96

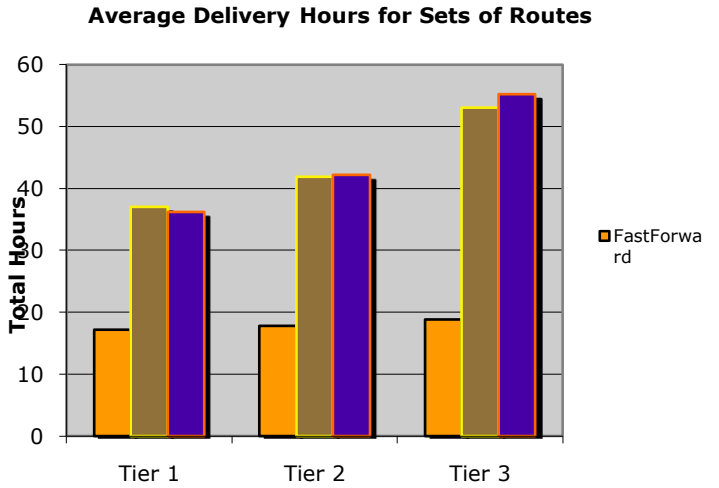
Notional Hypersonic Vehicle

- Flight Velocity: 4,700 km/h
- Range: 12,000 km

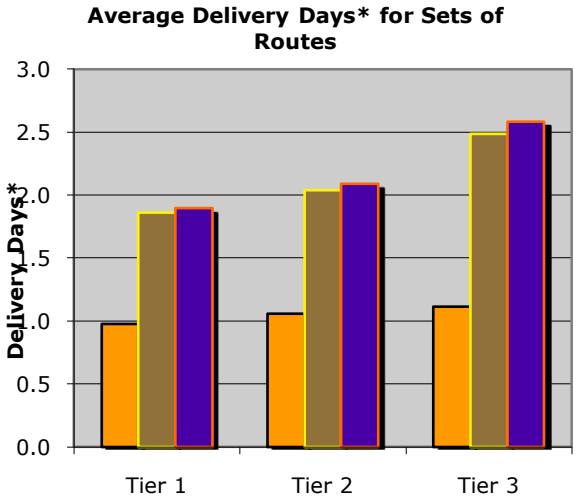
Viable City-Pair Comparison

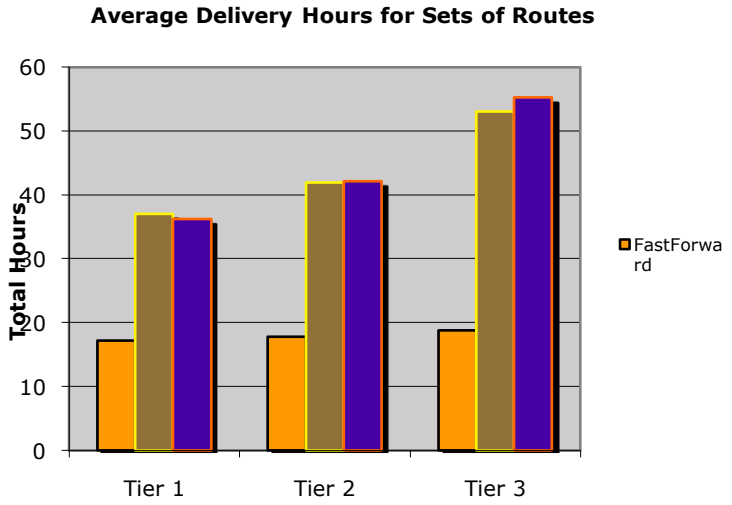
Gulfstream Quiet Supersonic Jet





Notional Hypersonic Vehicle





Marginal Difference: Quality of Service

First: resize the market capture:

- **Maintained original market sizing function, but changed two parameters**
1. ***Percentage of overall market served by our city-pairs = 28% (vs 40%)***
2. ***Total number of flights per day = 14 (vs 30) ****
- **New market sizing becomes 686 kg/flight**

Second: revisit the CABAM (Cost and Business Analysis Module) tool from our previous NHV study, to perform our cost flow analysis of the life of the project

- **Used similar parameters to the NHV case, with the following exceptions:**
  - **Number of Ground Crew per Jet is 50****
  - **Number of Facilities is 6 (for Tier 1 study)**
  - **Propellant is at 50,000 lbs of Jet Fuel using prices for the week of 06/01/2009**
  - **Vehicle Reliability is assumed similar to that of the Concorde**
  - **Approximately 3,640 flights per year**
  - **Payload capacity set to new market sizing (686 kg)**

* For Tier 1 network sizing. Inclusion of all networks will lower market sizing further , favorably affecting the pricing strategy.

** Ground crew determined by comparison to FedEx requirements for their Memphis mega-hub, and similar requirements for UPS

Initial Analysis of SBJ Versus NHV

- **Using the pricing strategy from our original study ($800/kg) we find a significantly higher Net Present Value (NPV)**

Item		Value
WACC		15.82%
Payload (kg)		**686**
Price ($/kg)	**$**	**800.00**
Net Present Value (NPV)	**$**	**1,107.51**
Cost	$	9,036.98
Revenue	$	44,327.60
Total Equity Investment	$	3,572.12

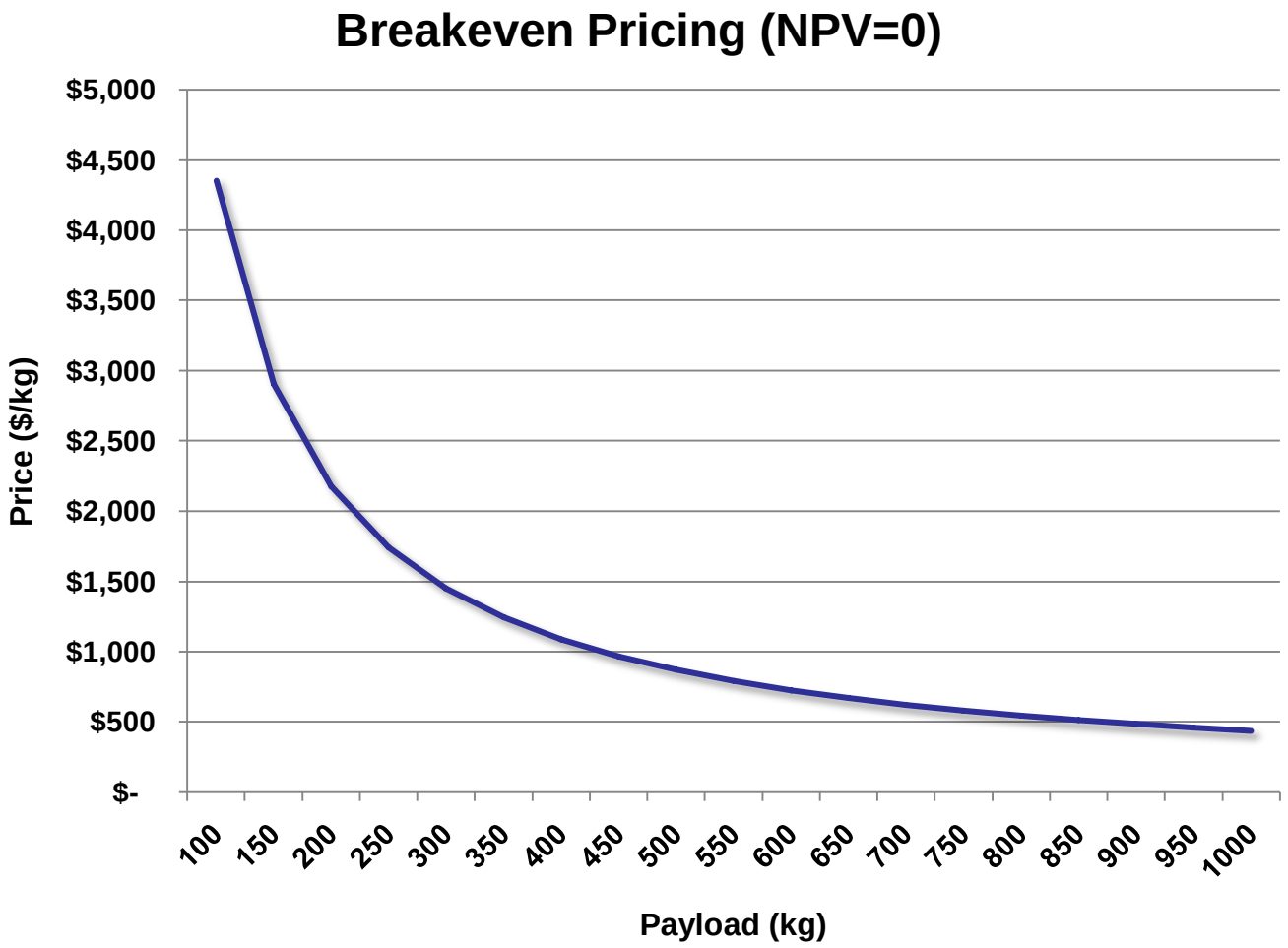
- **Optimizing payload usage at this initial price, our breakeven NPV occurs at a payload of 544 kg**

Item		Value
WACC		15.82%
Payload (kg)		**544**
Price ($/kg)	**$**	**800.00**
Net Present Value (NPV)	**$**	**(0.00)**
Cost	$	9,036.98
Revenue	$	35,167.83
Total Equity Investment	$	3,572.12

- **Since our market sizing is greater than this minimum threshold, we optimized using the market size and found a breakeven price point of ~$635/kg**

Item		Value
WACC		15.82%
Payload (kg)		**686**
Price ($/kg)	**$**	**634.69**
Net Present Value (NPV)	**$**	**(0.00)**
Cost	$	9,036.98
Revenue	$	35,167.83
Total Equity Investment	$	3,572.12

Economic Modeling



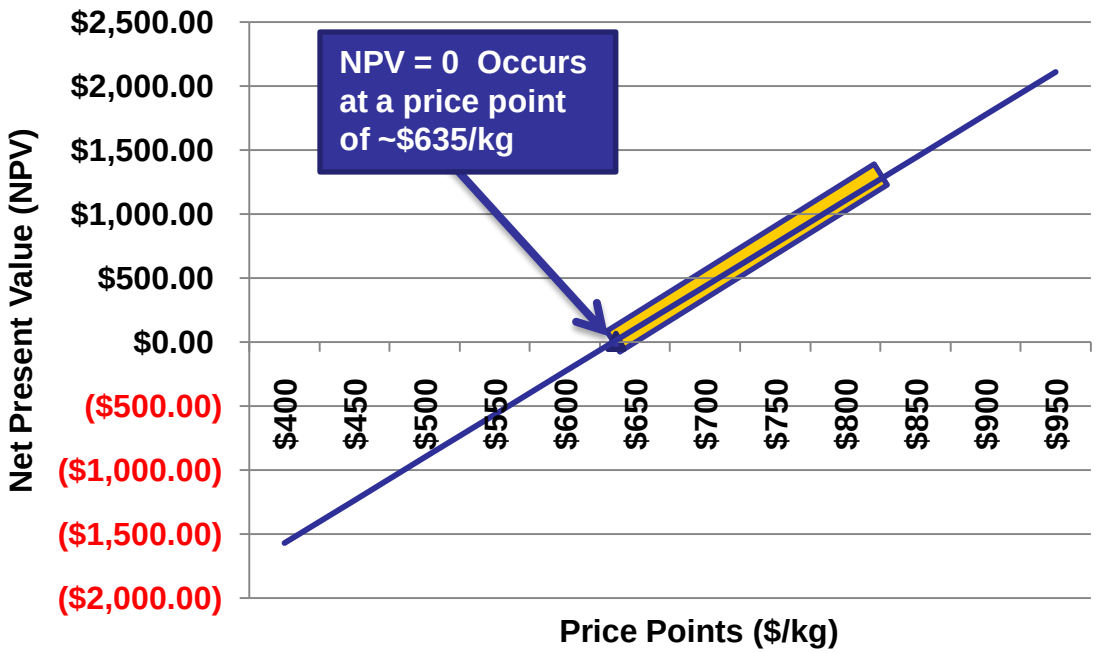
Pricing varying by Payload

Because the market sizing is within our payload capabilities, we decided to pursue the pricing optimization (which is within a company's control)

With a breakeven price of approximately $635/kg, we have a price range that is both:

- **NHV Competitive**
- **Profitable**

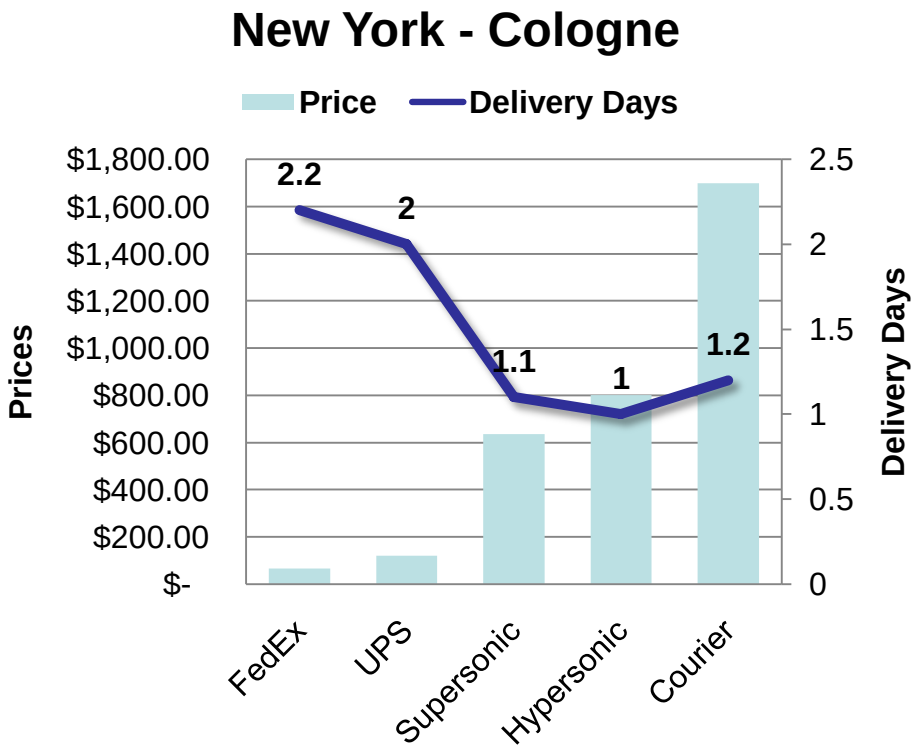
Net Present Value - NPV ($M, FY2009): 686 kg/flight

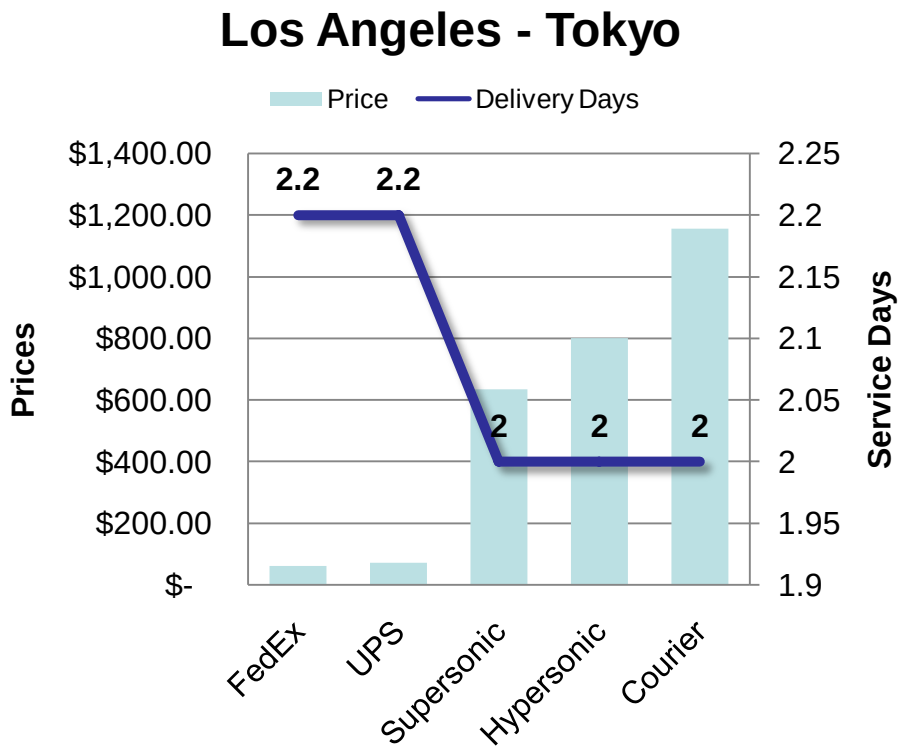


Profit Range

Two points of interest are apparent from the comparisons below:

- Delivery days experience improvement with supersonic transport (with similar outcomes as the NHV)
- The breakeven price point for supersonic is somewhat competitive to the NHV, and significantly better than for courier service





Price Comparison for City-Pairs

- **Based on the CABAM tool**
  - **Supersonic has cheapest costs**
  - **Supersonic has cheapest pricing**

- **Based on the GHoST Calculator tool**
  - **Hypersonic's better range and speed give it more viable city-pairs**

- **For shorter range city-pairs, faster is not necessarily better (ie. Having a package ready for distribution by midnight vs by 6am)**
  - **In the case of city-pairs that can be served by either the NHV or the Supersonic, the latter will most likely win contracts due to its cheaper price-point**
  - **Interestingly, for London-NY the NHV would win out over the Supersonic due to an entire day's improvement in delivery service**

- **Potential future study: explore a tiered service level network (subsonic, supersonic, hypersonic)**

Markets Served

With delivery days

Start City	End City	Hypersonic	Supersonic
Los Angeles	London	1.1	1.2
Los Angeles	Cologne	1.1	
Los Angeles	Shanghai	2	
Los Angeles	Hong Kong	2	
Los Angeles	Tokyo	2	2
New York	London	1	1.1
New York	Cologne	1	1.1
New York	Shanghai	1.2	
New York	Tokyo	1.2	
London	Los Angeles	0.3	0.3
London	New York	0.3	1.1
London	Shanghai	1.1	
London	Hong Kong	1.1	
London	Tokyo	1.1	
Cologne	Los Angeles	0.3	
Cologne	New York	0.3	0.3
Cologne	Shanghai	1	1.1
Cologne	Hong Kong	1	
Cologne	Tokyo	1.1	
Shanghai	Los Angeles	0.1	
Shanghai	New York	0.2	
Shanghai	London	1	
Shanghai	Cologne	0.3	0.3
Hong Kong	Los Angeles	0.1	
Hong Kong	London	0.3	
Hong Kong	Cologne	1	
Tokyo	Los Angeles	0.1	0.1
Tokyo	New York	0.2	
Tokyo	London	1	
Tokyo	Cologne	0.2	

Conclusion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- Tier 1 Cities (7). Chosen as the initial study set based on current express package market sizes.
- Tier 2 Cities (3). Emerging regions that would be best candidates to expand the delivery network.
- Tier 3 Cities (3). Additional regions to result in more global capabilities.

Selected City Pairs