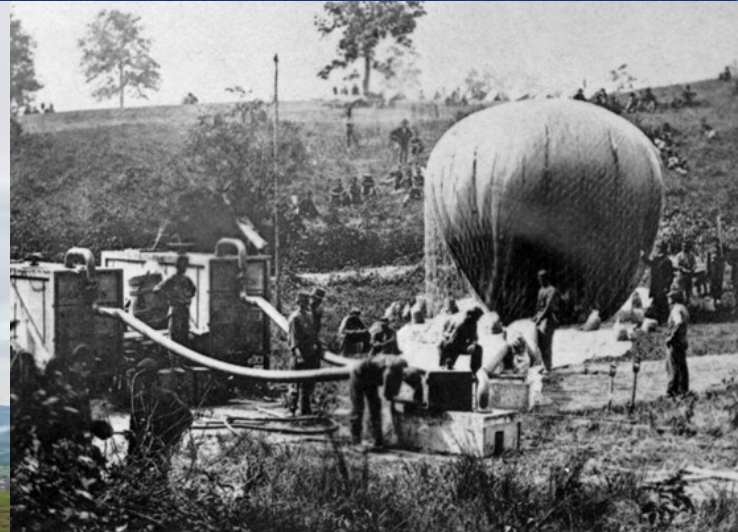


Market Dimensional Expansion, Collapse, Costs, and Viability



OVERVIEW



- What is 2D Demand?
- What is 3D Value?
- What is a 4D Market?
- How do Markets Pair to Form 7D Systems?
- What are ND Systems?
- How did the surveillance market evolve?
- Cost, Value, and Demand must fall within Market Constraints
- Summary

2D Demand is the Quantity-Price Relationship



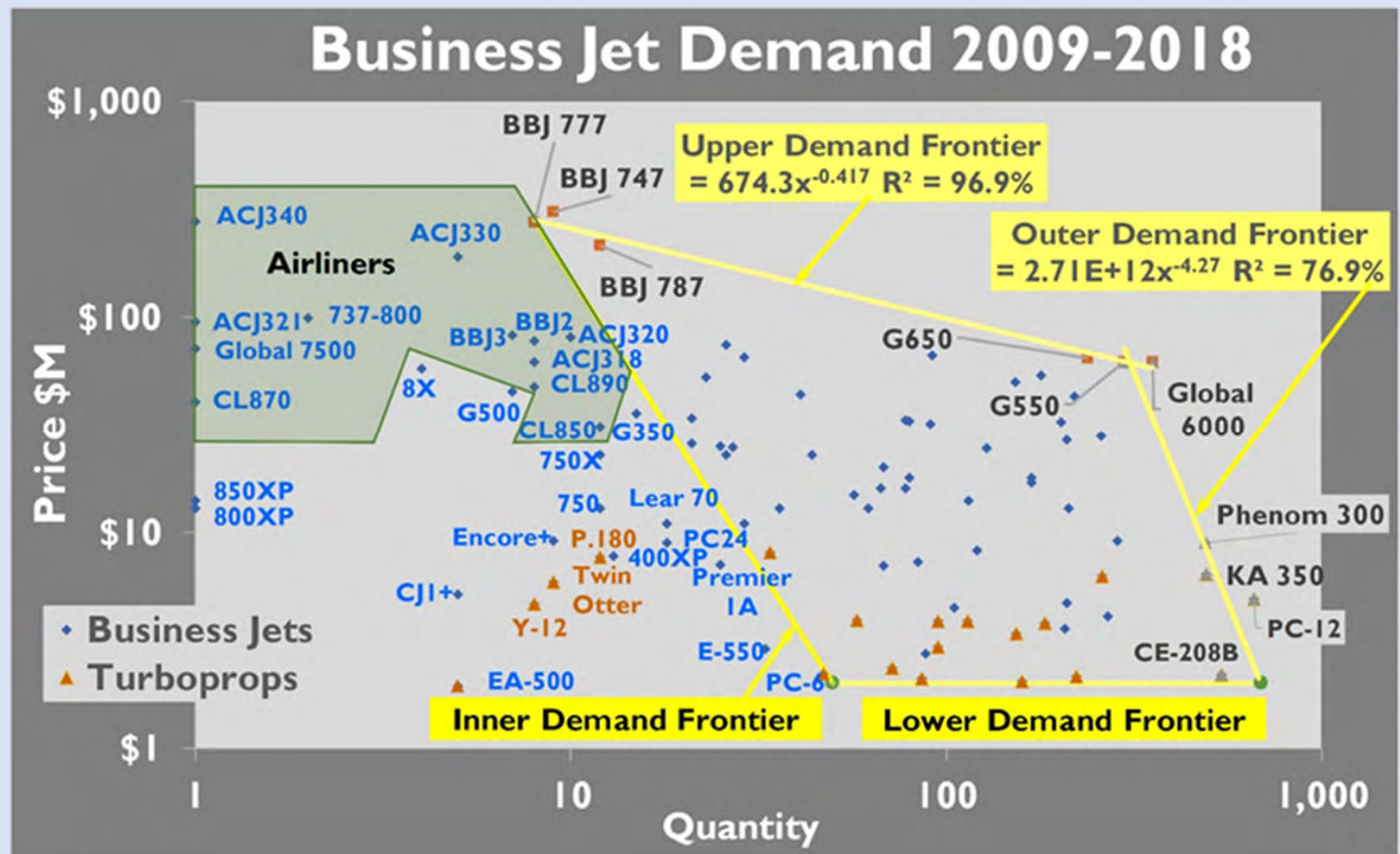
Markets have limits:

Upper Demand Frontier:
Price Limited

Outer Demand Frontier:
Saturation Limited

Lower Demand Frontier:
Margin Limited

Inner Demand Frontier:
Efficiency Limited



Not knowing these limits can sink a program or an entire company

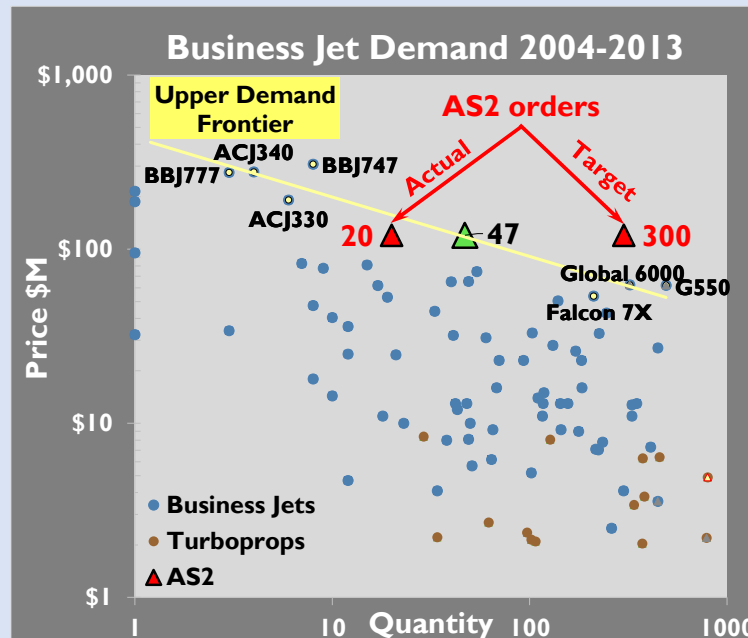
Ignoring These Limits Can Lead To Financial Disaster



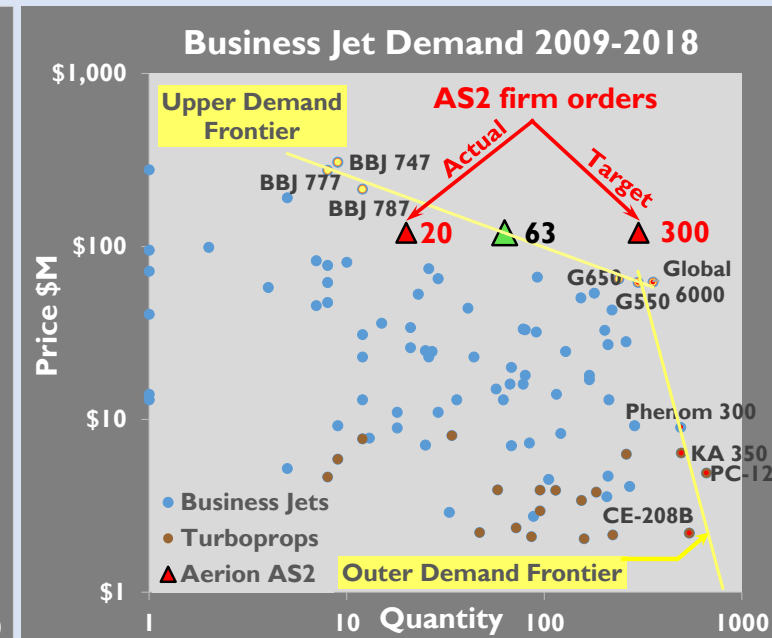
Consider the Aerion AS2



They launched with 20 orders



5 Years later, they still had 20 orders



The company wanted to build 300 supersonic business jets in 10 years at \$120M each

In Dec 2020, I wrote a LinkedIn post stating that they wouldn't get 300 orders since that would put them past the Demand Frontier



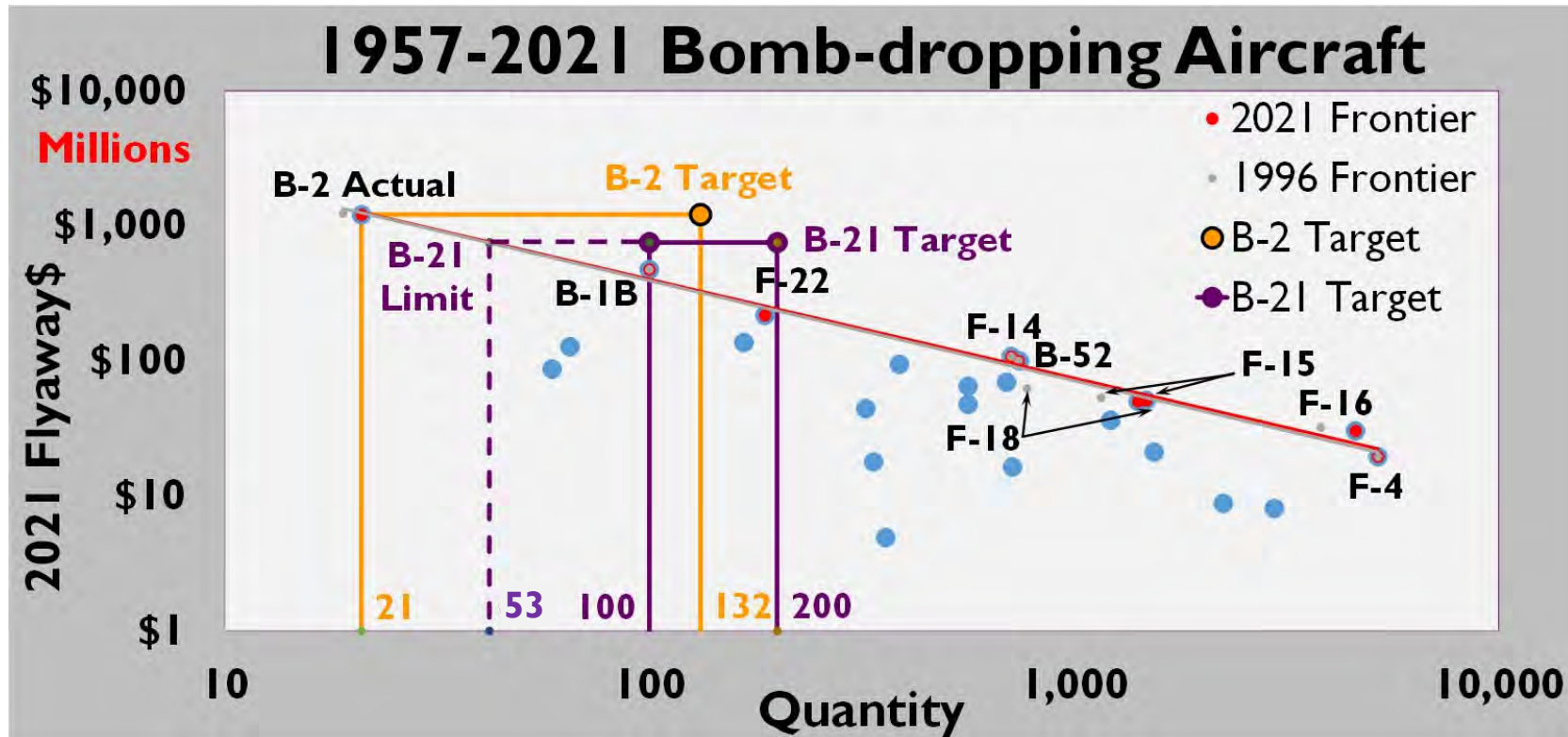
New Bombers Must Abide By Its Demand Frontier



That Frontier has moved only 2% over 25 years

The B-2 ran afoul of it

The B-2I faces the same issue



These limits mean we can only afford a few squadrons at very high prices –
This means we should get more less-expensive solutions forward-based

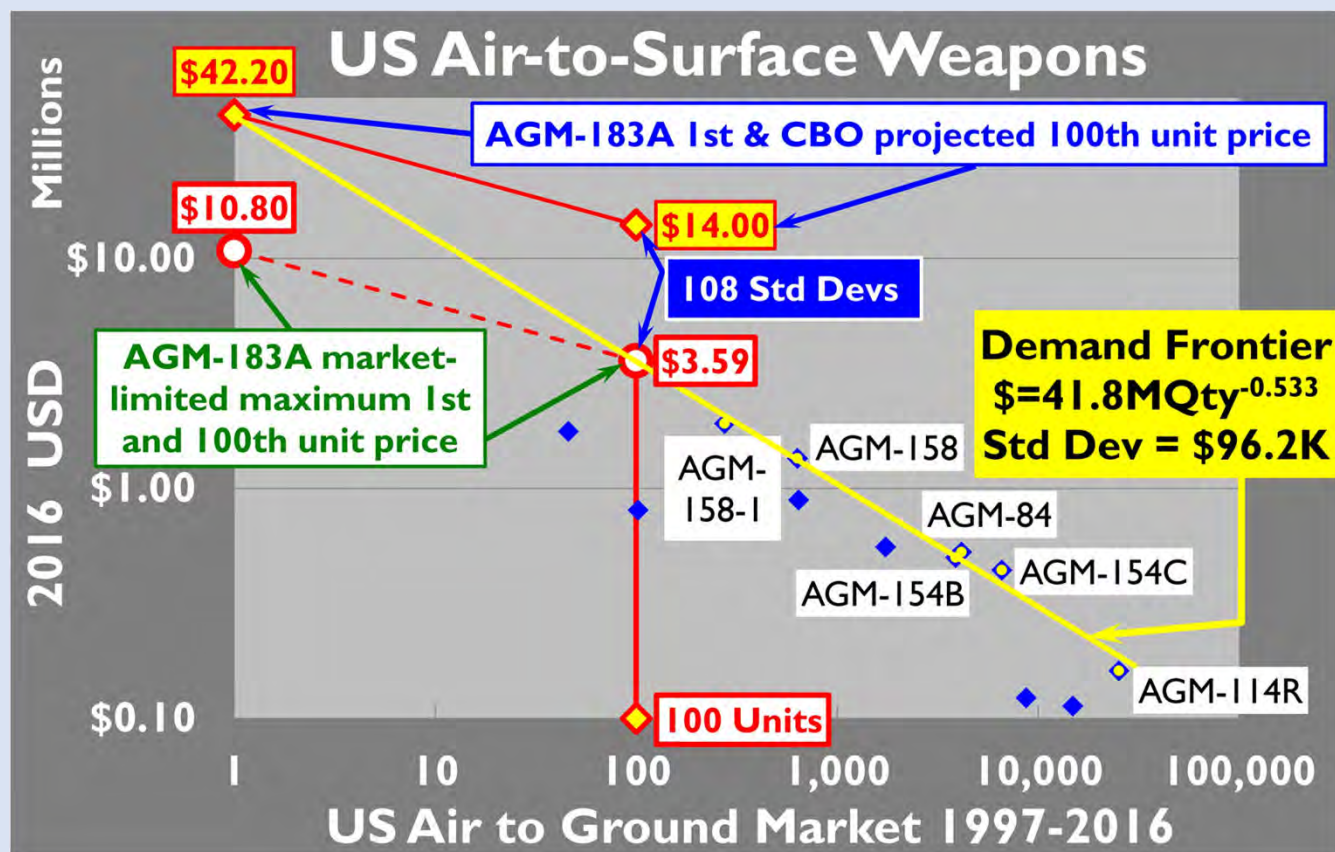
Air To Surface Missiles Have Limits Too



The USAF wants 100 AGM-183s



The United States Congressional Budget Office said they would recommend buying 100 of these missiles, with an average price of \$14M each, but...

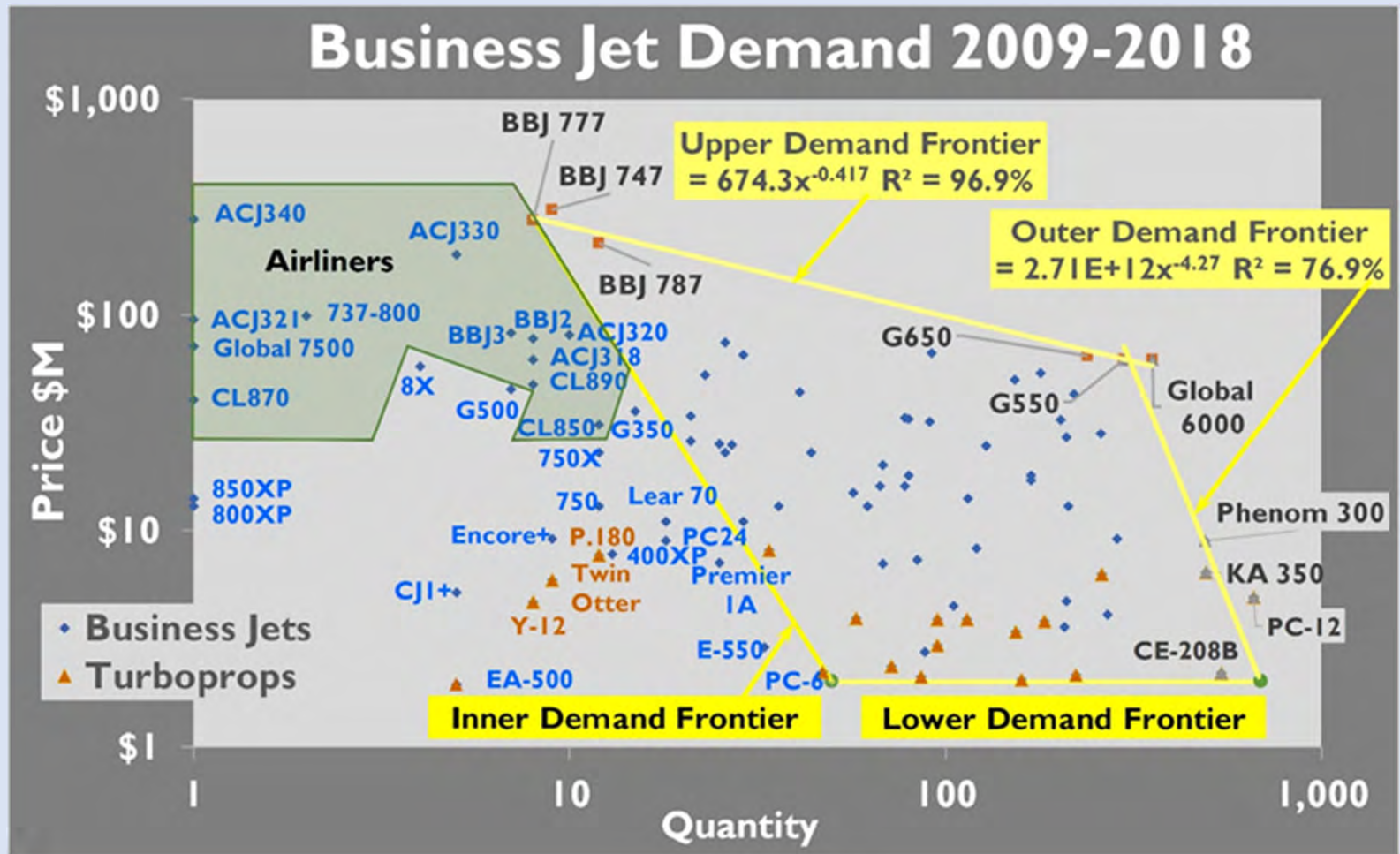


At 108 Standard Deviations past the Demand Frontier, there is no virtually no chance that the USG can afford 100 AGM-183S

If 2D Demand is the Quantity-Price Relationship



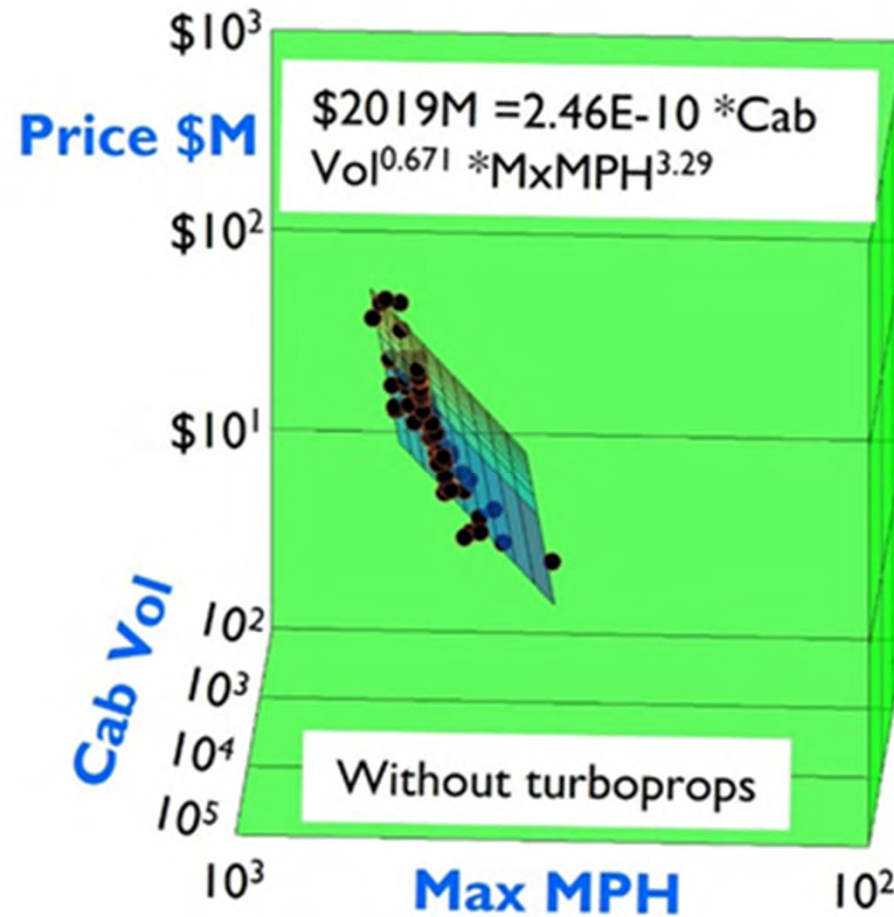
What holds the Prices up?



3D Value Reveals What Customers Willingly Pay For



Business Jet buyers
who can afford it
willingly pay for bigger
cabins and faster planes

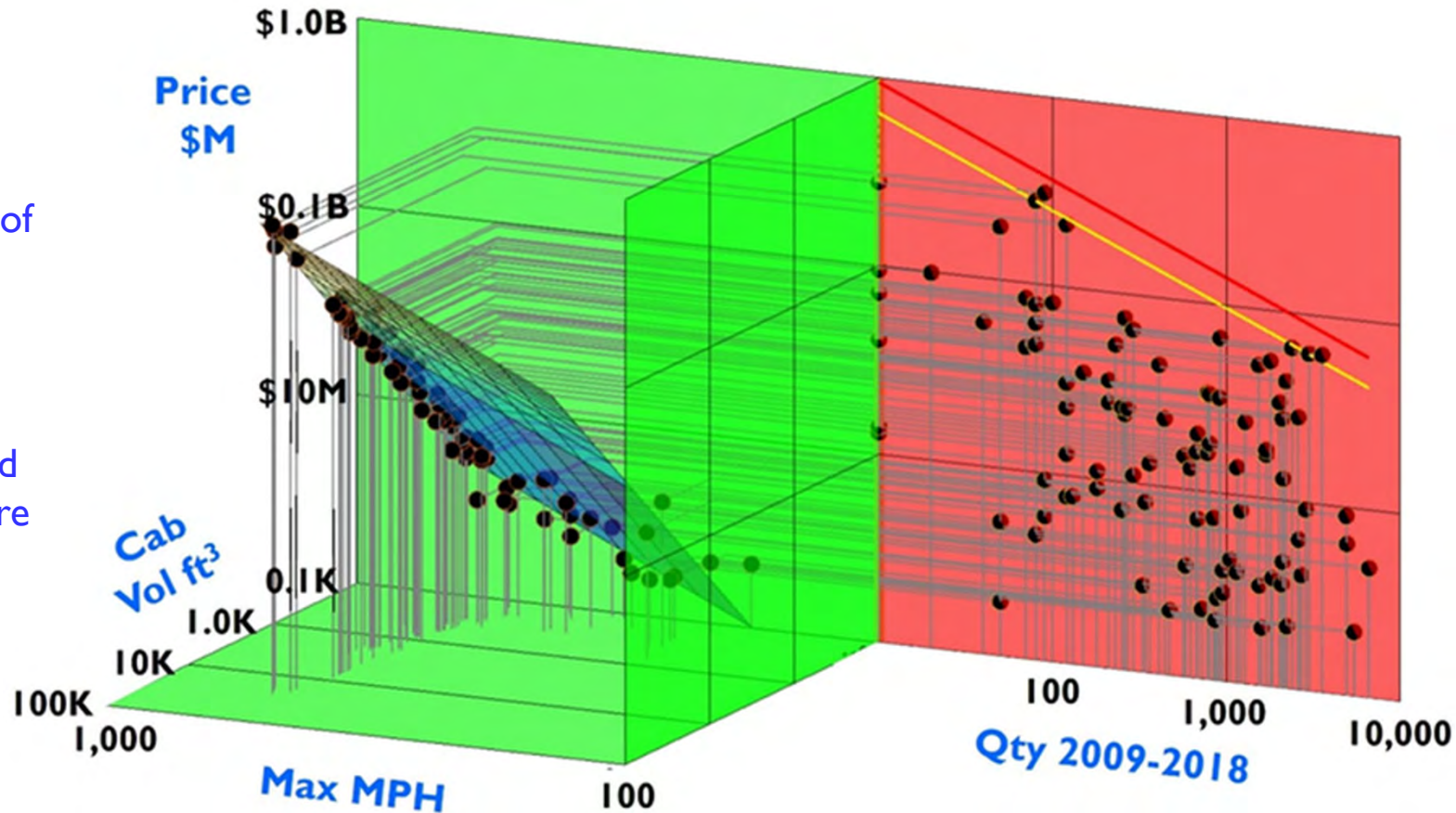


4D Markets Merge 2D Demand and 3D Value Space



Every market forms these relationships as ordered quads governed by the Law of Value and Demand:

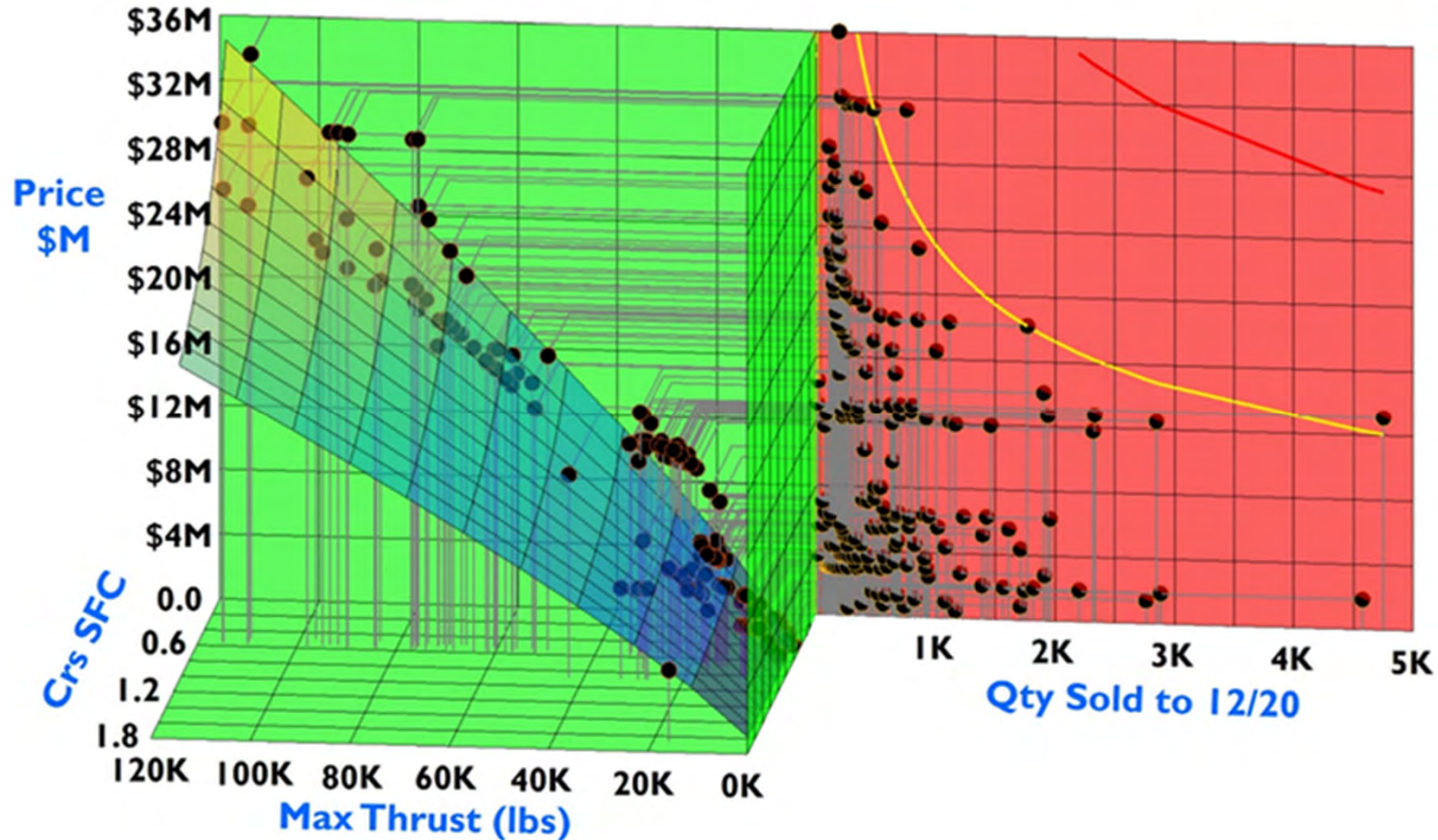
- 1) Features drive Value
- 2) Value sets Price
- 3) Price limits quantity sold
- 4) Quantity sold is a feature



Consider the 4D Market for Turbofan Engines



It behaves much the same way as the market for business jets, with ordered quads explaining market positions



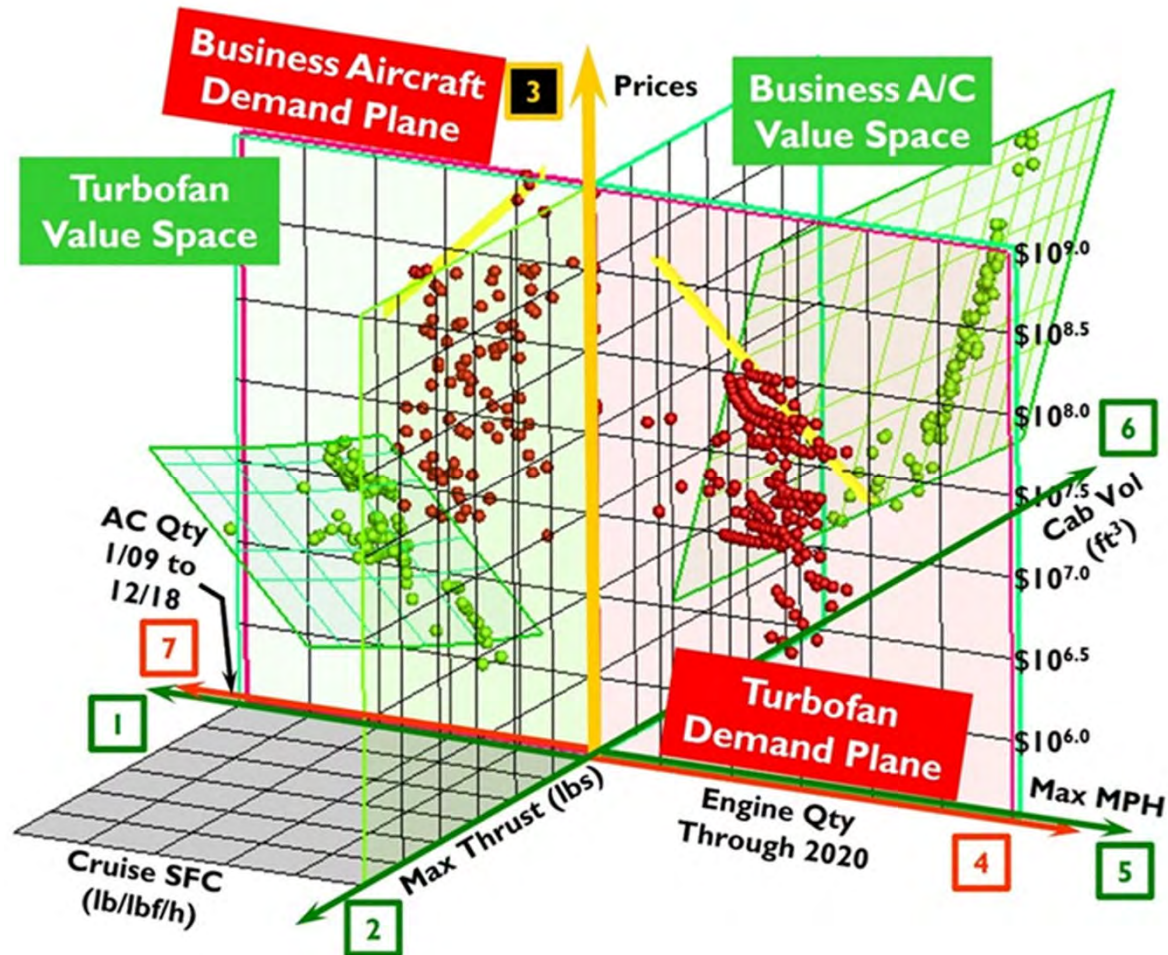
Note that Turbofans and Business Jets Share the Price Axis, meaning ¹⁰

7D Systems Form Between Related 4D Markets



Since both markets share the Price axis,

$$4D+4D=7D$$

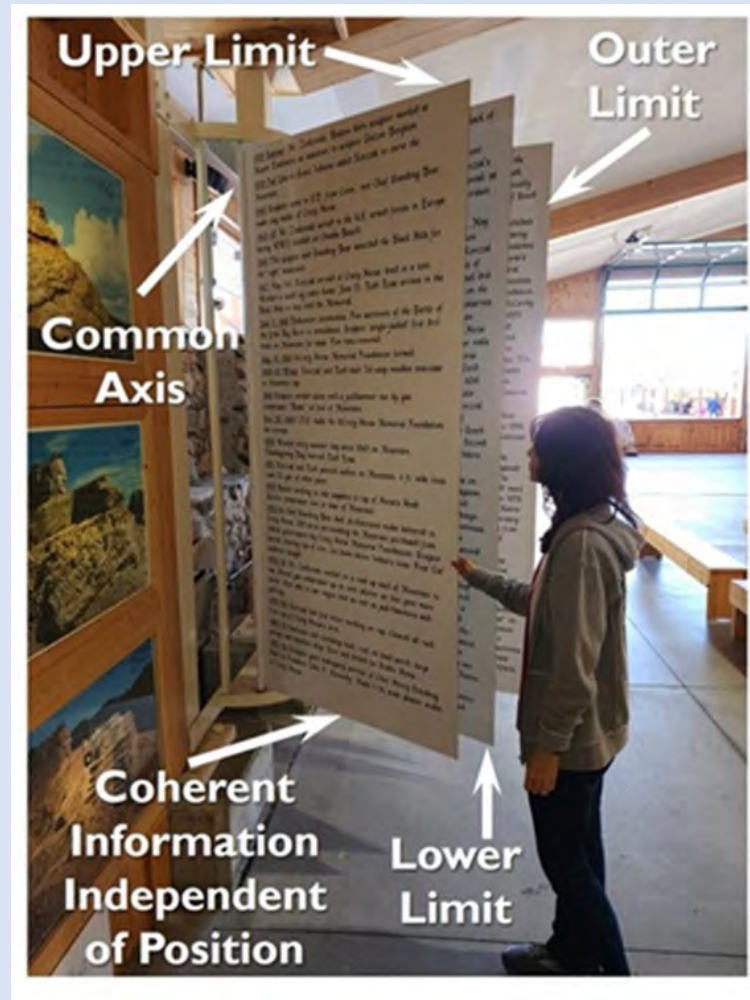


What If We Wanted More Dimensions In One View?



Have you ever noticed how poster racks and Rolodexes keep their information intact?

This gives us some ideas for displaying markets

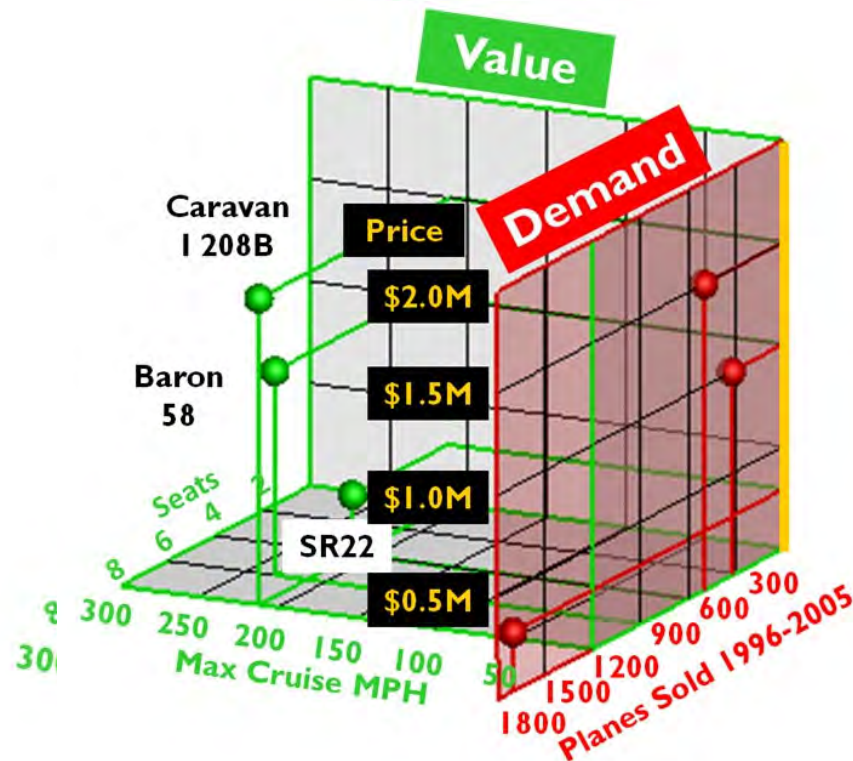


Consider These 3 General Aviation Planes



Model	Seats	Max MPH	\$M (2005)	Quantity
SR22	4	212	\$0.29	1705
Baron 58	6	232	\$1.00	330
Caravan I	8	213	\$1.50	504

Their 4D plot is



ce
 .0M
 M
 .5M
 M
 .0M
 M
 .5M
 M

The Demand Plane is like a poster; we can rotate it

Once rotated, what once took 180° of arc now needs 90°

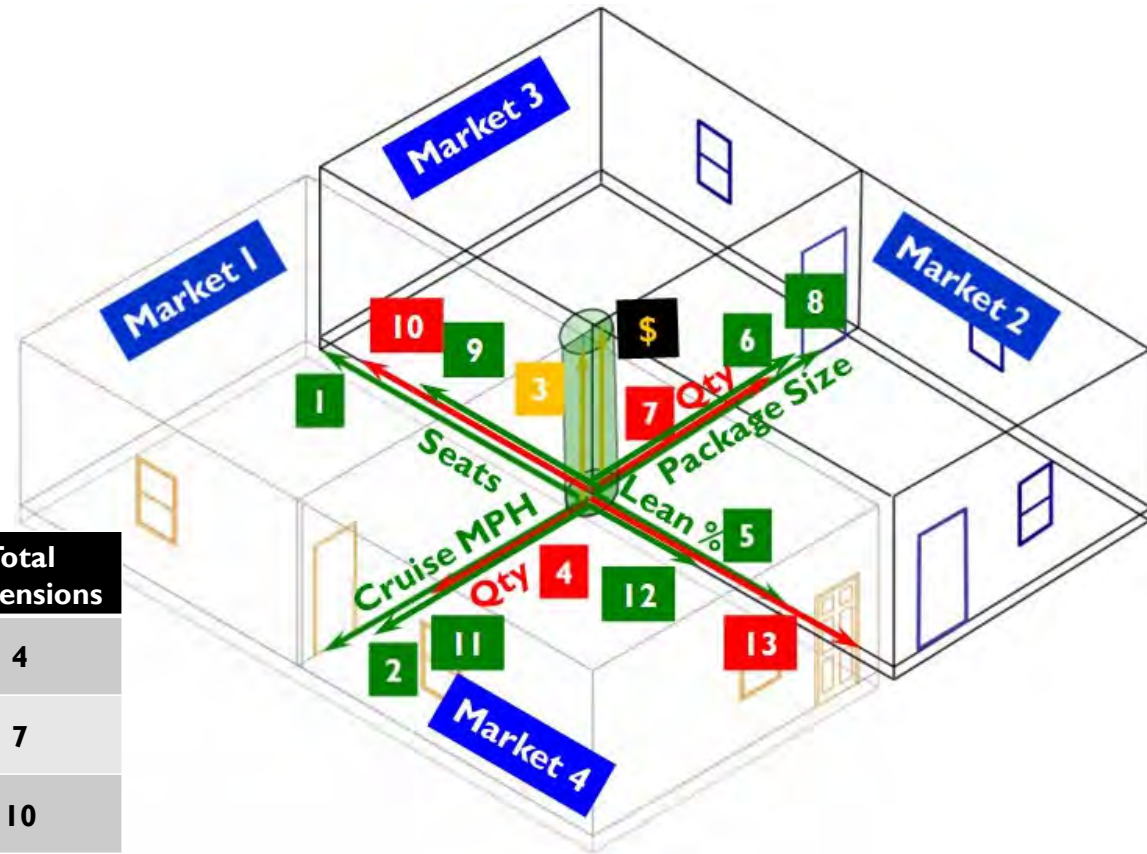
With Each Market Taking 90°, We can Plot 4 at Once



Here, Market 1 is the one for General Aviation Aircraft, while Market 2 is for Ground Beef

We could also plot Markets 3 and 4 (which could be anything)

A pattern develops...



Note the center cylinder—how can use that?

Markets	Value Dimensions	Quantity Dimensions	Currency Dimension	Total Dimensions
1	2	1	1	4
2	4	2	1	7
3	6	3	1	10
4	8	4	1	13
n	2n	n	1	3n + 1

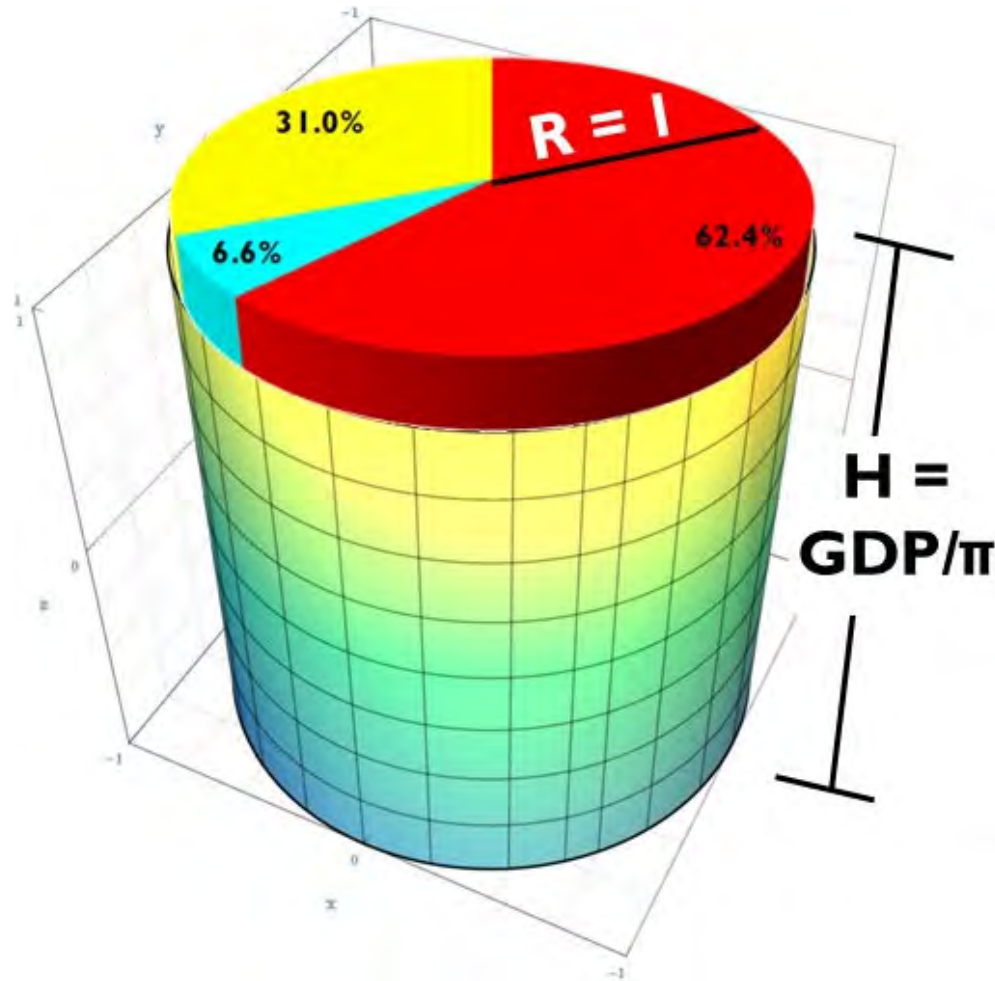
The CIA on GDP



In 2014, the CIA characterized about \$78.3T of GDP in this way:

Blue = Agriculture
Yellow = Industry
Red = Services

We could show every subset of the economy at the same time – but for that, we'll need *dimensional collapse*



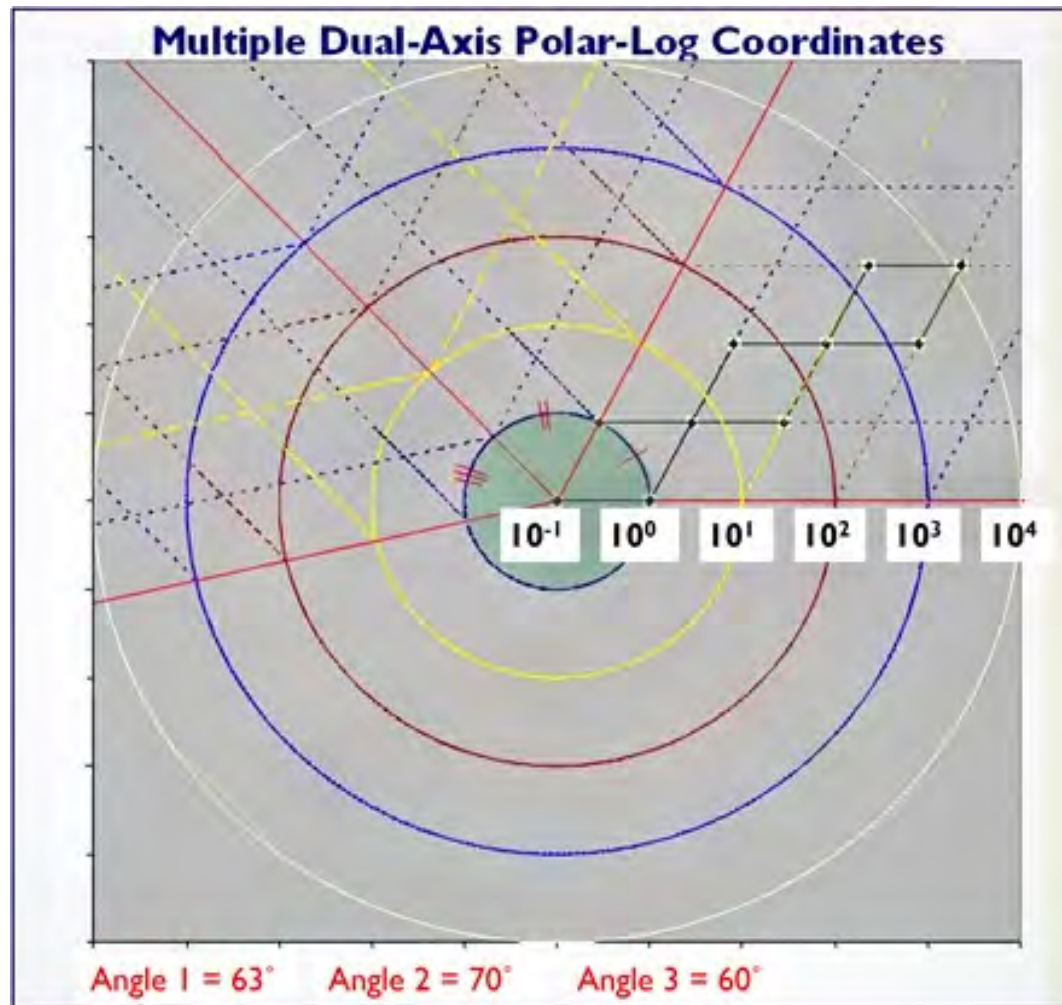
Compressing All Markets Simply Extends The Process



We start with one market off an anchor line, with its **proportion of the center circle representing its contribution to GDP**

If a market's contribution to GDP is larger, indicative of **dimensional expansion**, we represent it appropriately

We can add another market according to its part in the World GDP



And another...

Obviously, there is no upper limit to the number of markets we could depict

Each market's portion of GDP varies over time

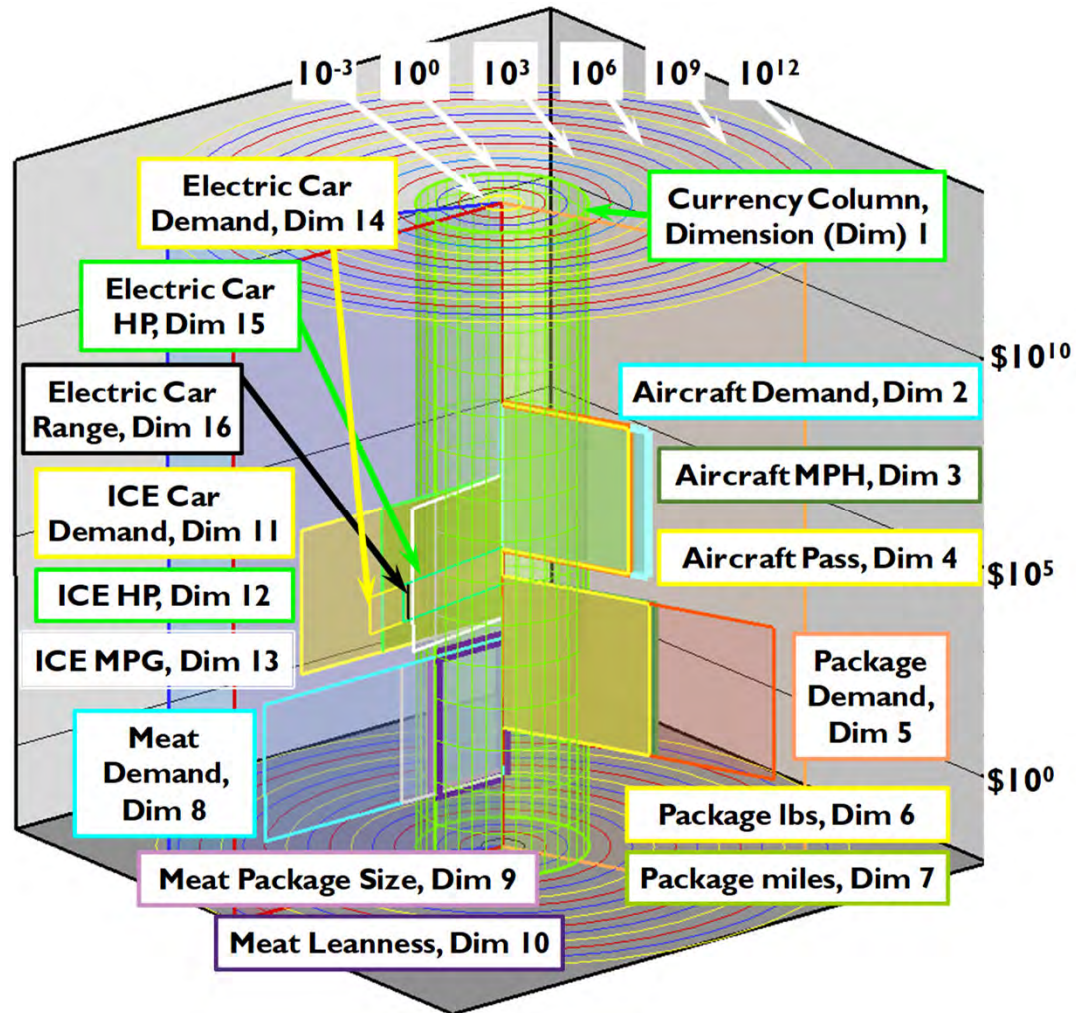
What Does a 5-Market, 16D System Look Like?



Electric cars use
Dimensions 14, 15, & 16

Internal Combustion
Engine (ICE) cars use
Dimensions 11, 12, & 13

Ground Beef uses
Dimensions 8, 9, & 10



The Currency Axis,
Dimension 1, is
common to all markets

Aircraft market uses
Dimensions 2, 3, & 4

Package Delivery uses
Dimensions 5, 6, & 7

Here's How We Built Up The Previous View



After we employ one common currency axis for Price, each market takes two Value dimensions and one Quantity dimension

Market	Dimension Name	Units	Dimension Type			Number of	
			Common	Value	Demand	Markets	Dimensions
All	Currency	Dollars	X				1
Civil Aircraft	Demand	Units per Year			X	1	2
	Max MPH	Miles per Hour		X			3
	Passengers	Seats		X			4
Package Delivery	Demand	Parcels per Year			X	2	5
	Package lbs	Pounds		X			6
	Package Miles	Miles to Delivery		X			7
United States Meat	Demand	Pounds per Year			X	3	8
	Package Size	Pounds per Package		X			9
	Leanness	Percentage		X			10
Internal Combustion Engine Car	Demand	Units per Year			X	4	11
	HP	Horsepower		X			12
	MPG	Miles per Gallon		X			13
Electric Car	Demand	Units per Year			X	5	14
	HP	Horsepower		X			15
	Range	Miles		X			16
All		Dimension Count	1	10	5		

How Did We Depict The Markets We Used?



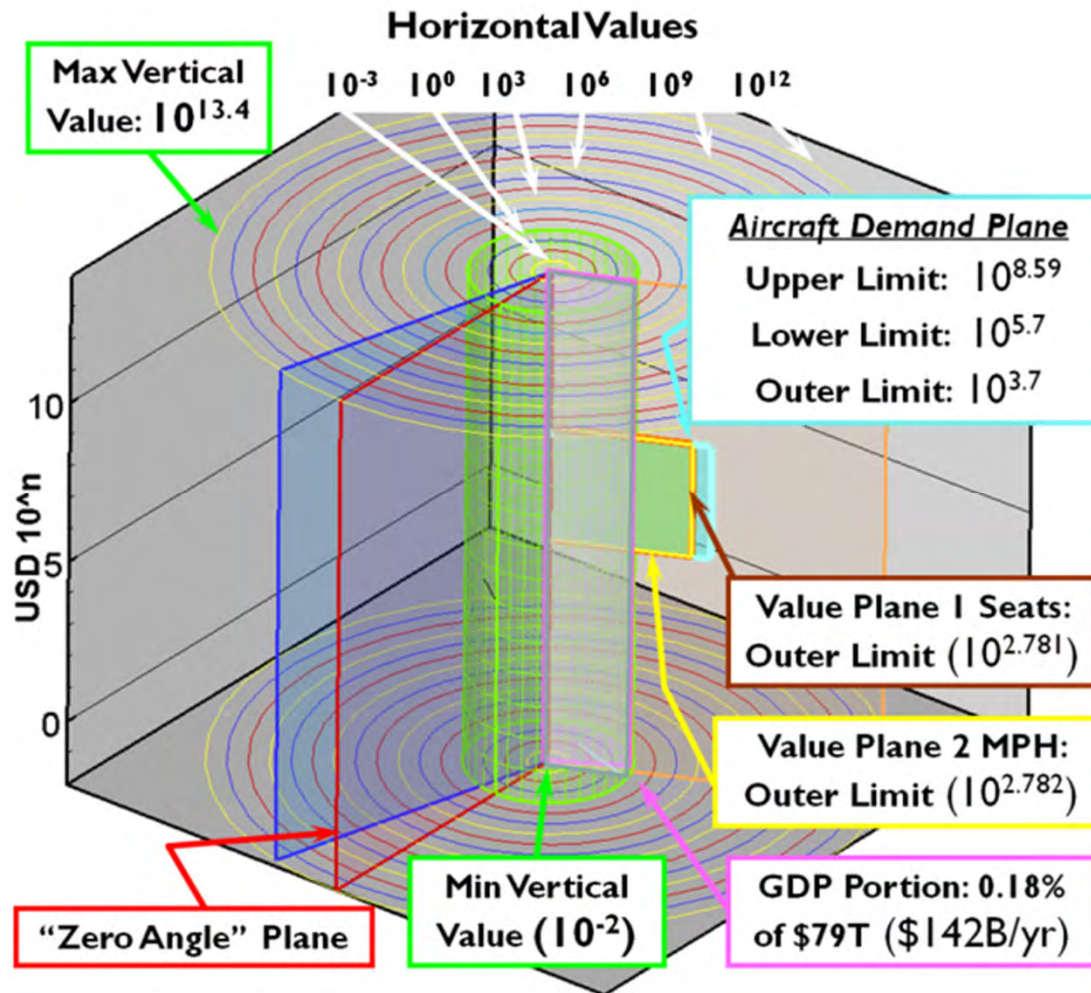
Draw a “Floor to Ceiling” Angle 0 Plane (in Red, for the start of Industry)

Add Services (Orange) and Agriculture (Blue)

Create a center cylinder with $R=1$, for GDP

Horizontally, each ring goes out by a factor of 10

Vertically, each level goes up by a factor of 10



The upper boundary for all planes in a market is that market's highest-priced item

The lower boundary for all planes in a market is that market's lowest-priced item

The lateral extent for all planes is the highest value for that variable

The angle between the Value Planes shows that market's part of GDP

A Brief History of Surveillance*,**



Proc Biol Sci. 2007 Jun 22; 274(1617): 1505–1509.

Published online 2007 Apr 10. doi: [10.1098/rspb.2007.0138](https://doi.org/10.1098/rspb.2007.0138)

PMCID: PMC2176157

PMID: [17426016](https://pubmed.ncbi.nlm.nih.gov/17426016/)

Reconnaissance and latent learning in ants

Nigel R Franks,^{*} James W Hooper, Anna Dornhaus,[†] Philippa J Aukett, Alexander L Hayward, and Stefanie M Berghoff

▶ Author information ▶ Article notes ▶ Copyright and License information [PMC Disclaimer](#)

Abstract

Go to: ▶

We show that ants can reconnoitre their surroundings and in effect plan for the future. *Temnothorax albigenis* colonies use a sophisticated strategy to select a new nest when the need arises.

- Rock ants look for
- Floor area
- Headroom
- Darkness
- Hygiene state
- Proximity of hostiles

Part of their collective output (GDP) is their surveillance

Ants first appeared on the earth between 140 to 168 million years ago

Hypothesis: Humans have been doing surveillance since they emerged, forming part of their GDP

*<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2176157/>

**<https://expeditions.fieldmuseum.org/australian-ants/ant-evolution-and-environment>

Watchtowers Were A Way To Gain Early Warning



This tower, on a hill in Krupina, Slovakia (about 200 kilometers east of Vienna, Austria), built in the late 1500s, combined with others, gave the town advance warning of approaching armies (its updated stairs and porch came later)

The uneven terrain around the town called for several watchtowers, which drained resources

Watchtowers have no mobility and rely on a network of them to work well



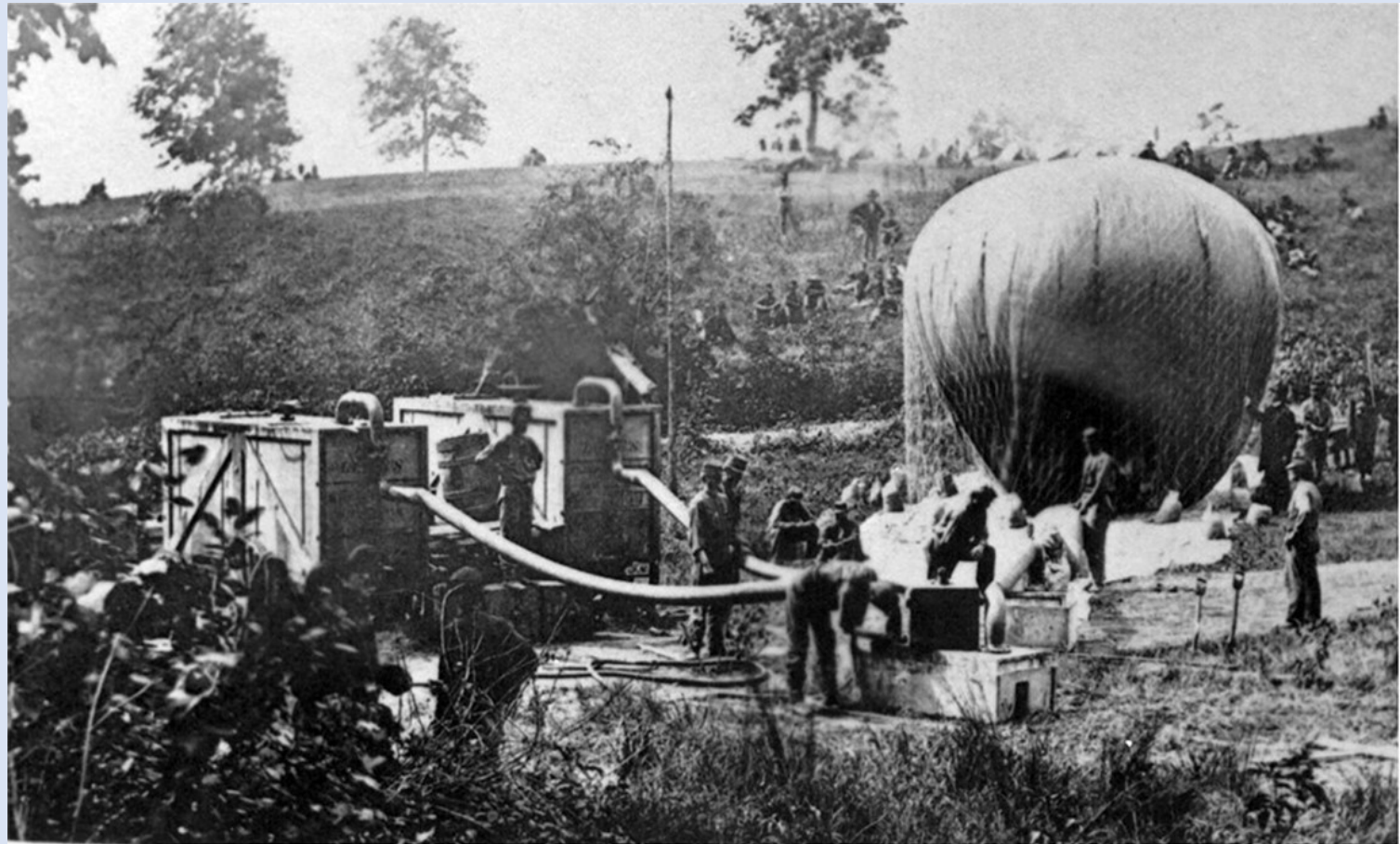
Hundreds of Years Later, There Were Advances



The French had the first use of balloons in surveillance in 1794

Both sides used balloons in the Civil War; this is the Union Balloon *Intrepid*

Balloons made great targets, and were dangerous for pilots



World War I Saw More Advances



This Caudron G.3 was an improvement



The Allied Powers flew over 2800 of these models, flying faster and higher than airships

The added features did not ensure safety



Flying battlefield assessment, this G.3 pilot (my grandfather) had his tail shot off (friendly fire)

USG Response: Go Higher and Faster

After WWII, The Cold War Drove New Platforms



The Lockheed U-2 went higher than ever



While it flew successfully for years, the Russians eventually shot one down

Solution: Higher and Much, Much Faster



The SR-71 went to 85K' and Mach 3.2 and was never shot down – but it was costly

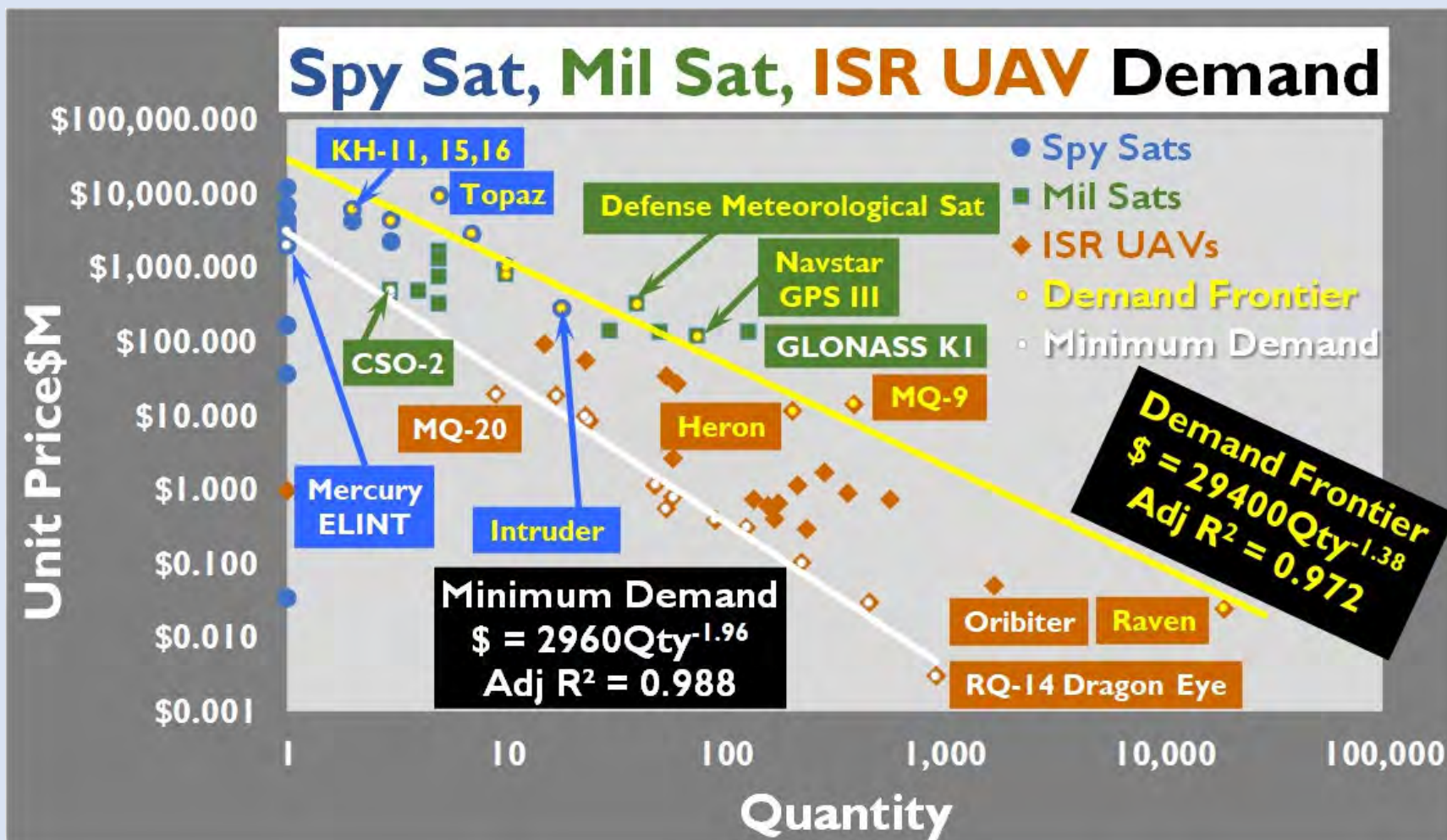
An Evolved Response: Go Unpiloted

Partial Move to Satellites And UAVs



Satellites and UAVs share Steep Demand slopes, revealing more money at the top of the market

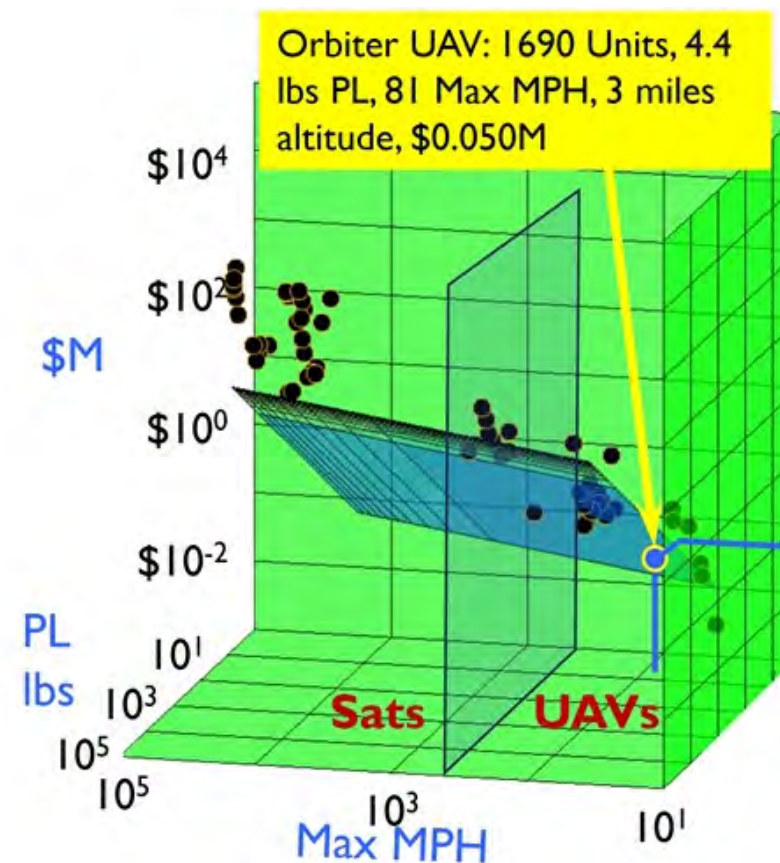
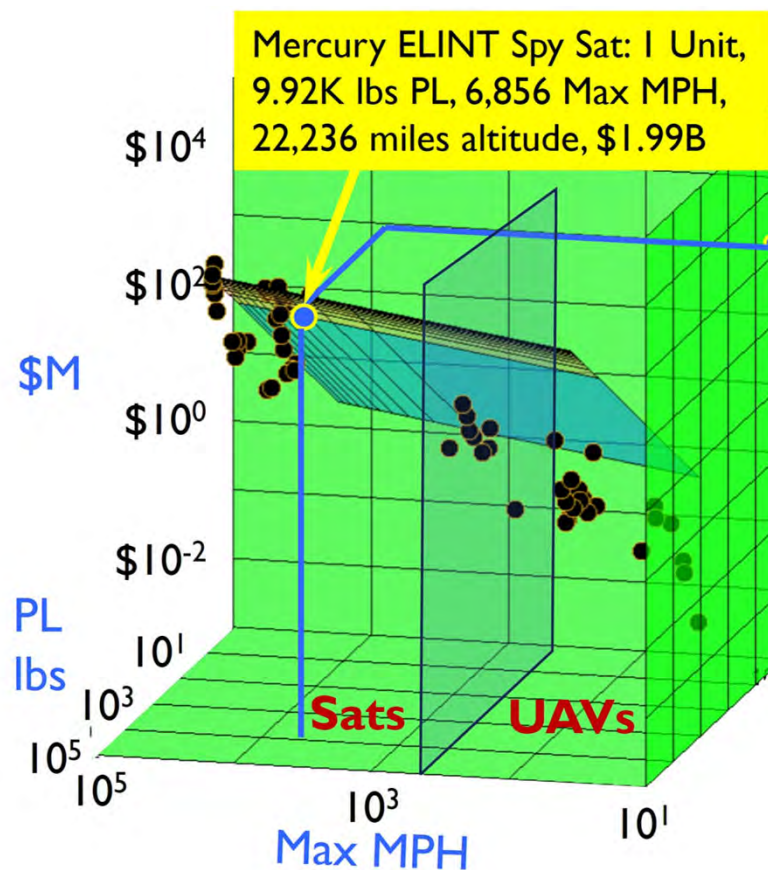
The market minimum suggests that if you can build one good unit, you'll have a baseline expectation set by the Minimum Demand



UAVs and Sats Have The Same Value Proposition



Buyers pay more for Payload, Miles per Hour, and Altitude, and pay less for each succeeding unit (that is they have a Product Demand Curve)

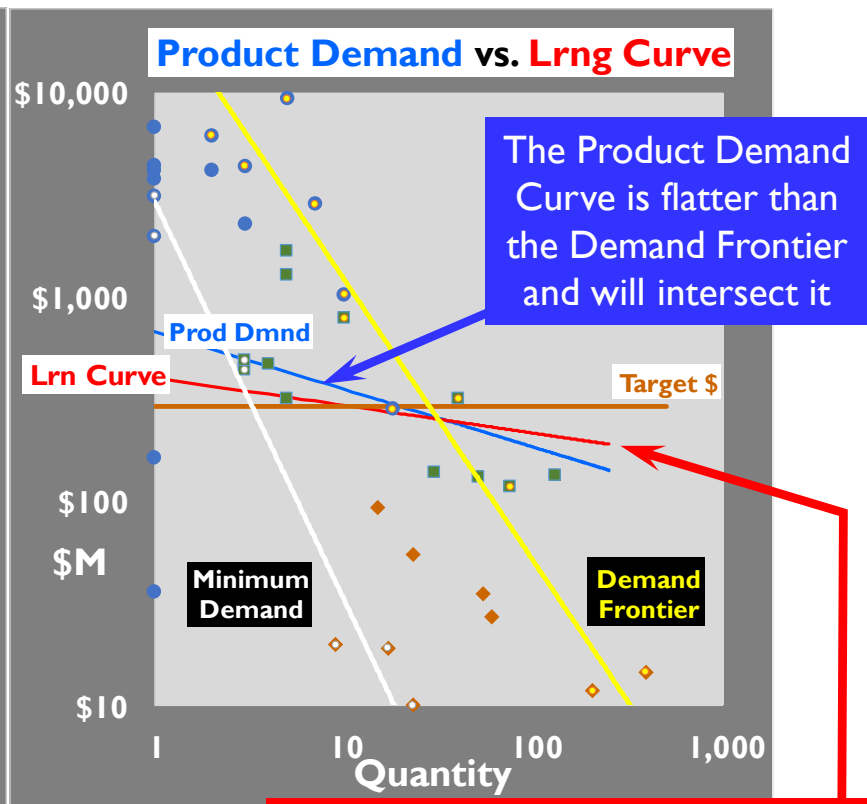
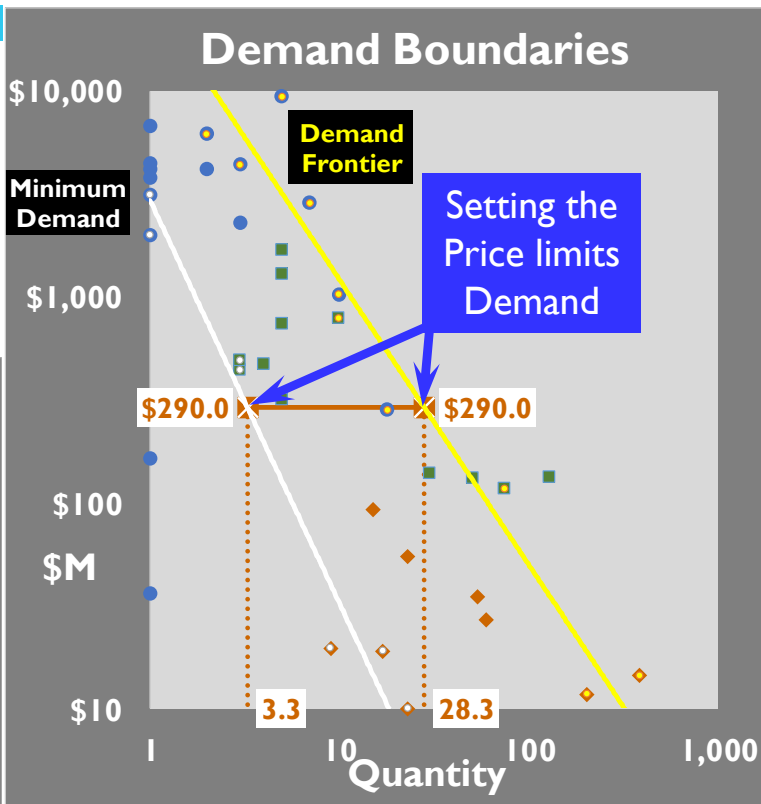
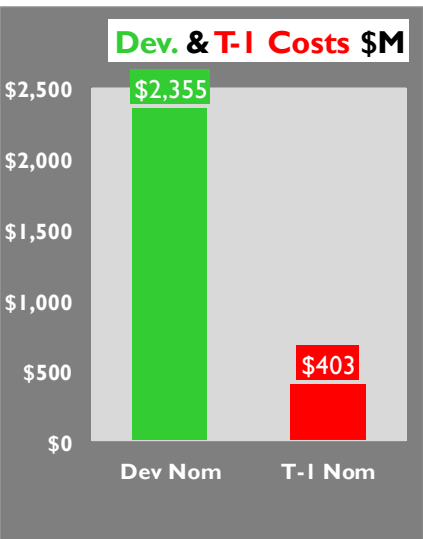


Successful programs balance Cost, Value, and Demand

An Interactive Estimator Helps Bound The Problem



Feature	Qty	Units
Altitude	500	Miles
Payload	4,000	lbs
Max Speed	17,000	MPH
Quantity	20	Units
Empty Wt	32,000	lbs
Lrn Curve	91.0	%



New Product Estimator

$$\$M = 0.0291 * PL \text{ lb}^{0.766} * \text{Max MPH}^{0.301} * \text{Alt Miles}^{0.169} * \text{Qty}^{-0.283}$$

2022\$

\$290.0

If your Learning Curve is > 82.4%, it will intersect Product Demand

Every addition to the market changes it; analysts should follow its movement

Summary



- All Markets work in 4D according to the Law of Value and Demand
 - Features drive Value
 - Value sets Price
 - Price limits quantity sold
 - Quantity sold is a feature
- We can combine any number of markets into a single view
 - Each market slice is their GDP
 - Markets evolve over time
 - Ever-evolving Reconnaissance has been part of GDP since the beginning of humanity
- Viable products balance Cost, Value, and Demand

