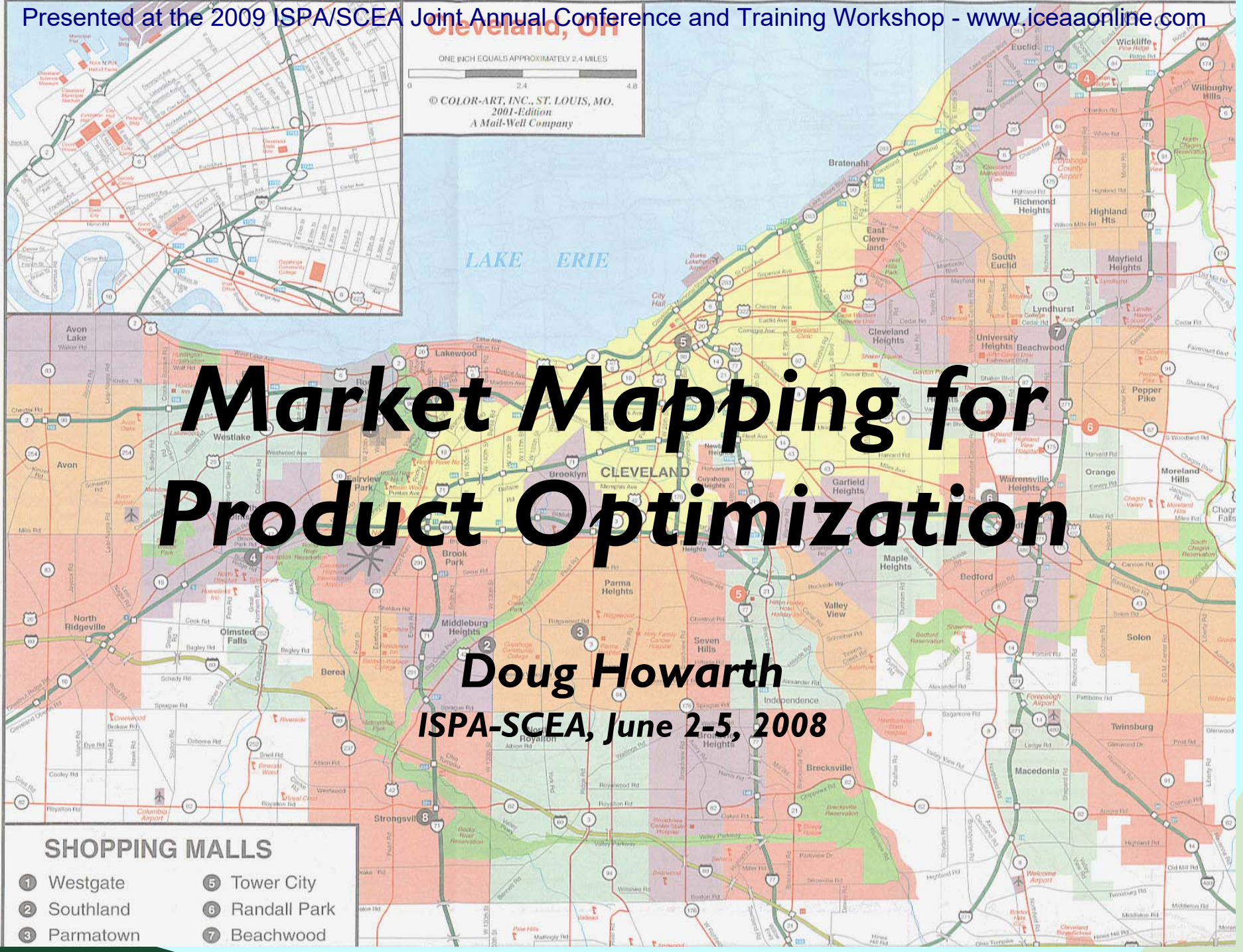


Market Mapping for Product Optimization

Doug Howarth

ISPA-SCEA, June 2-5, 2008

Market Mapping: What, Why & How

- ***What:*** Multidimensional Economic Maps are Analogous to a series of Geographic Maps
- ***Why:*** Economic Maps, like Geographic Maps, offer Direction and Obstacle Avoidance
- ***How:***
  - Plot Demand Map
  - Derive Demand Equations
  - Depict Valued Attributes Map
  - Determine Predicted Value Equations
  - Compress Data into World View
  - Use this Data to Derive New Product Attributes

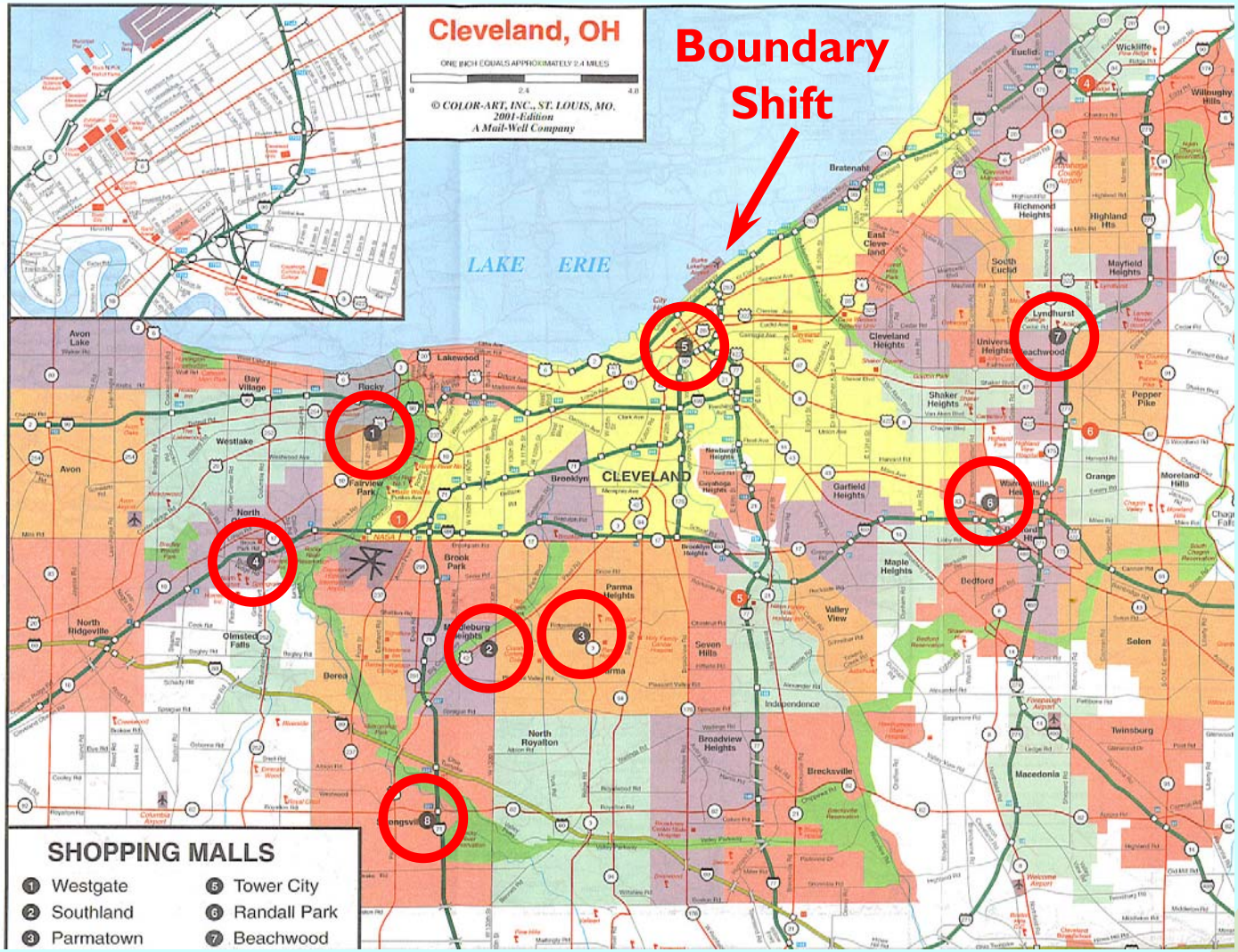
Consider this Geographic Map

This map has Important Information

Lake Erie forms a boundary

Boundaries Change – In 1957 Cleveland Expanded Burke Lakefront Airport

Cleveland has Malls



The Malls Compete Against Each Other – And they Spread out

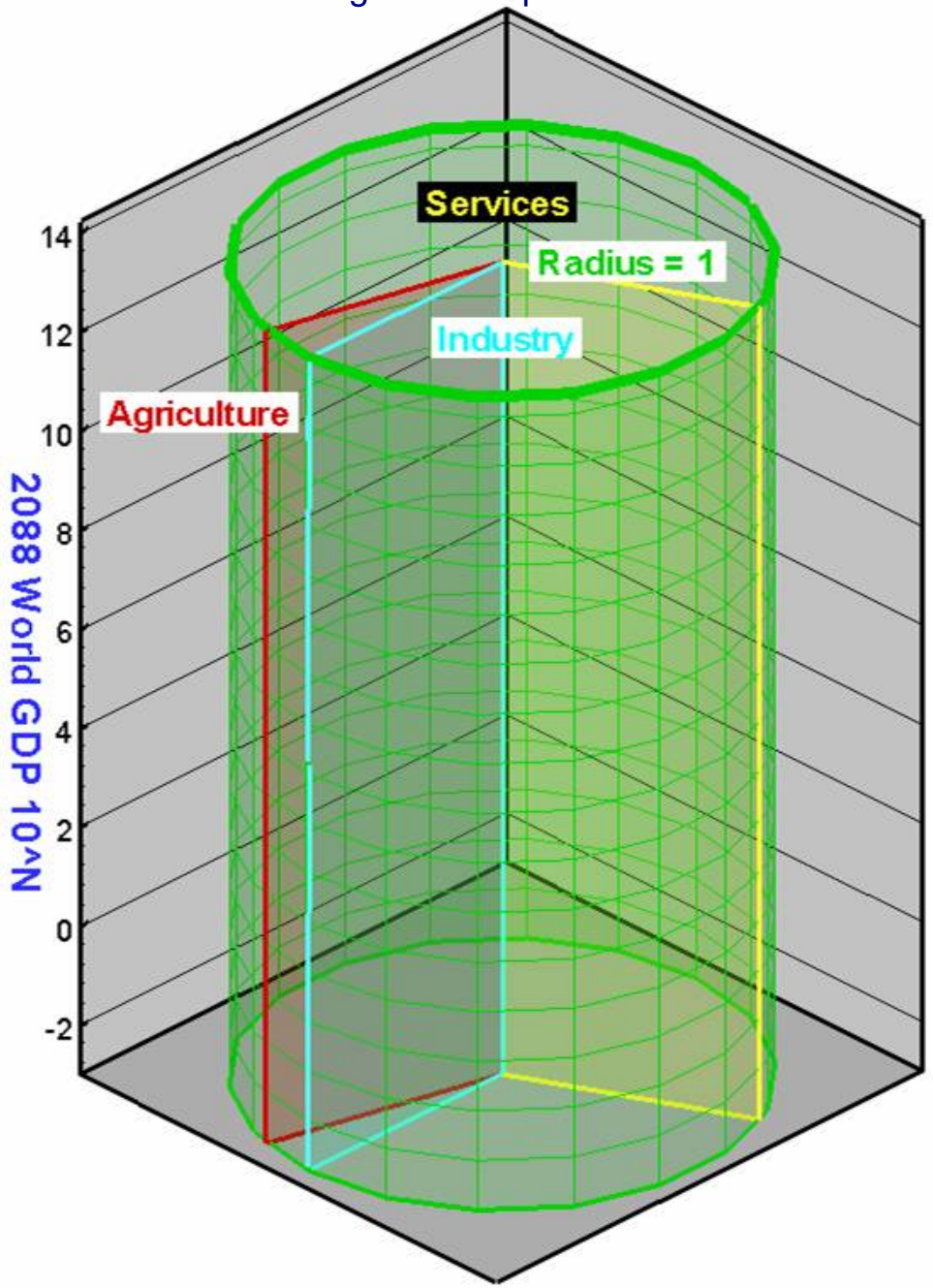
Now, Consider the Gross World Product (GWP)

This Pie-Cylinder has a Radius of 1, and Vertical Log-Scaling

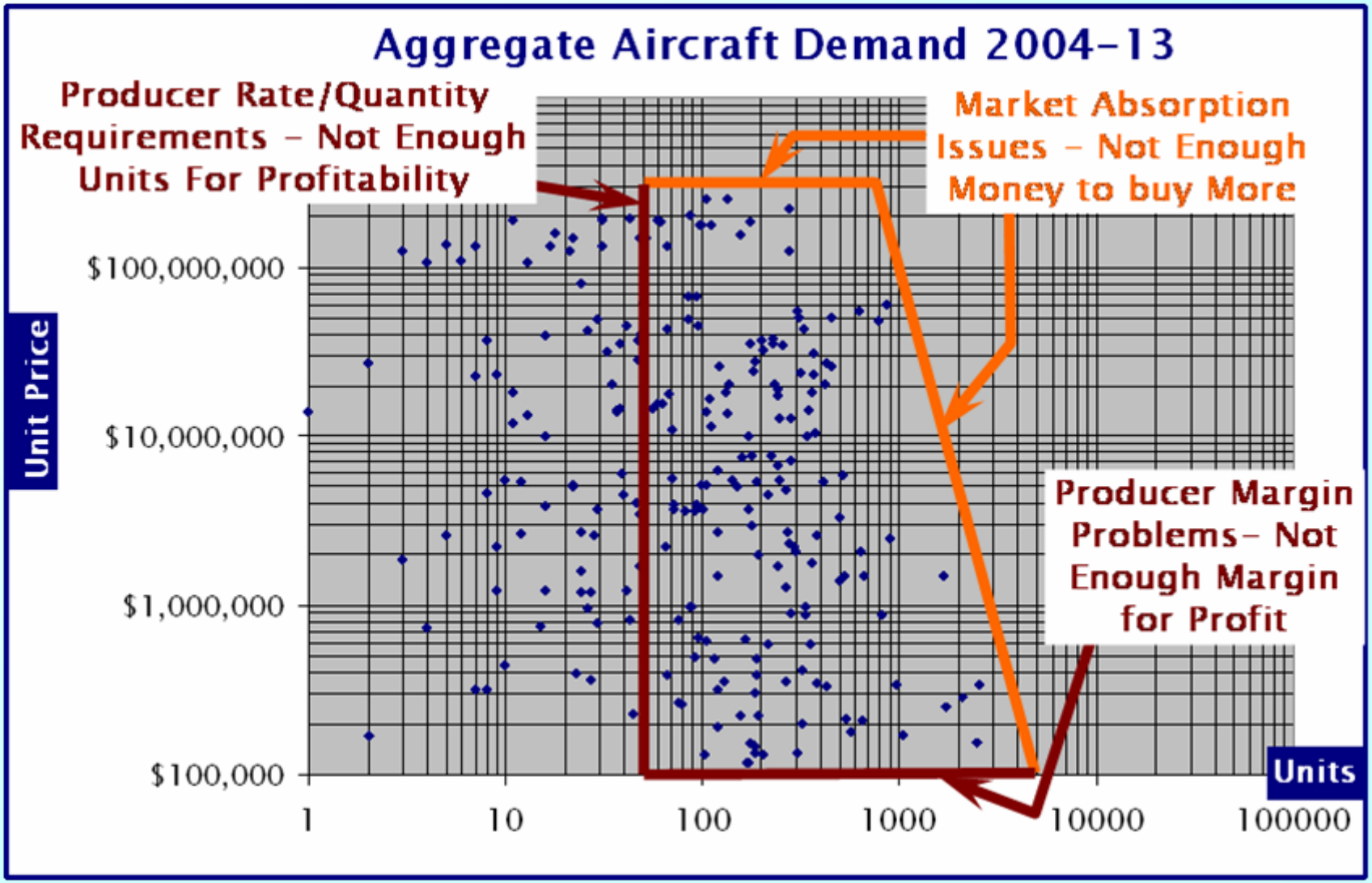
The GWP was ~ about $78.4T in 2008

The Market for New Commercial Aircraft is about 0.2% of Total GWP

How can we map part of that Market?



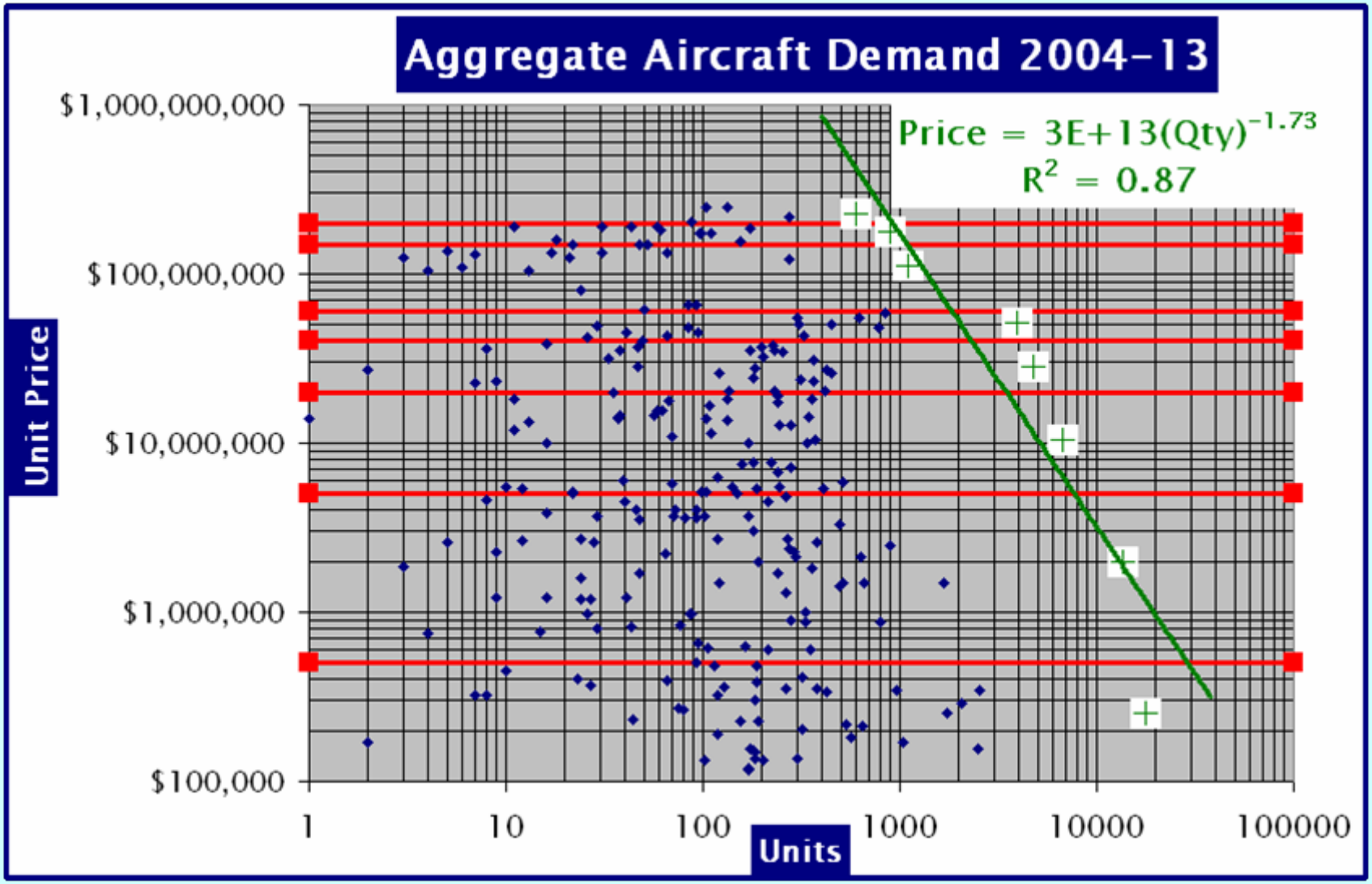
Map of Market's Quantity-Price Points



The Aircraft Market's 233 Models each have a Quantity-Price Point

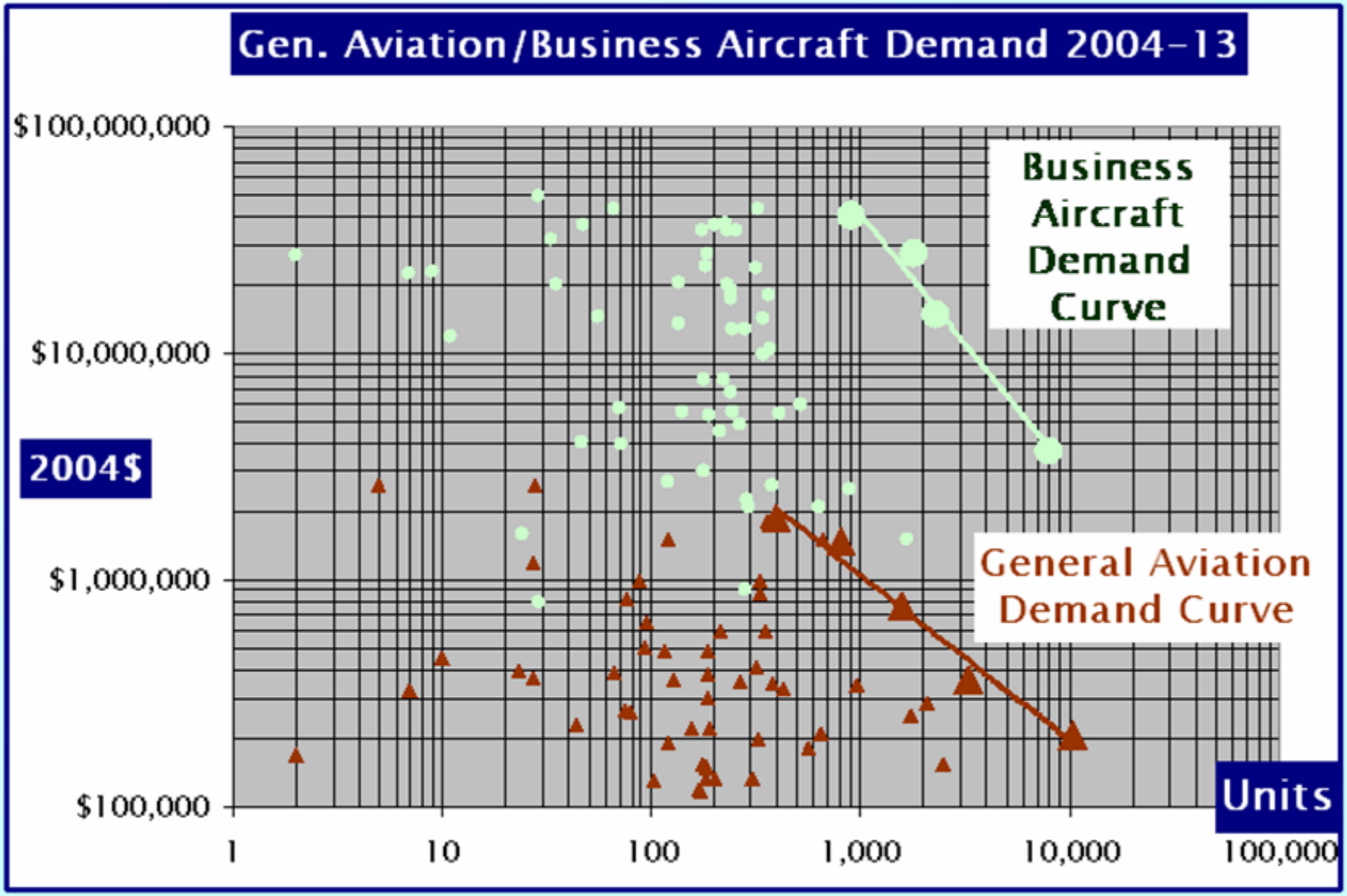
Markets have Definable Boundaries

Determining Market Demand



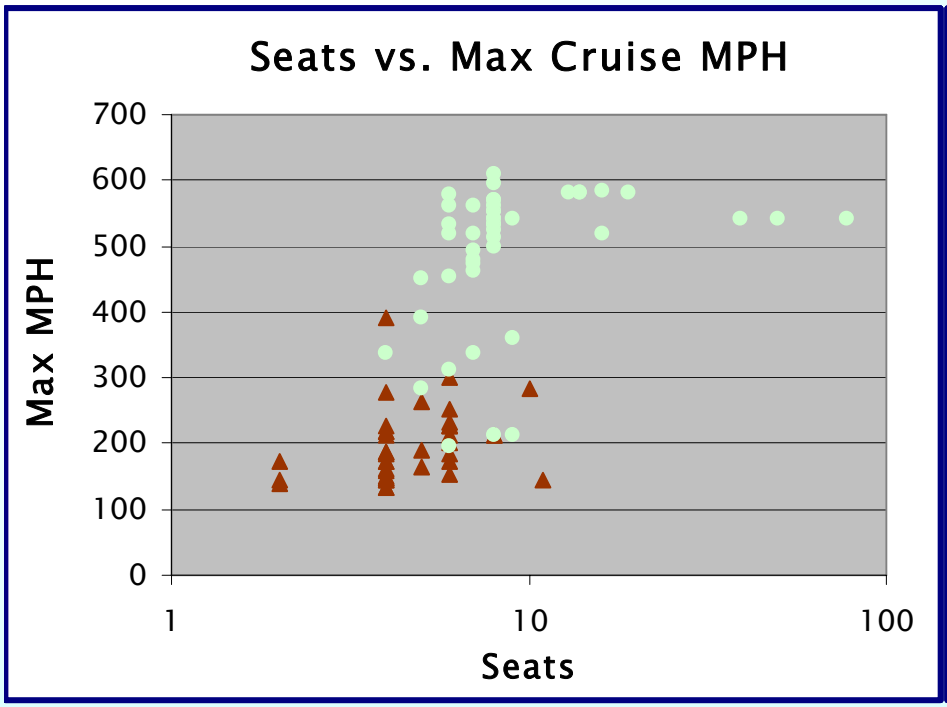
We can Separate the Market into Bins and Determine Demand

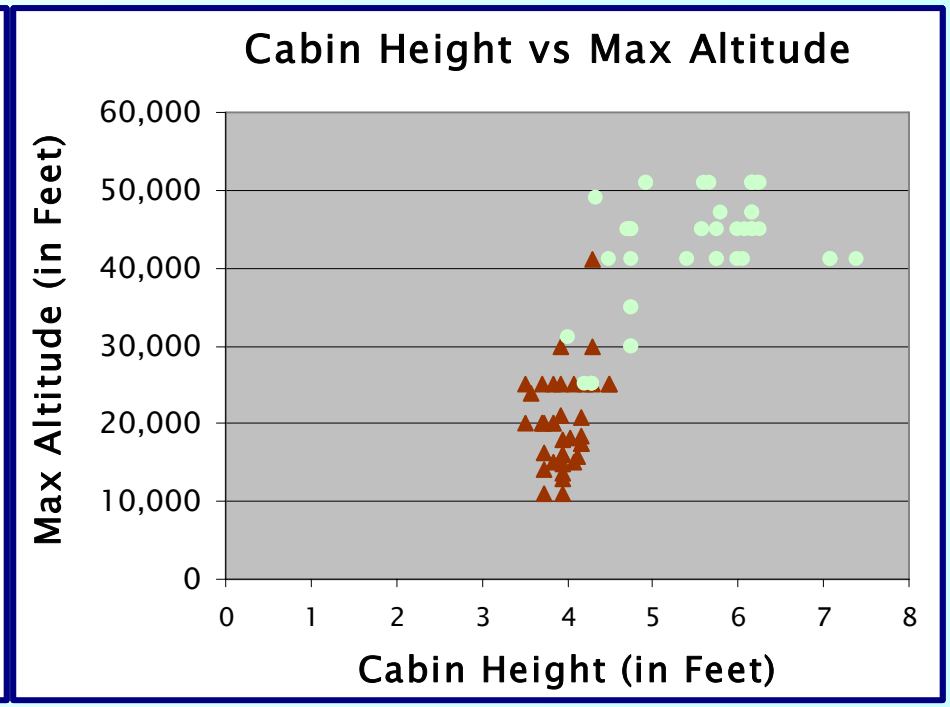
We can do the Same for Sub-Markets



Business Aircraft & General Aviation Aircraft are Sub-Markets to the Market for all Aircraft – They have Their own Demand Curves

These Aircraft have Important Attributes





Hypothesis: **Aircraft Value is a function of these attributes**

$$V_M = A_1 * A_2 * \ldots A_N * e_i$$

Where:

V_M = Value in a Market (as represented by sustainable prices)

A_i = contribution of i^{th} attribute to product value

e_i = error term of the equation

Multiple Regression on the Data Yields

	Pearson's^2	MAD	
$V_m = 0.0764 * Seats^{0.940} * MPH^{2.71}$	77.8%	35.0%	(5)
$V_m = 0.0946 * Seats^{0.618} * MPH^{2.07} * CabH^{2.64}$	83.0%	26.4%	(6)
$V_m = 8.56E\text{-}05 * Seats^{0.573} * MPH^{0.936} * CabH^{3.01} * Alt^{1.26}$	88.6%	23.7%	(7)

Where:

Seats = typical number of seats

MPH = typical cruising speed

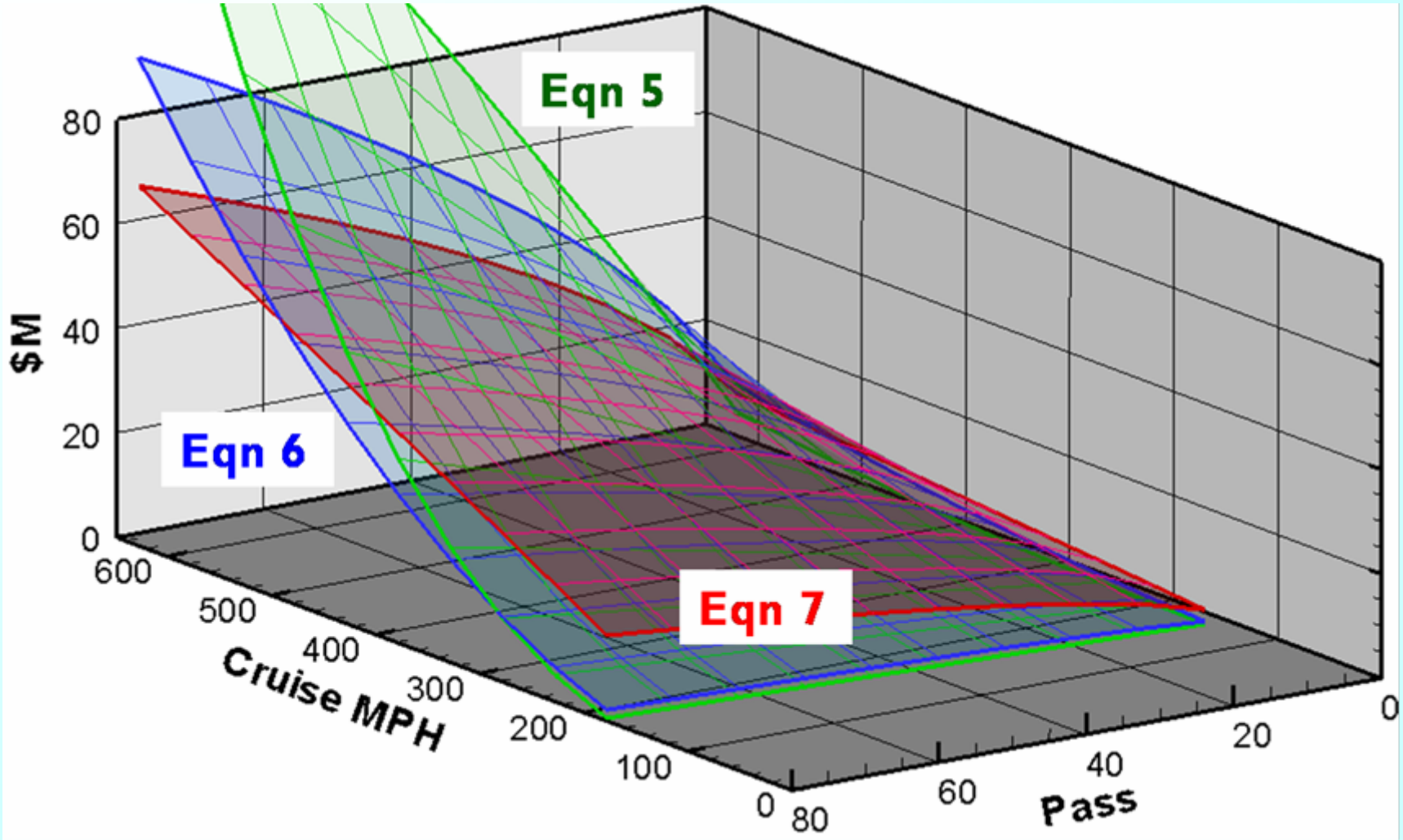
Cabin H = Cabin height (in feet)

Alt = Maximum Cruising Height (in feet)

Pearson's^2 = Pearson's Corr. Coefficient^2

MAD = Mean Absolute Deviation

Displaying Value Responses of the Market



If we let Cabin Height = 73", from Equation 6, our result is

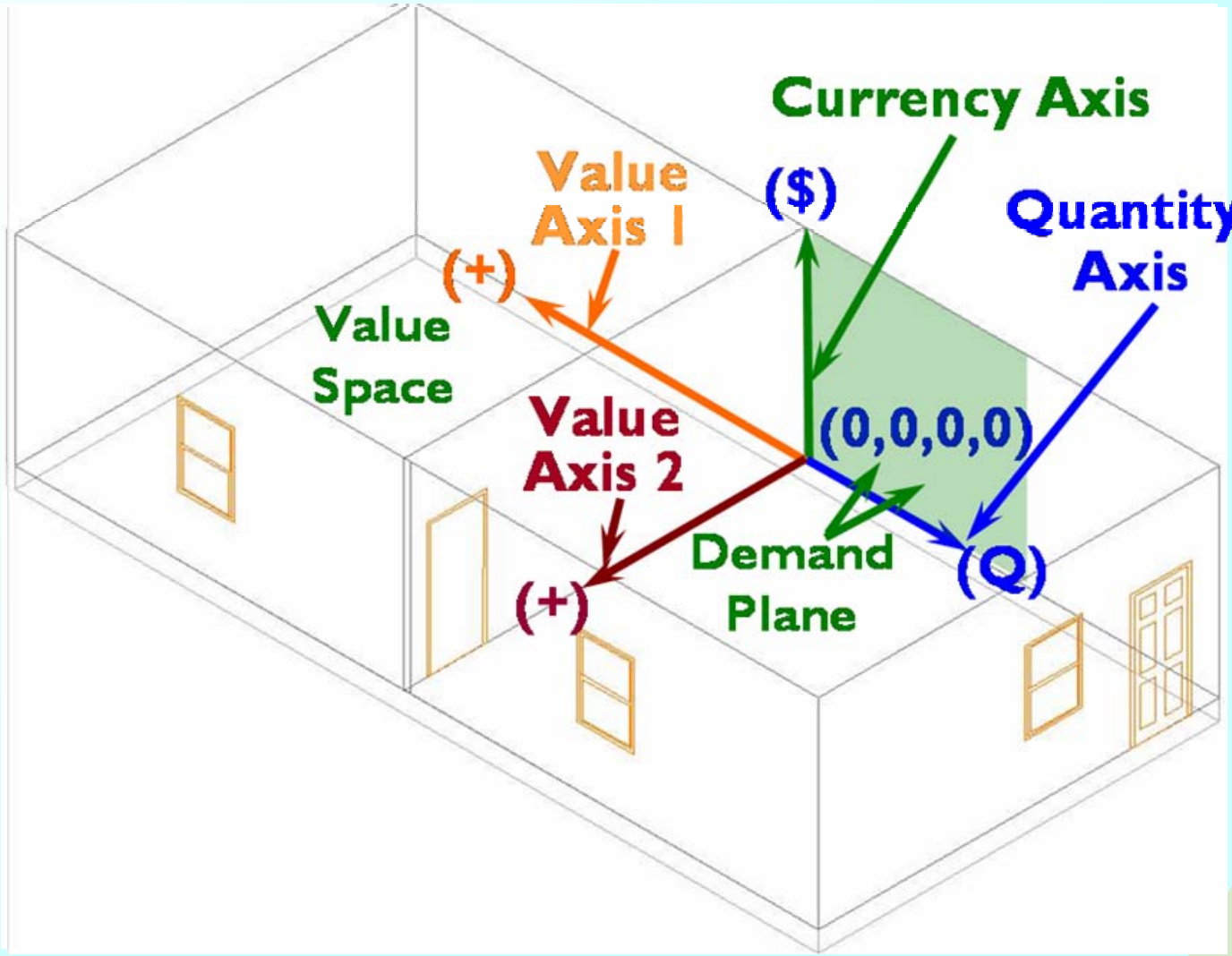
If we let Max Altitude = 45,000', from Equation 7, we obtain

Structures Which Share an Axis Include

Two-room Houses like this

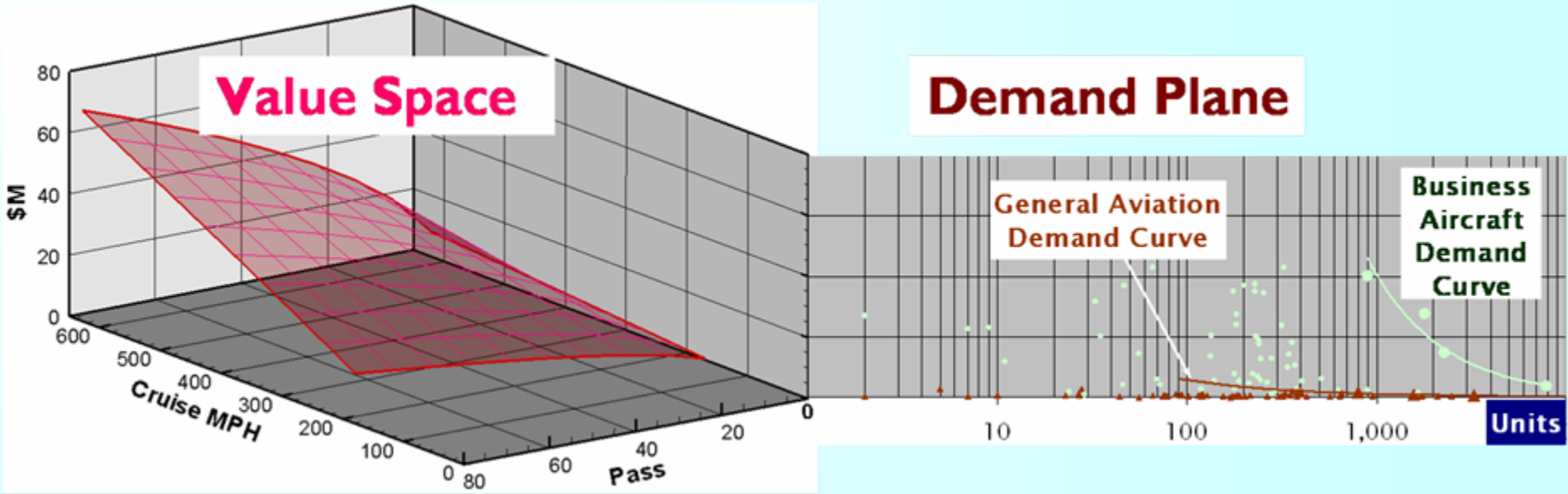
They Have 4 Axes which Radiate from a Single Point (0,0,0,0)

If we move from Physical to Economic Structures and Rename the Axes, then



We have a 4 Dimensional Economic System, with Value Space & the Demand Plane Sharing a Currency Axis

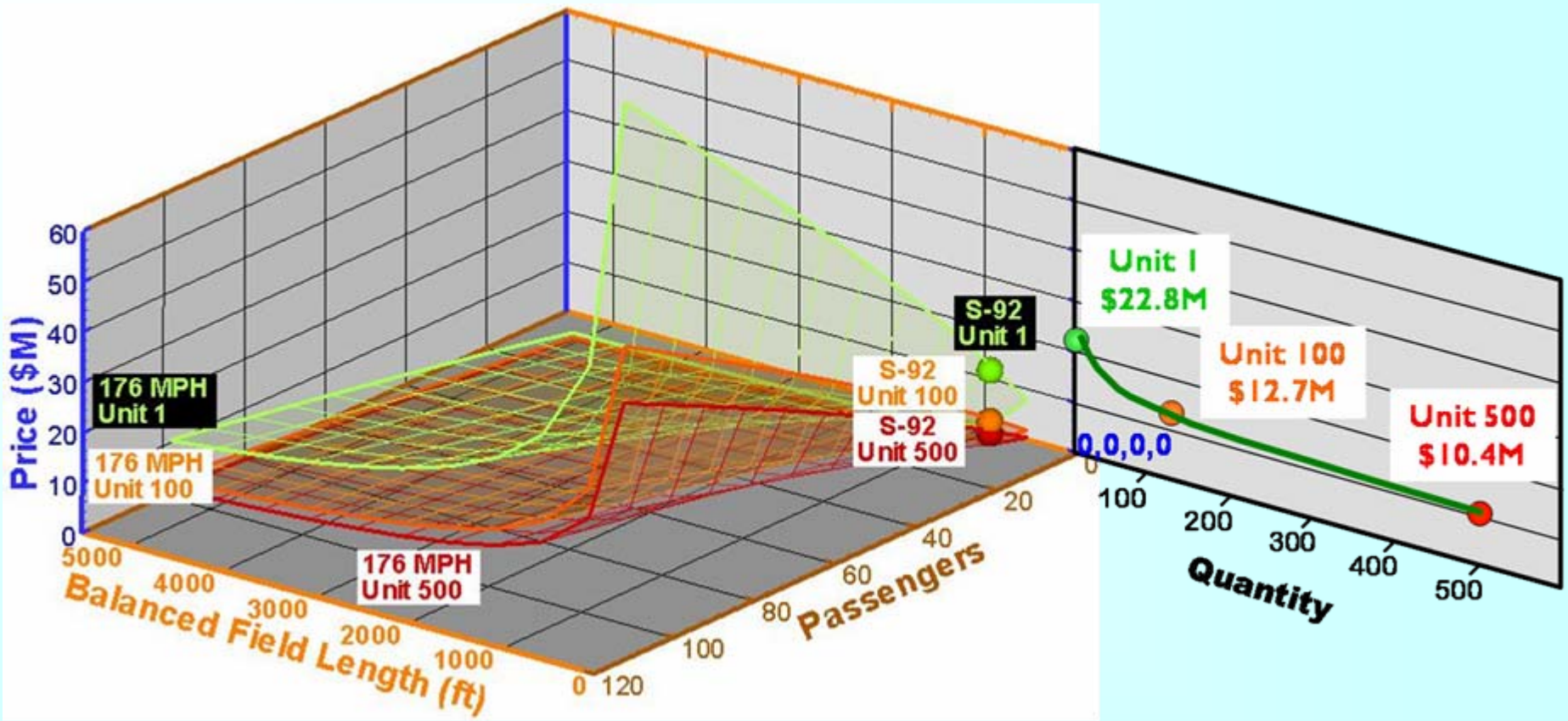
We Just Examined a 4D Economic System



Here, the Value Response Surface Derived as Equation 7 Shares the Currency Axis with its Associated Demand Plane

Given that this Approach works for one Market, will it work for Others?

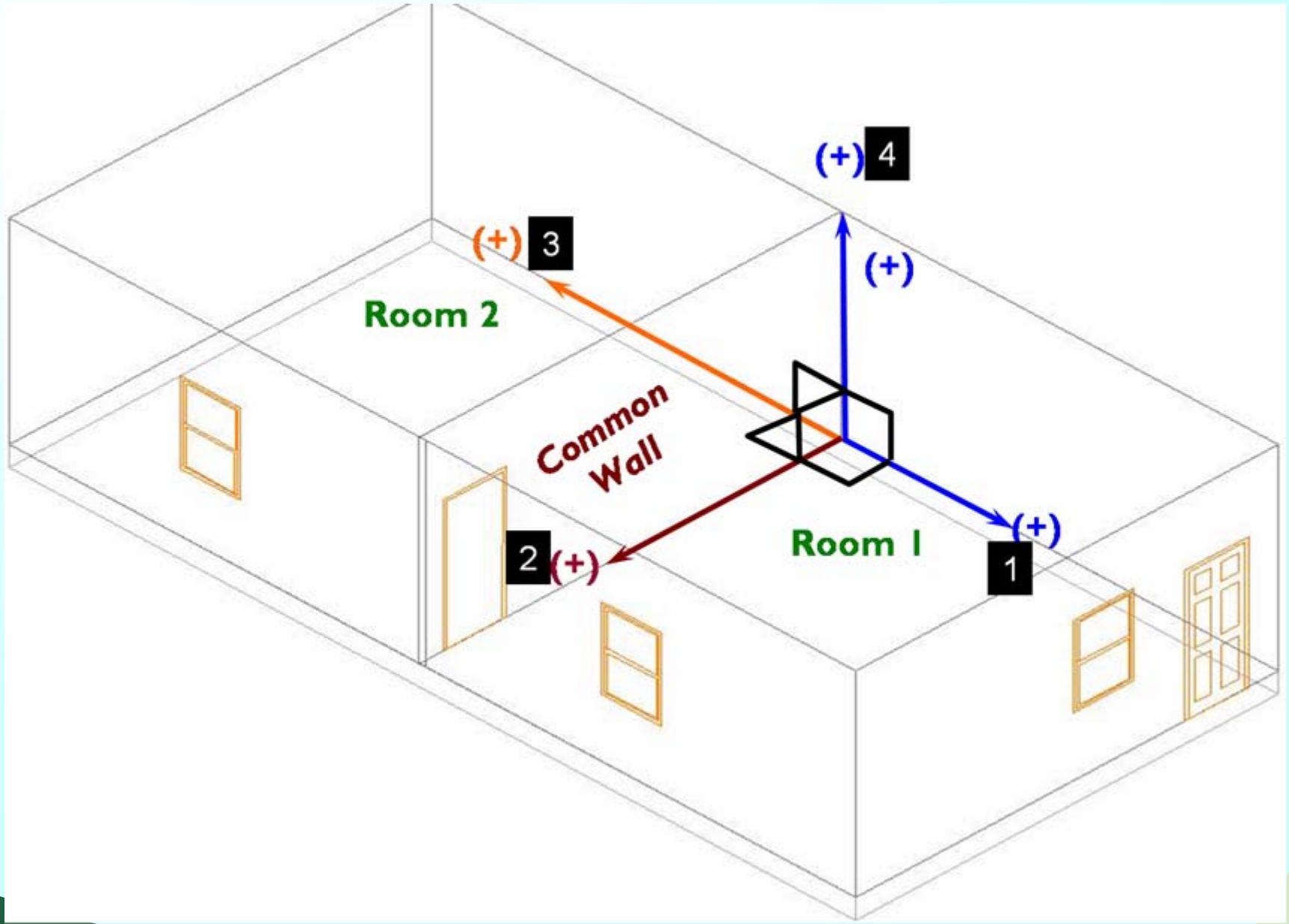
Here's a 4D System for a Helicopter



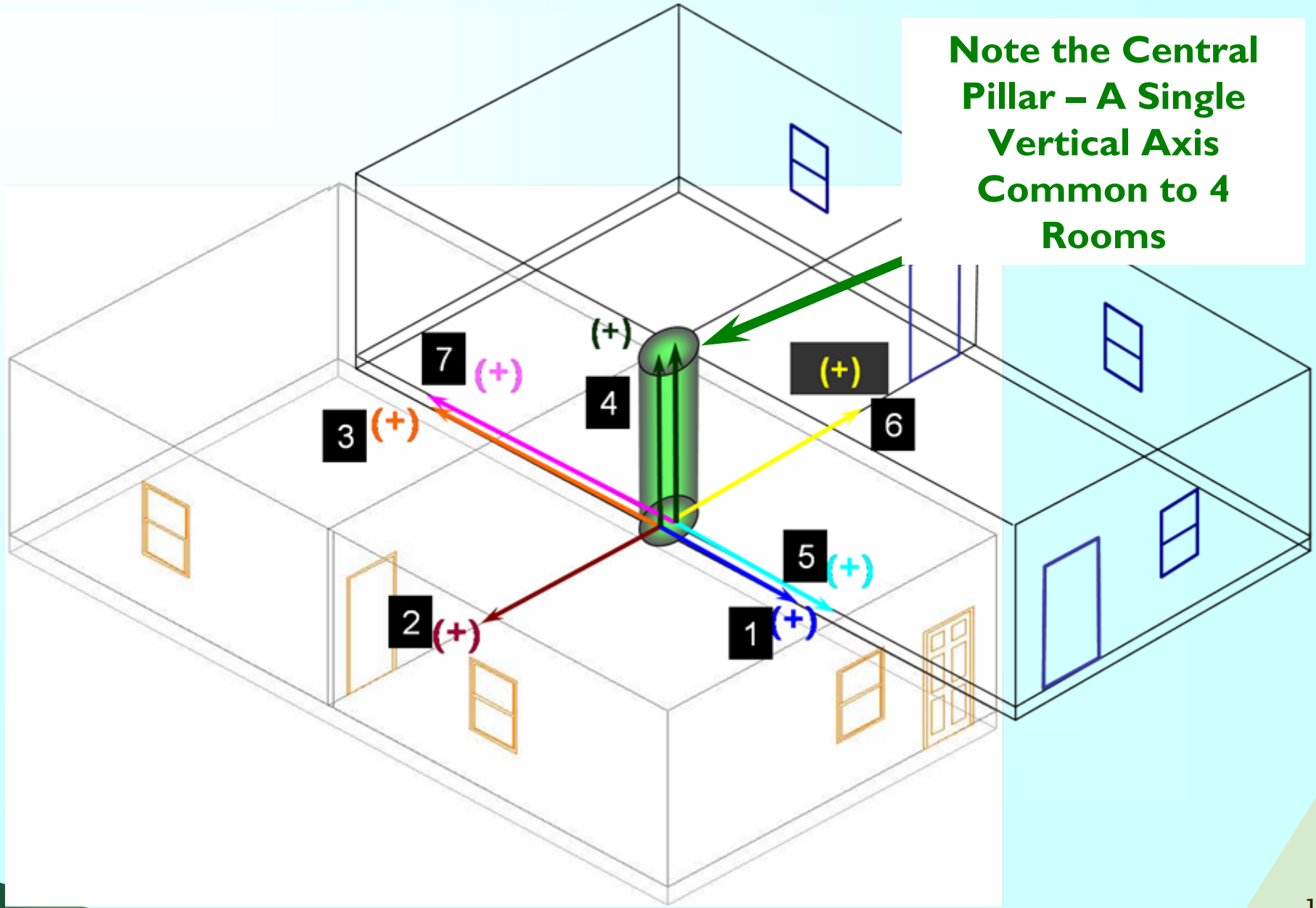
Values for Helicopters & Regional Aircraft allow Demand Derivation for a Hypothetical Helicopter like the Sikorsky S-92

Note that the MPH axis has been Swapped for Balanced Field Length

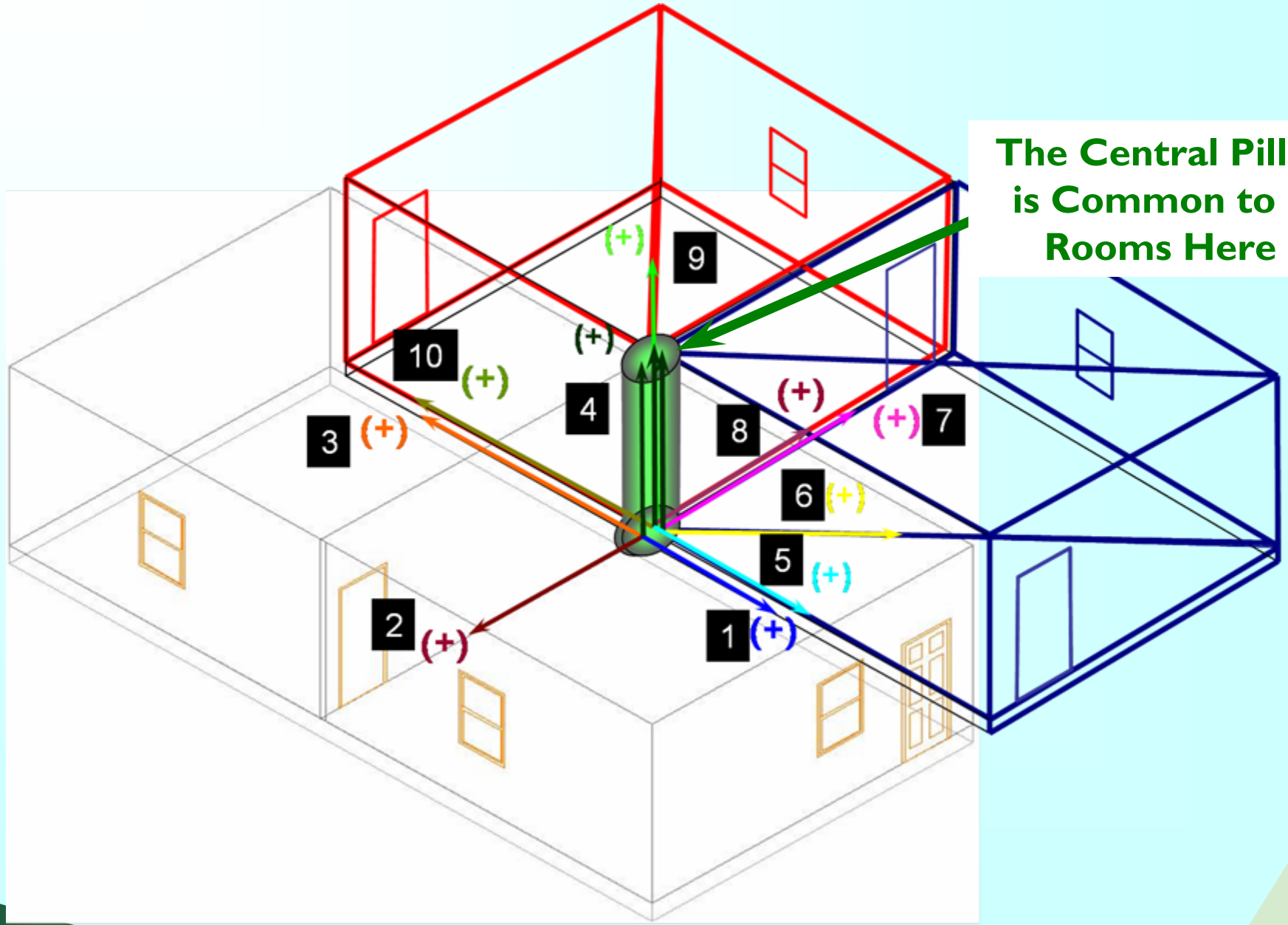
1 Market (2 Rooms) Gave us Four Axes



2 Markets (4 Rooms) Yields Seven Axes



3 Markets (6 Rooms) Yields 10 Axes



The Pattern leads to an Observation

Number of Markets	Primary 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
5	10	5	1	16
n	2n	n	1	3n + 1

To Consider "n" Markets, we Need to Plot in 3n+1 Dimensions

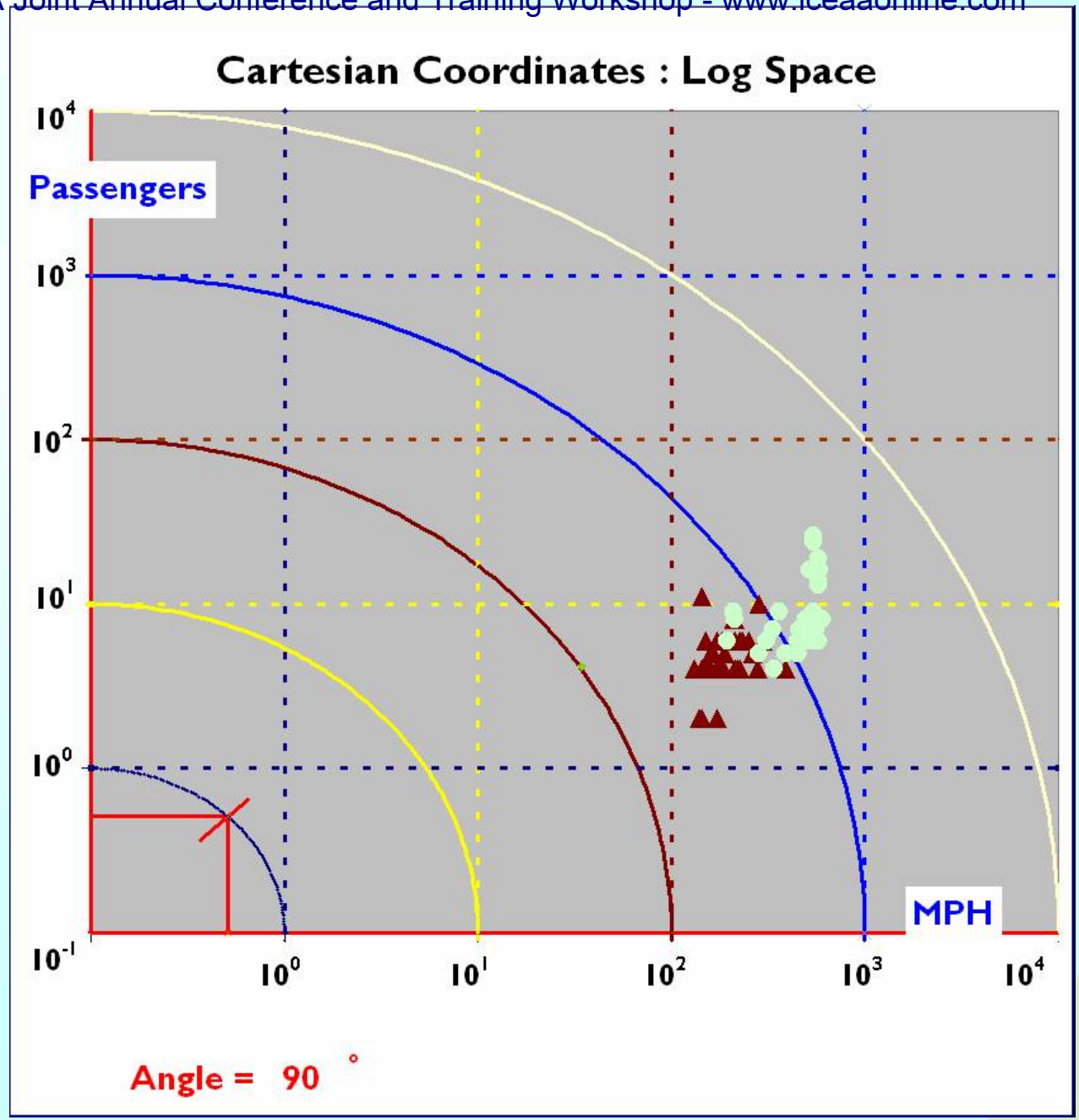
We Take Advantage of Log-Polar Coordinates

We have the Base 10 Logs of MPH and Passengers as Axes

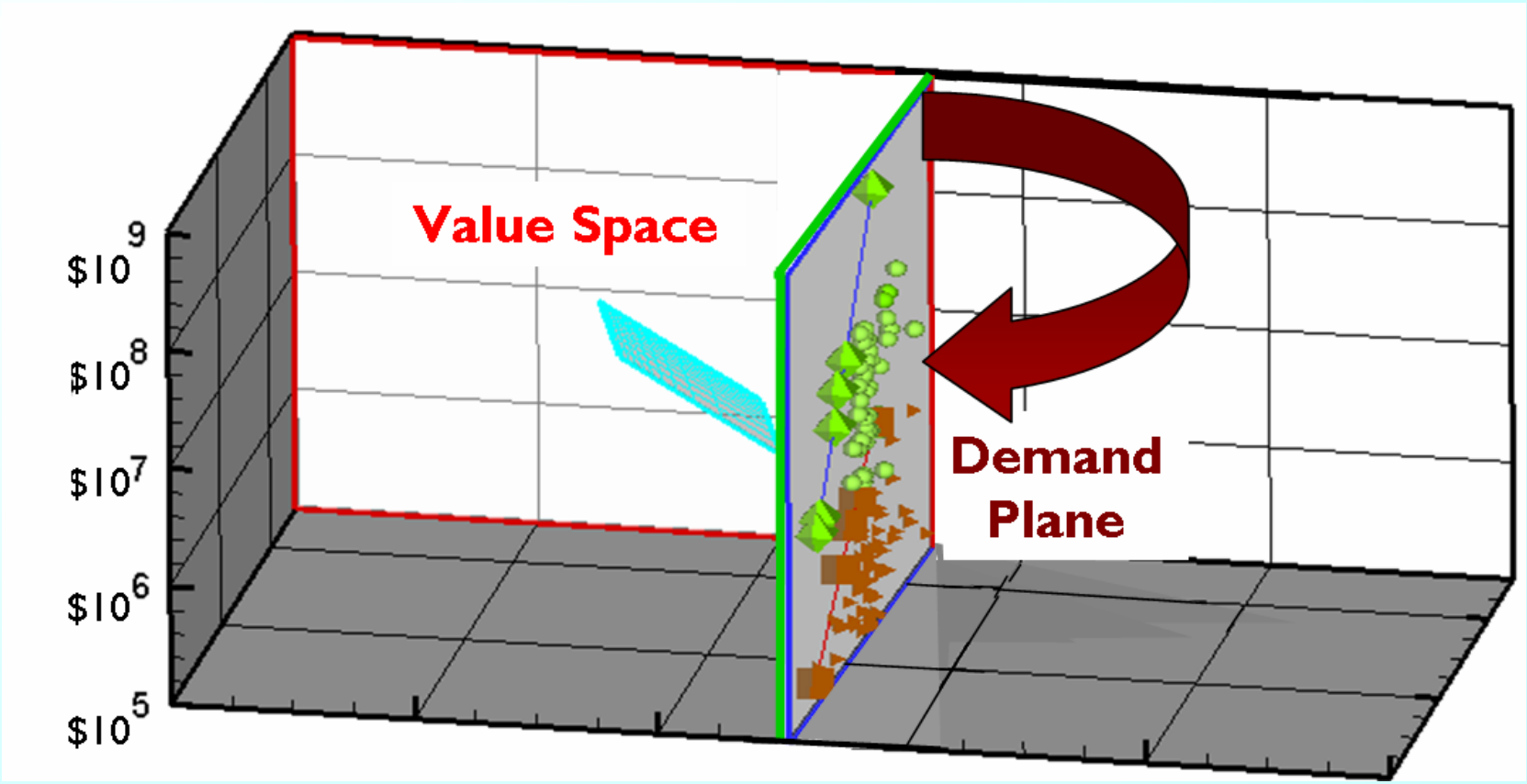
We Take their Polar Coordinates as we Adjust the Angle from 90°

Importantly, we can Return to 90°

Log-Polar Systems convert to Log-Cartesian



Compressing Demand Plane Onto Value Space



In Log Space, Power-Form Value Response Surfaces are Planar

Demand Planes can Effectively Collapse on to their Value Spaces for Convenience Using Polar Coordinates

With Demand Planes flat against their Respective Value Spaces, we can Plot All of the Markets Simultaneously

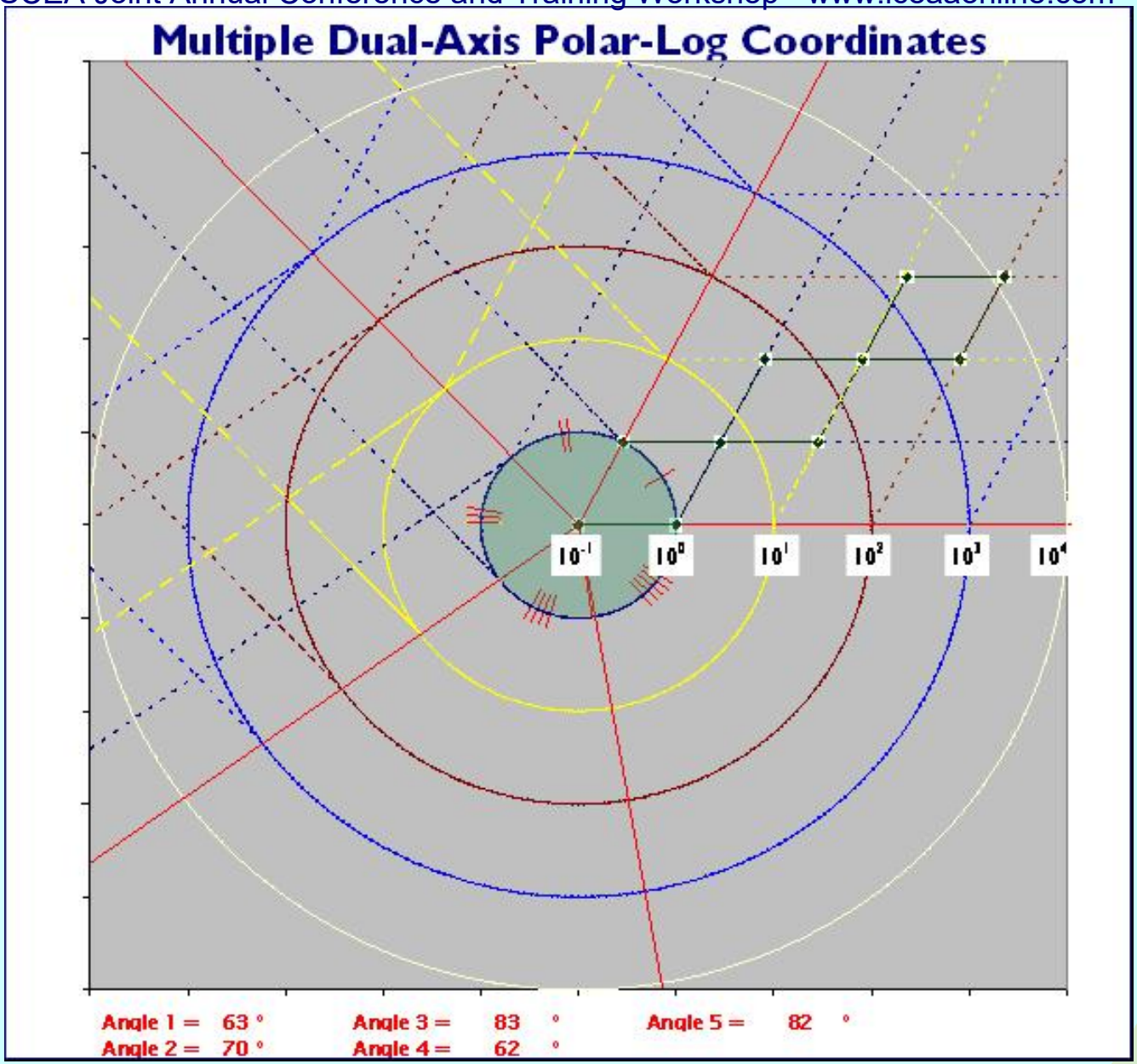
Multiple Market Conversion

We Begin with a Single Market Taking 10°
(1/36th or 2.8%) of Total

If this Market is Larger, We Accommodate it

If we need to show More Markets, We Accommodate them

This Method Considers N number of Markets – There is no Upper Limit



Complete Analysis Requires Redrawn Axes for Specific Markets

Redefined Dual Axes

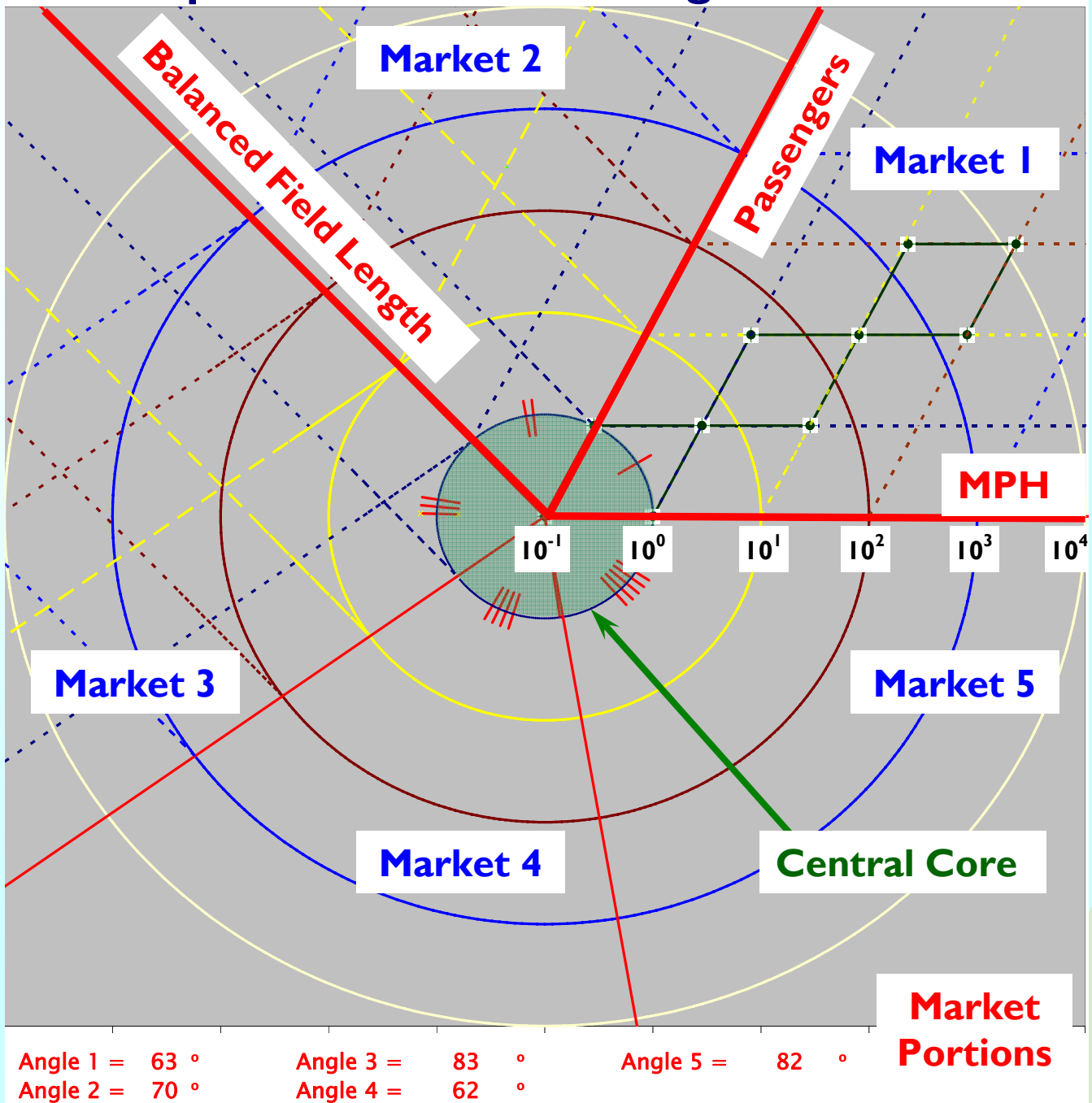
Dual-Axis Polar-Log Axes Serve 2 Functions as They

1) Plot Market Positions…These Angles Divide the Markets by Size

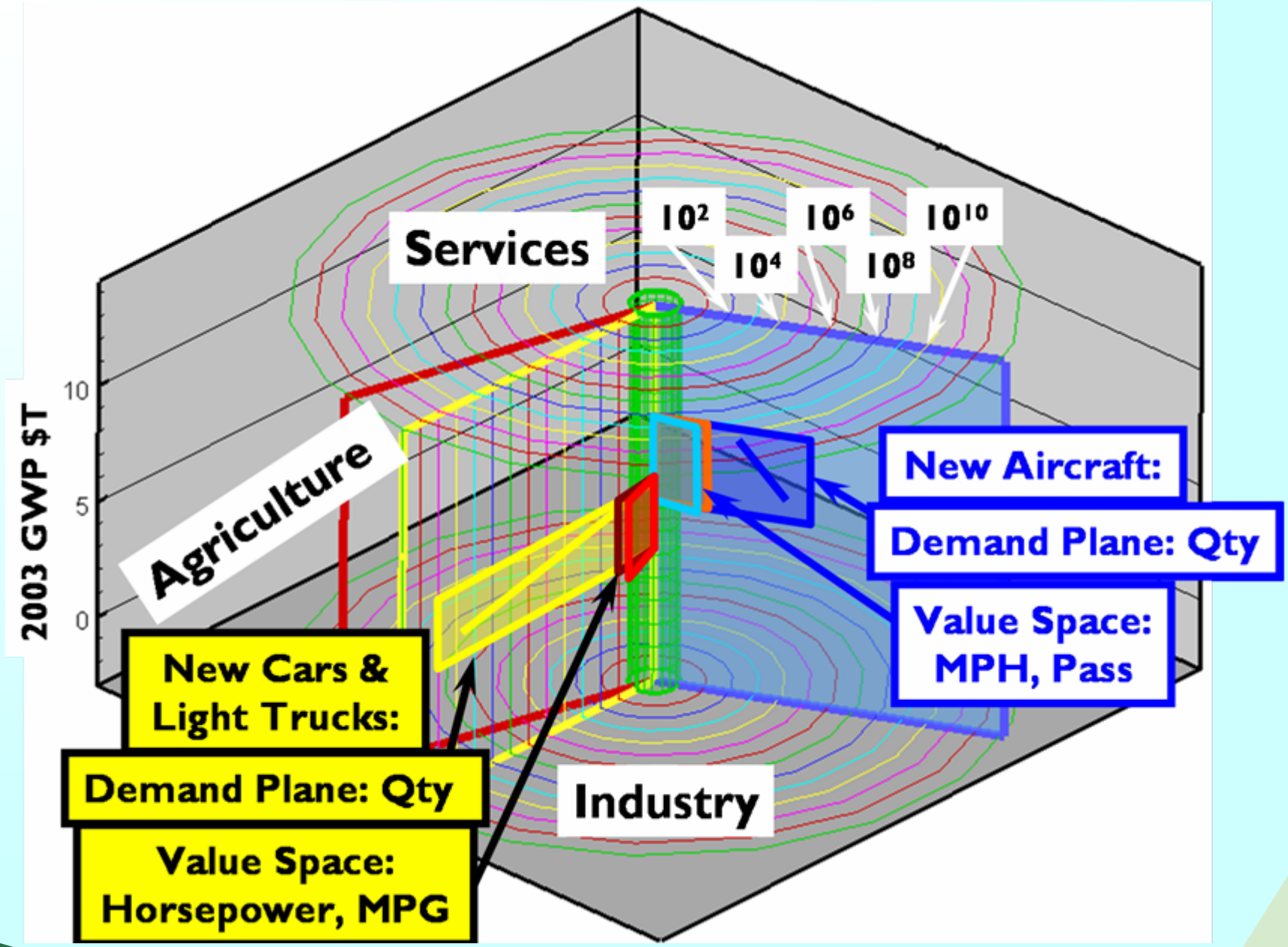
2) Plot Quantity & Value Attributes… These Axes Vary by Market

Theoretically, all Markets may be Simultaneously so Depicted

Multiple Dual-Axis Polar-Log Coordinates



Partial Worldview



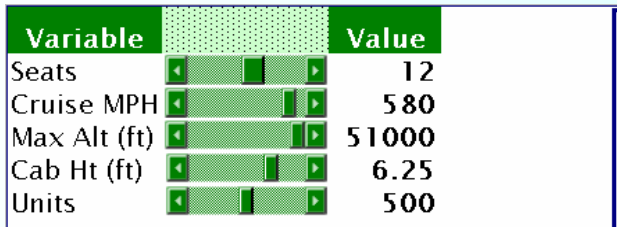
Market Map of Value and Demand

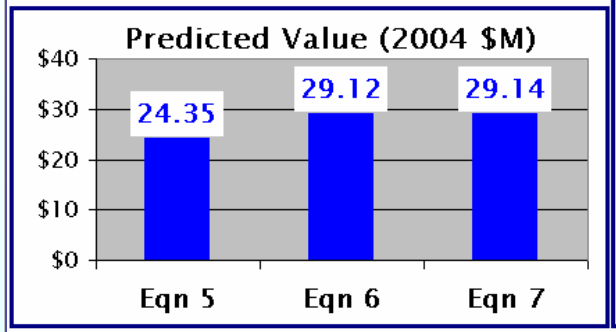
Begin with a Hypothetical Configuration

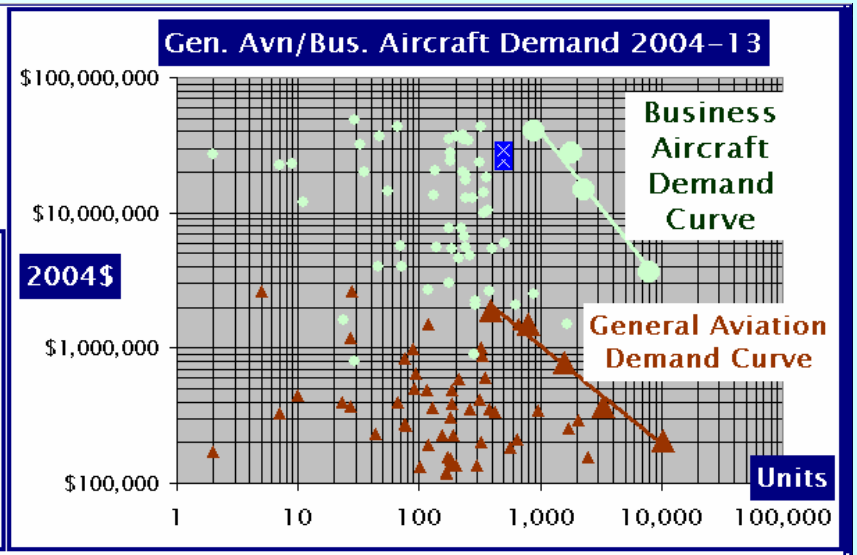
Then Vary Speed

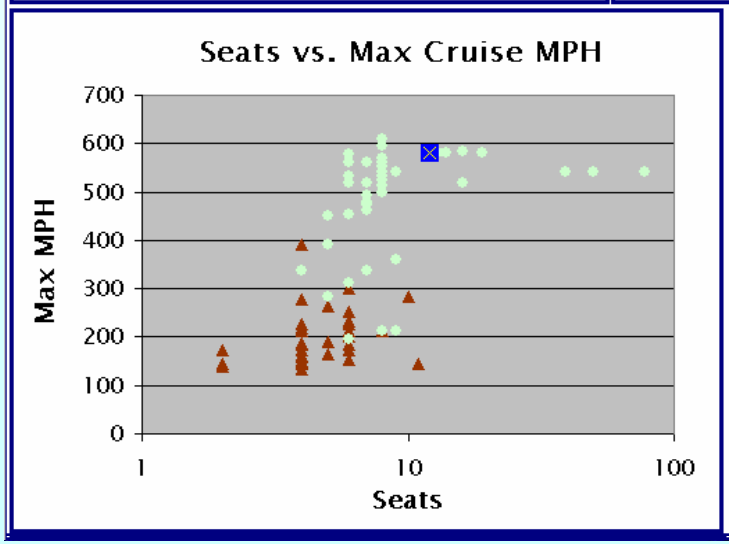
Then Seats

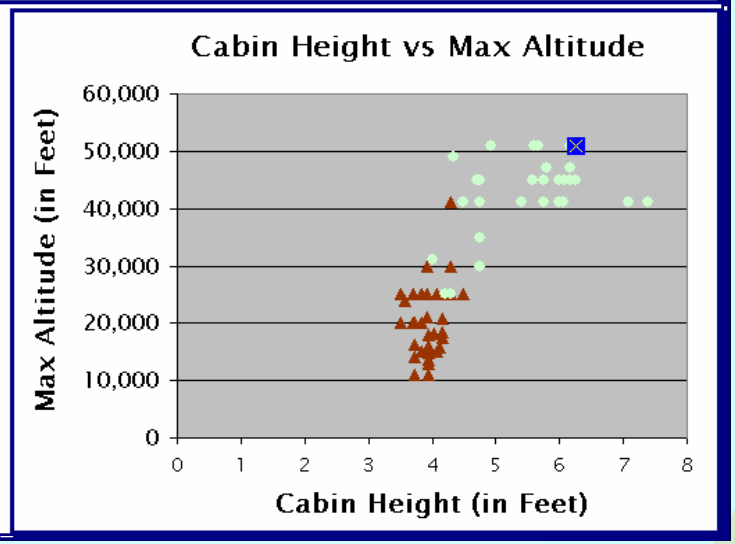
This Configuration Gives Some Distinction on Seats, but is Beyond the Demand Limit











Comparing Value to Cost Across a Variety of Market Openings & Configurations offers Best Design Possibilities

Summary and Conclusions

- **Market Maps are Analogous to Physical Maps**
- **Market Maps Show Competitor Locations**
- **Economic Map Data offers Analysts the ability to**
  - **Find Boundaries**
  - **Find Market Openings**
  - **Estimate Demand**
  - **Estimate Value**
- **An N-Dimensional Log-Polar Coordinate System allows Compression and Expansion of all the World's Market Data**