



PROJECT AIR FORCE

F-22A Post Multi-Year Procurement Options

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Background

- Congress has authorized 183 F-22A fighters, which are procured in existing contracts through 2009
- At issue is what to do after the last unit in lot 9 is produced
 - Shutdown the production line or shutdown and restart at a later date or continue production at full or low rates
- Air Force asked RAND Project AIR FORCE to assess the costs and the effects on the industrial base of different options

Study Objective

- Evaluate alternative courses of action for the F-22A following the delivery of the last unit under the current multi-year contract by assessing
 - Costs of alternate procurement strategies
 - Effects on industrial base

We Analyzed Four Alternatives After Lot 9

Cold Shutdown

- Production line closes permanently

Shutdown-Restart

- Production line closes temporarily

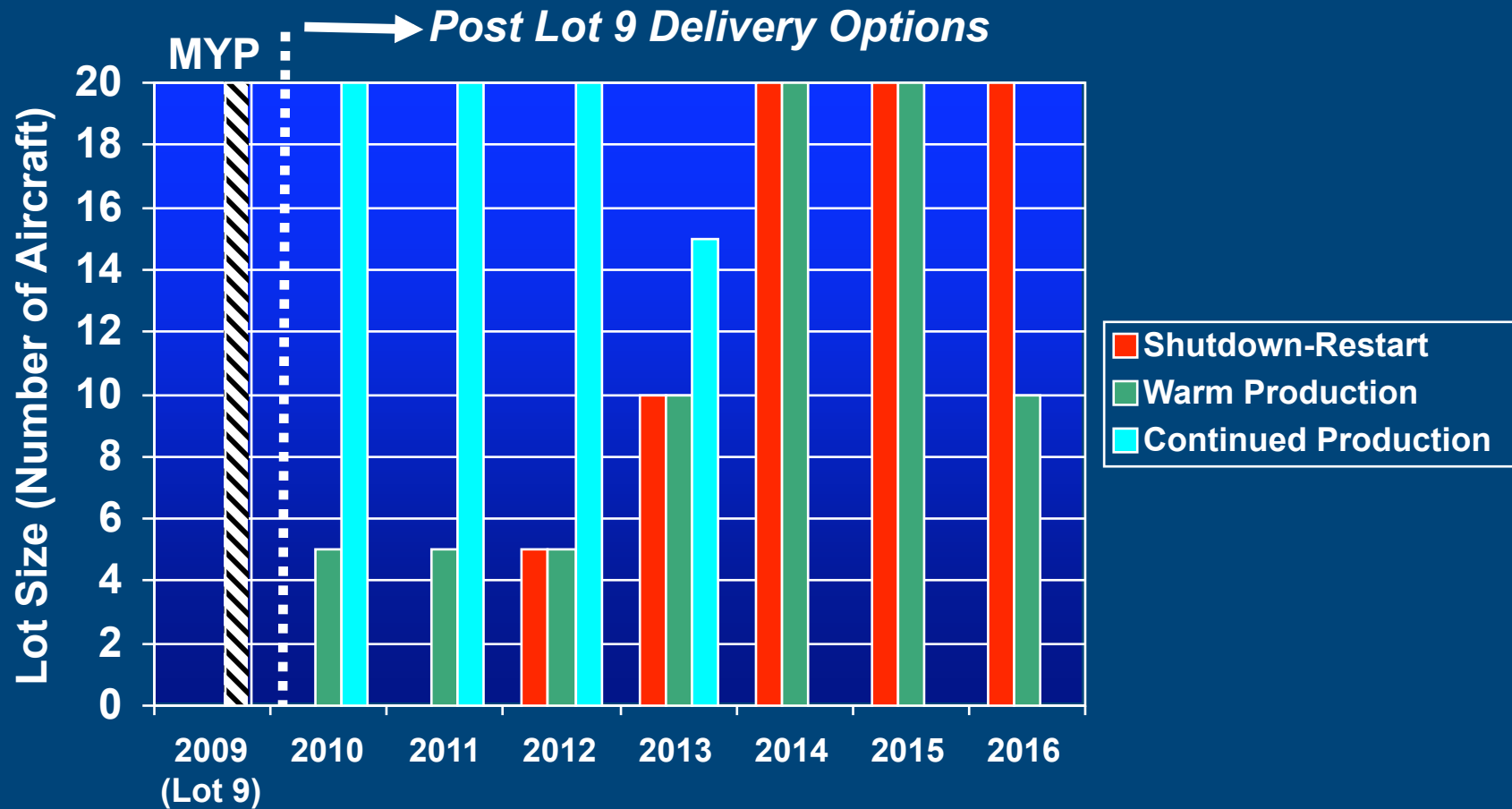
Warm production

- Production line continues but at a reduced rate

Continued production

- Production line continues at current rate

We Assumed Three Production Options, Each Producing 75 Aircraft After Lot 9



Contractor-developed rates and factors do not allow analysis beyond FY2016

Alternatives Will Affect Future Costs in Various Ways

- **Non-recurring costs may include:**
 - Preservation or disposition of tooling, technical information transfer, and facility disposition or preservation
 - Personnel retention, reduction-in-force, rehiring, training, clearances
 - Vendor re-qualification
- **Recurring costs include:**
 - Loss of learning
 - Loss of skilled workers (and resultant inefficiencies)
 - Lower rates of production
 - Increase in overhead rates due to diminished business base
 - Costs such as Program Agile Logistics Support (PALS), Production Support Annual Sustaining (PSAS), Production Support Other (PSO), Other Government Costs (OGC), and other nonrecurring and support costs

Results Are Near Approximations Due to Many Uncertainties

- **Uncertain business base**
- **Rates and factors contractor-developed, not negotiated**
- **No restart experience with a 4th generation fighter or recent examples by the primes**
- **Uncertain number of technical personnel retained for F-22A unique processes and critical technology**
- **Repercussions on supplier base and DMS based primarily on contractors' subjective assessments**
- **Overhead rates are based on contractors' estimates**

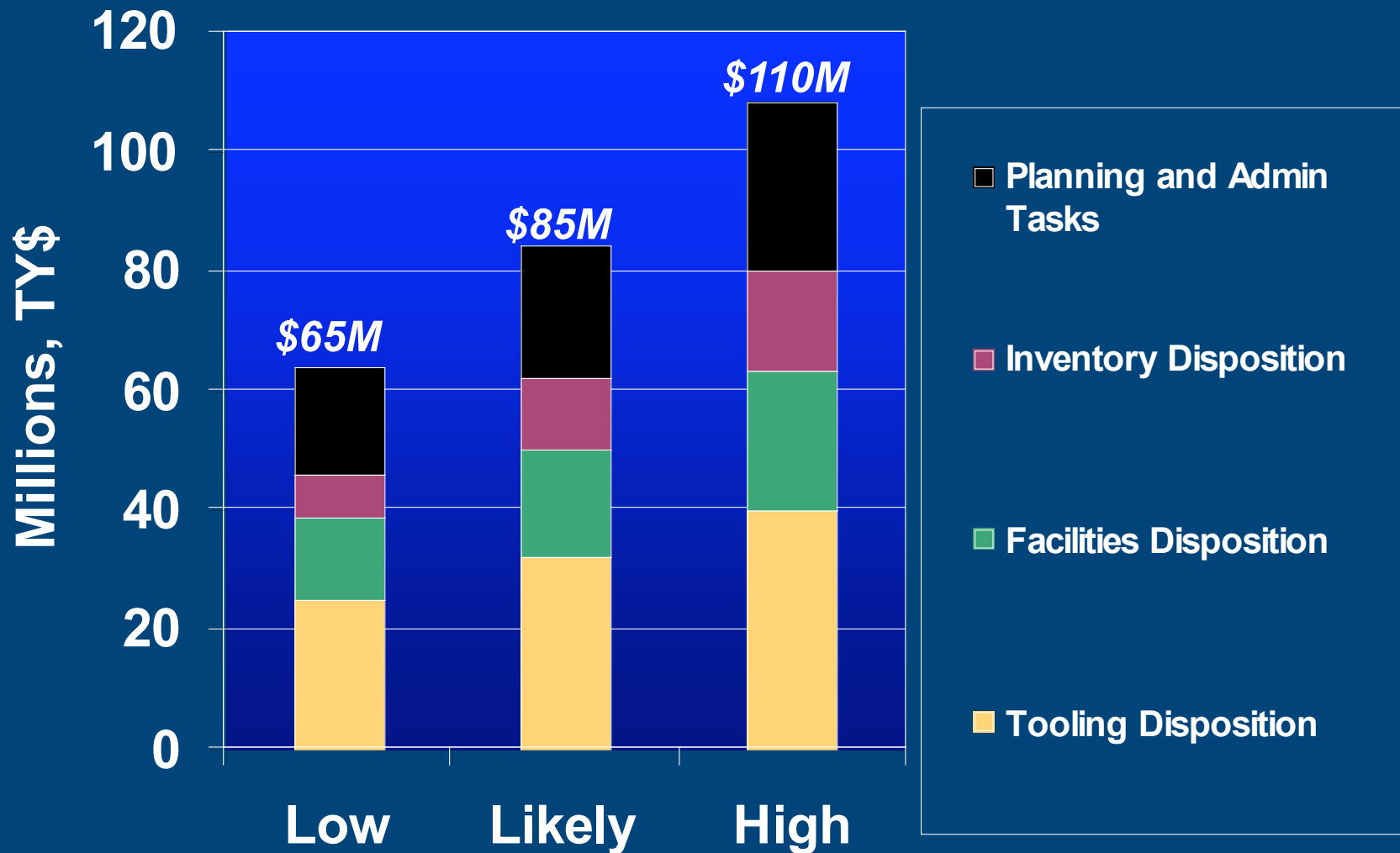
Outline of Today's Presentation

- **What are shutdown and restart costs?**
- **What are costs of 75 aircraft under each production option?**
- **What are the implications of shutdown for the industrial base**
- **Overall findings**

Activities Included in a Production Shutdown

Activity	Cold Shutdown
Tooling	
Accounting	X
Breakdown	X
Removal	X
Tool Scrapping	X
Shipping / Storage	
Line setup / Reorganization	
Personnel	
Reduction in Force	X
Reassignment	X
Rehiring / Retention	
Training	
Clearances	
Facilities	
Clearing	X
Reorganization / Setup	
Planning and admin	X
Inventory disbursement	X
Supplier re-qualification	

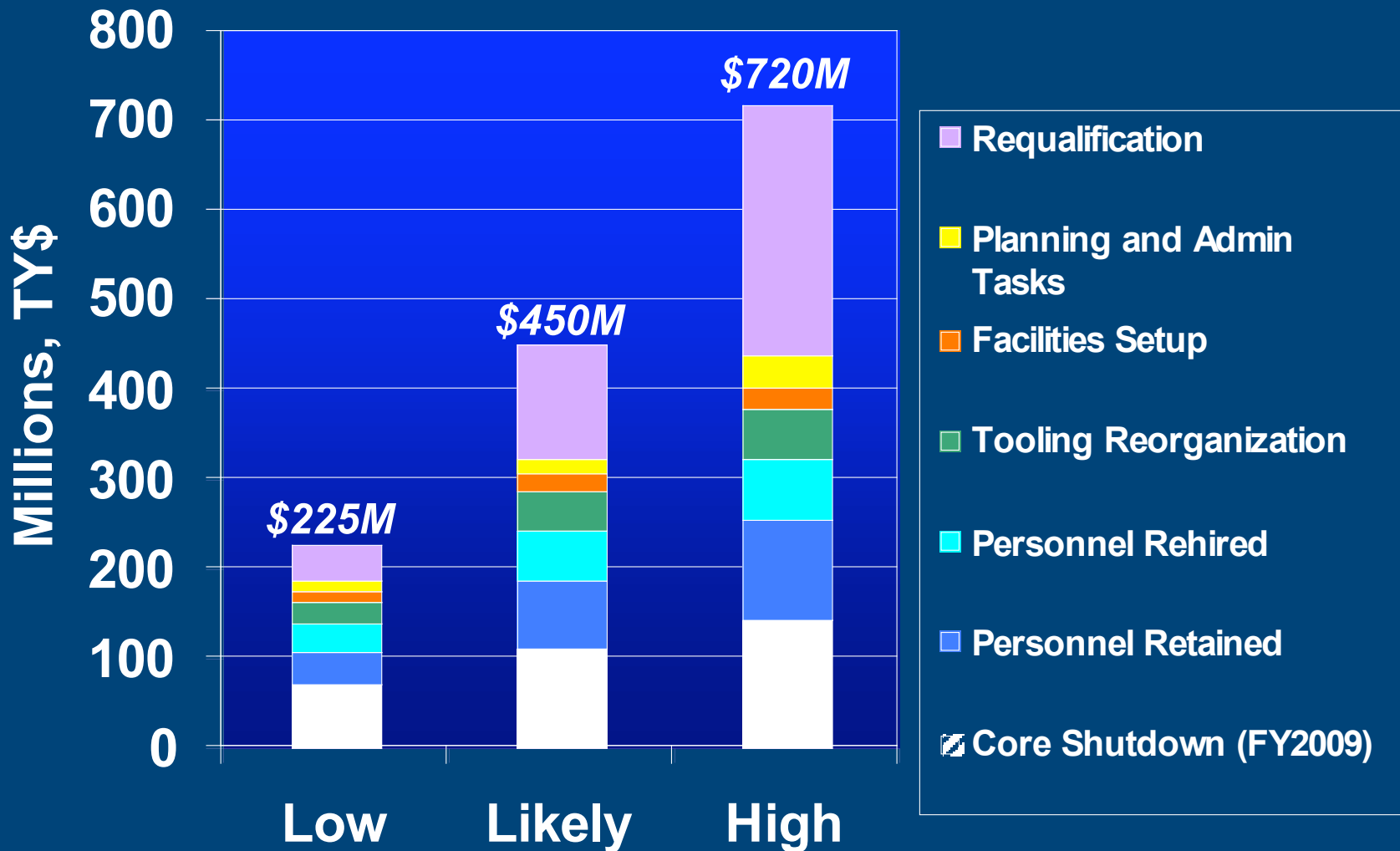
Likely Direct Cost for Cold Shutdown About \$65 to \$110 Million



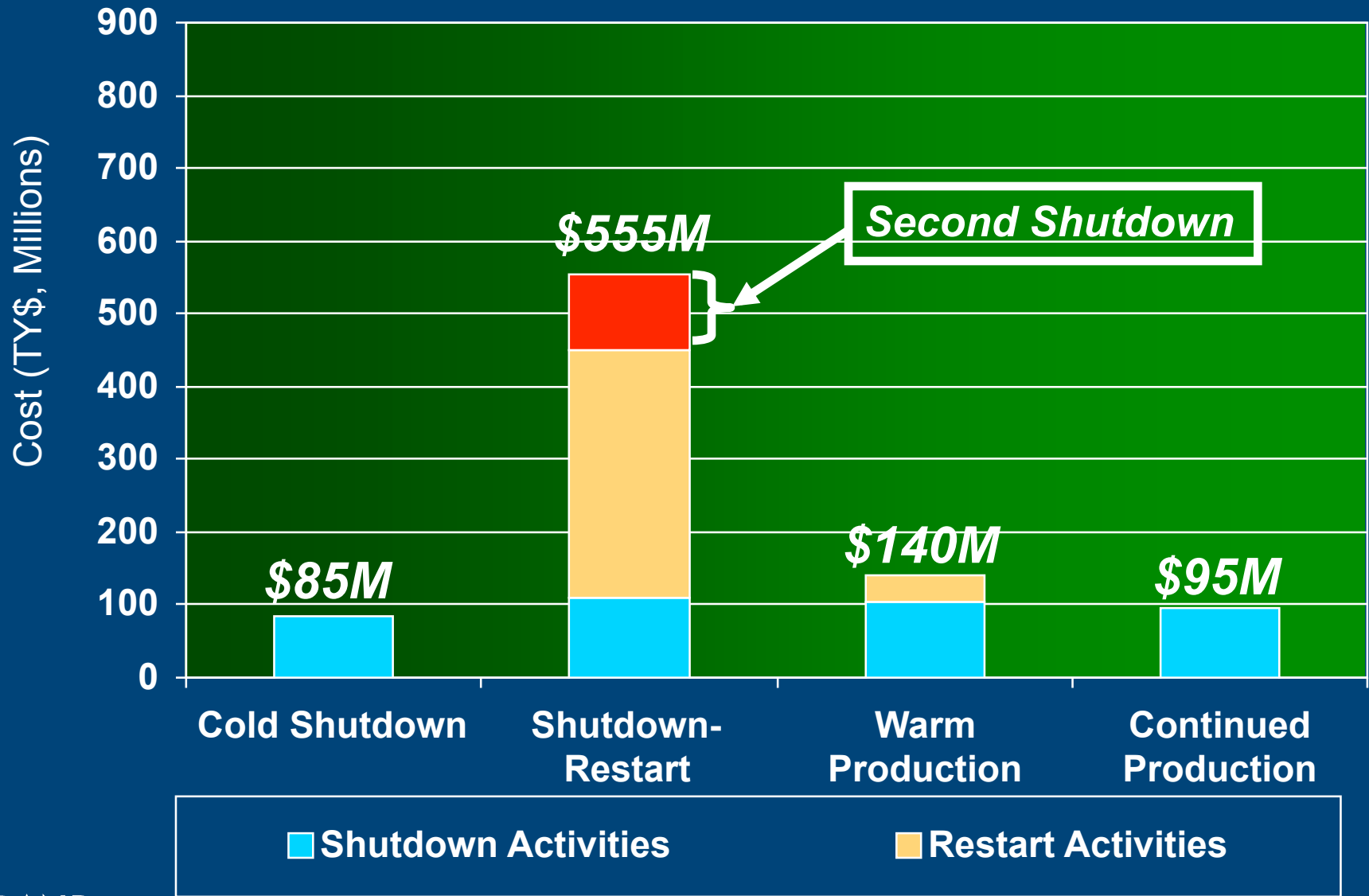
Shutdown-Restart and Cold Shutdown Share Many Activities

Activity	Cold Shutdown	Shutdown-Restart
Tooling		
Accounting	X	X
Breakdown	X	X
Removal	X	X
Tool Scrapping	X	
Shipping / Storage		X
Line setup / Reorganization		X
Personnel		
Reduction in Force	X	X
Reassignment	X	X
Rehiring / Retention		X
Training		X
Clearances		X
Facilities		
Clearing	X	X
Reorganization / Setup		X
Planning and admin	X	X
Inventory disbursement	X	X
Supplier re-qualification		X

Shutdown-Restart Costs Range From \$225 to About \$720 Million



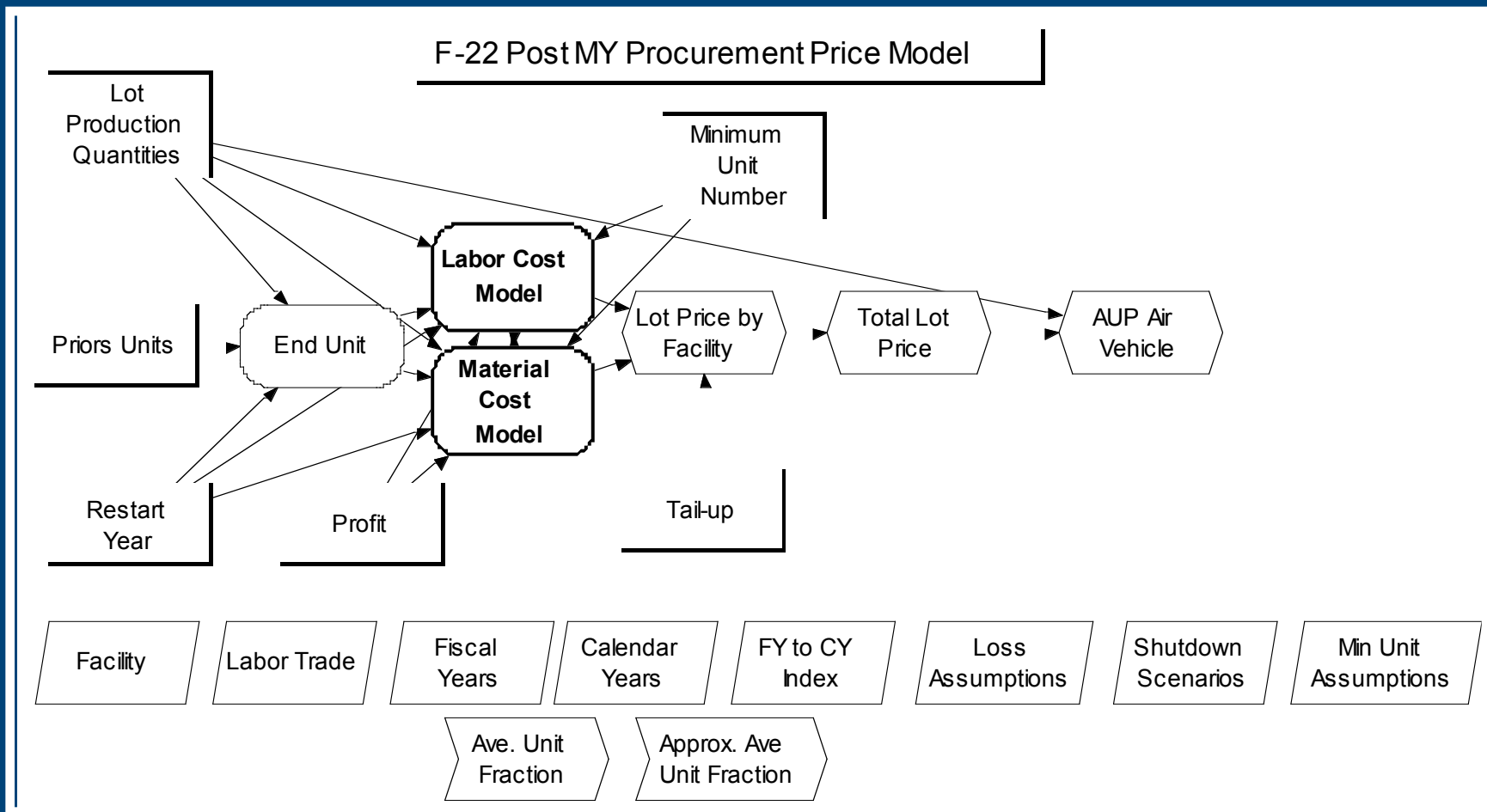
All Options Include Shutdown Costs, But Shutdown-Restart Includes Another Shutdown After the Restart



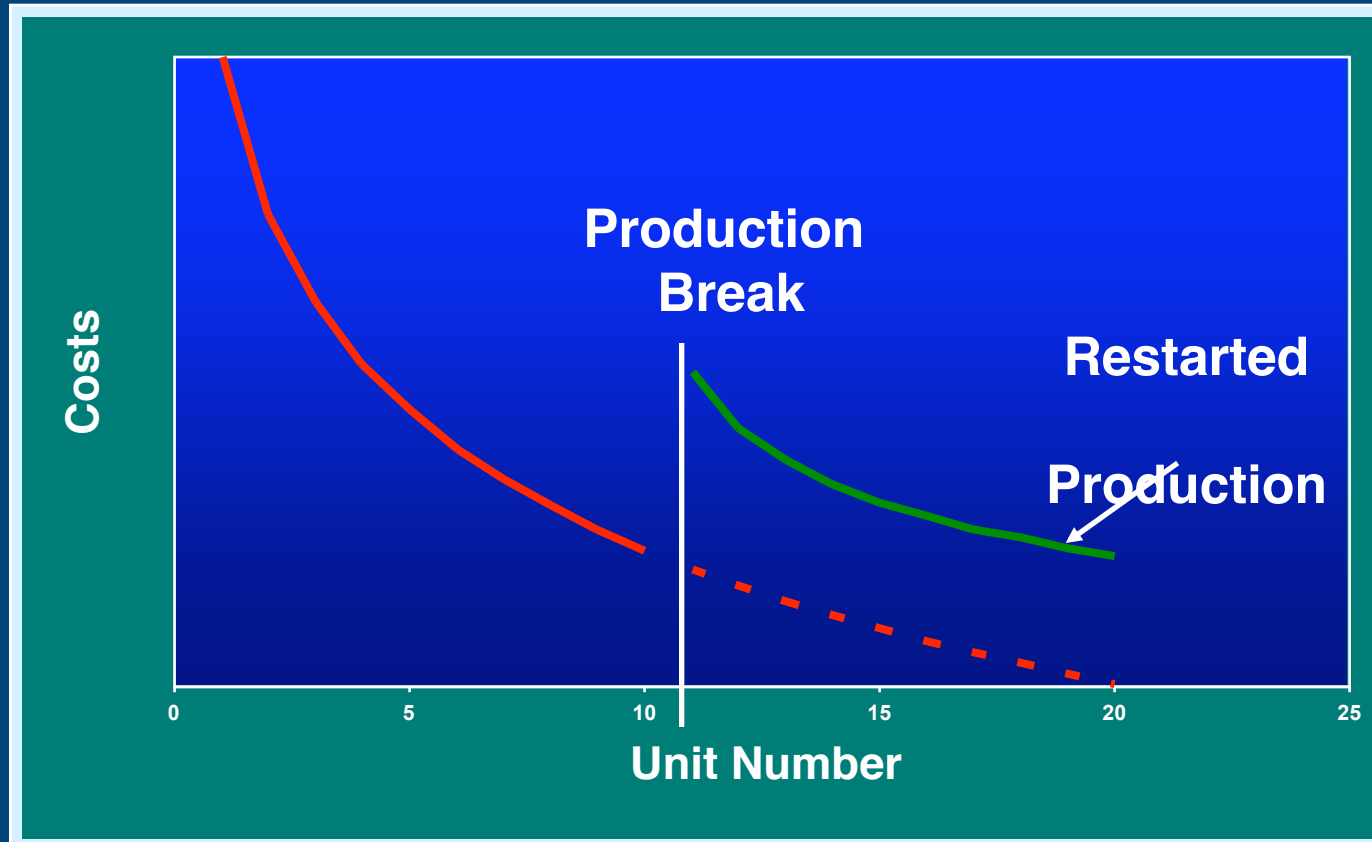
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Cost Model Used to Calculate Average Unit Flyaway Price Implications

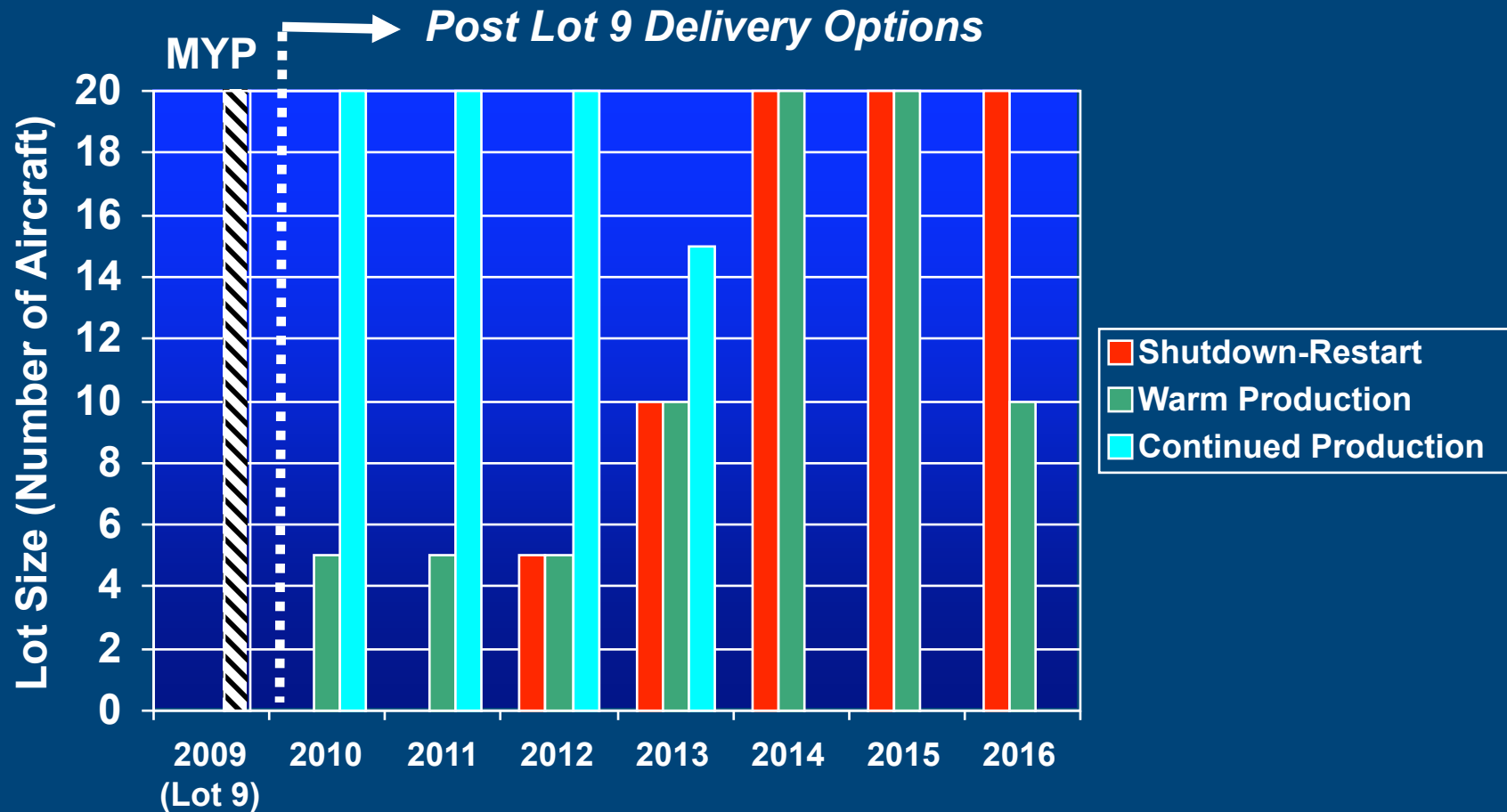


After a Shutdown, the Cost Improvement Curve Shifts, Then Flattens

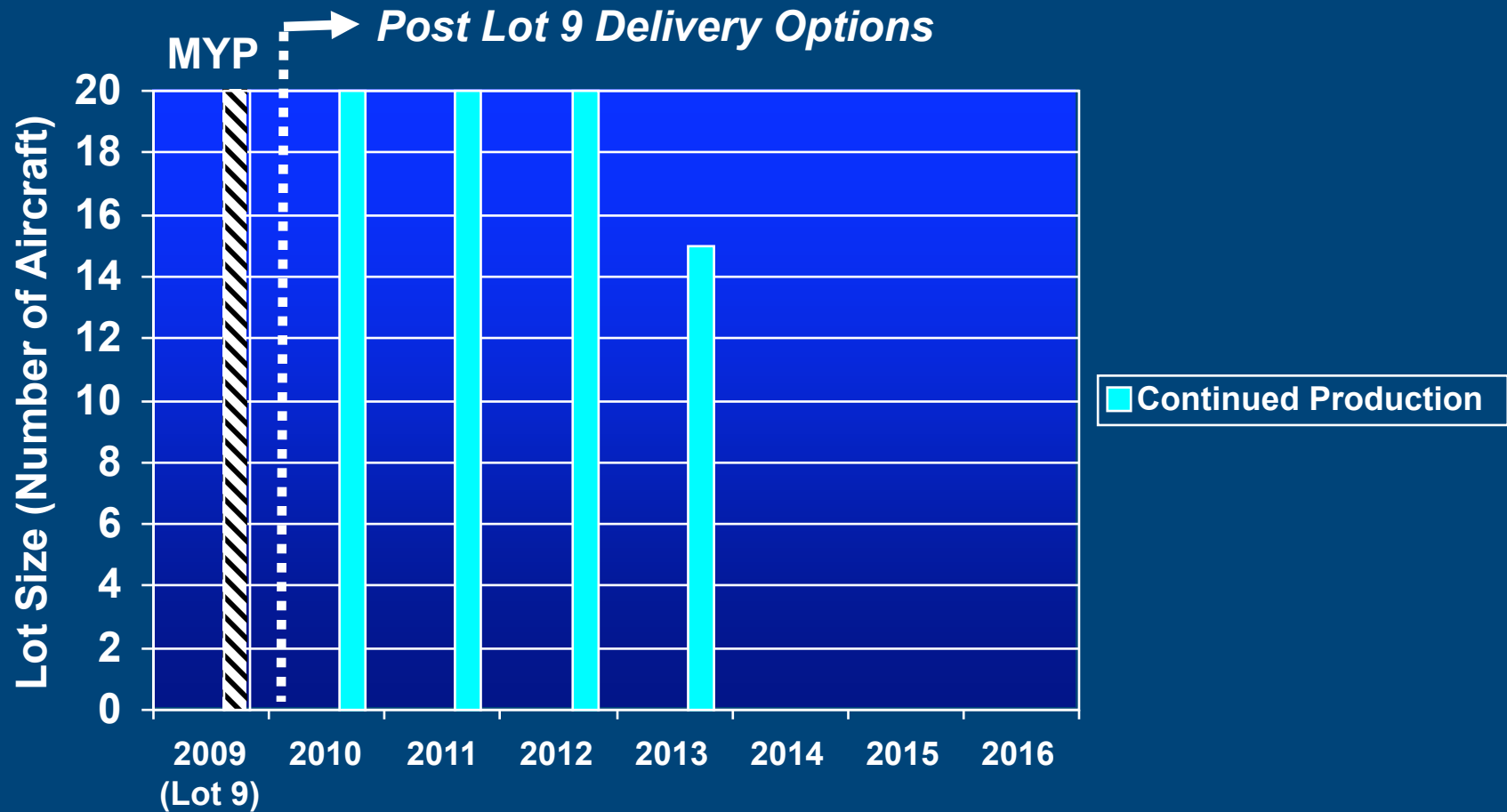


Source: *Reconstituting a Production Capability*, Birkler, et al.

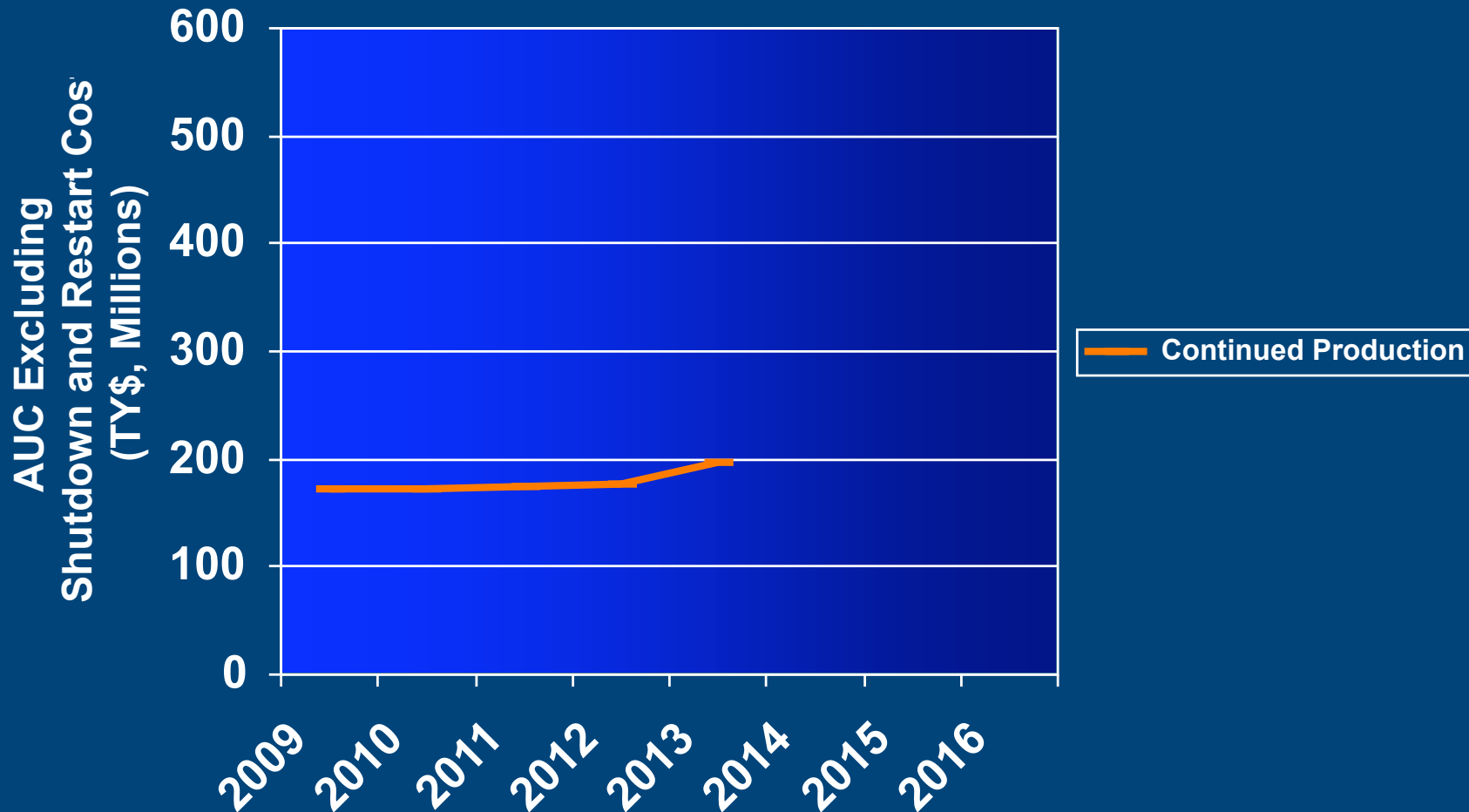
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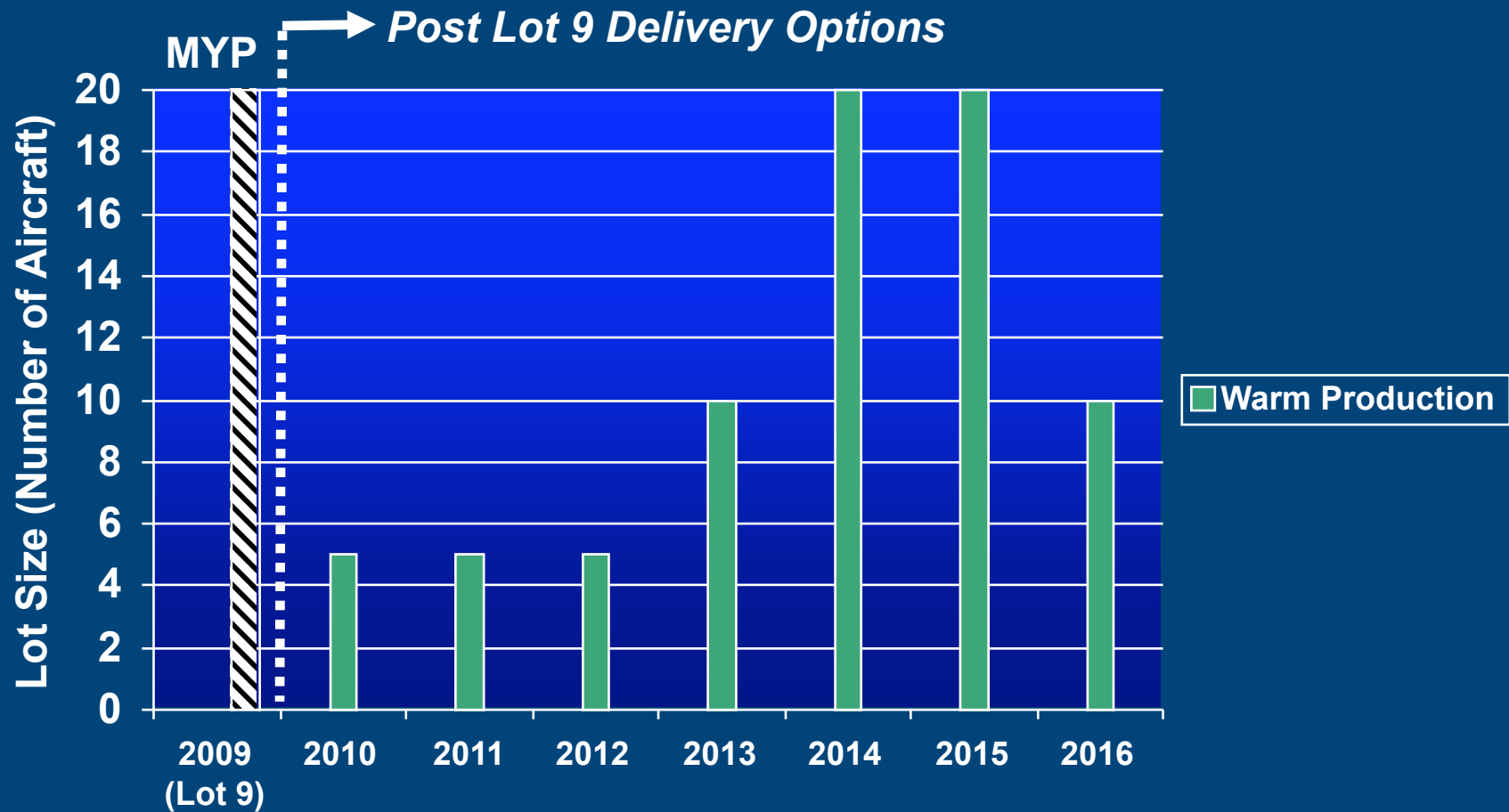
Production Continues for an Additional 75 Aircraft Buy After Lot 9



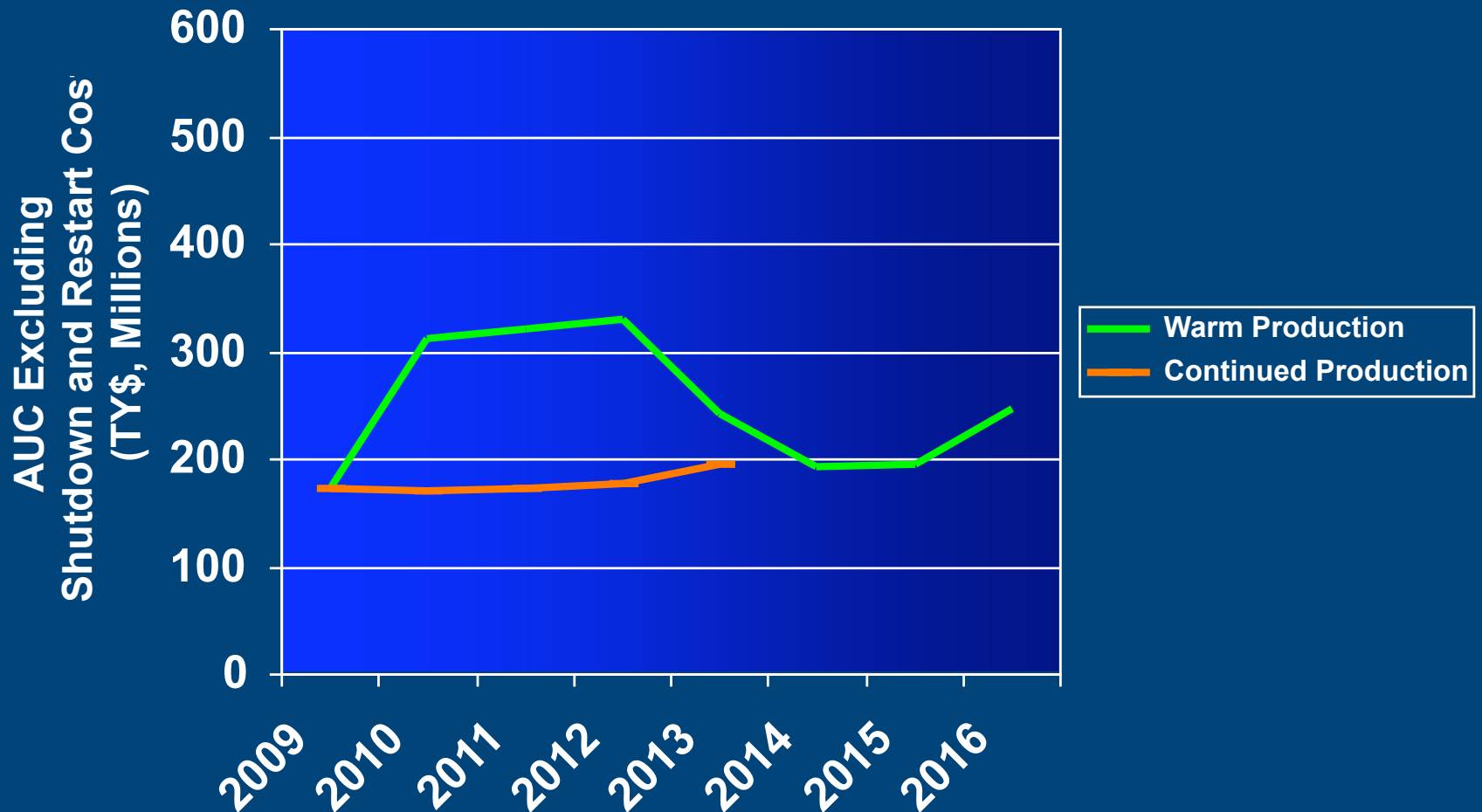
For Continued Production Option, AUPC Remains Virtually Constant



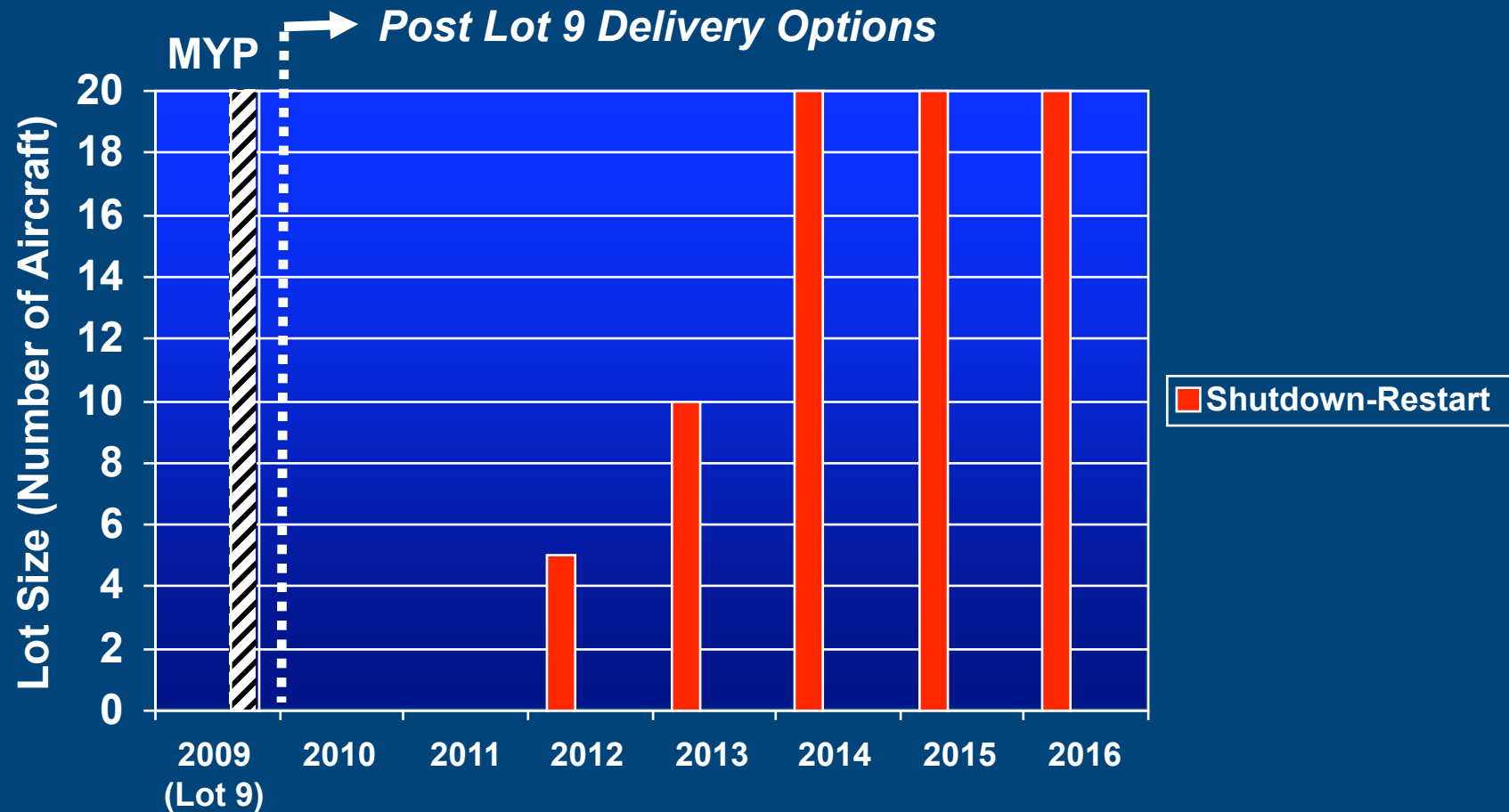
Warm Production Rate Is 5 Aircraft per Lot for Three Years



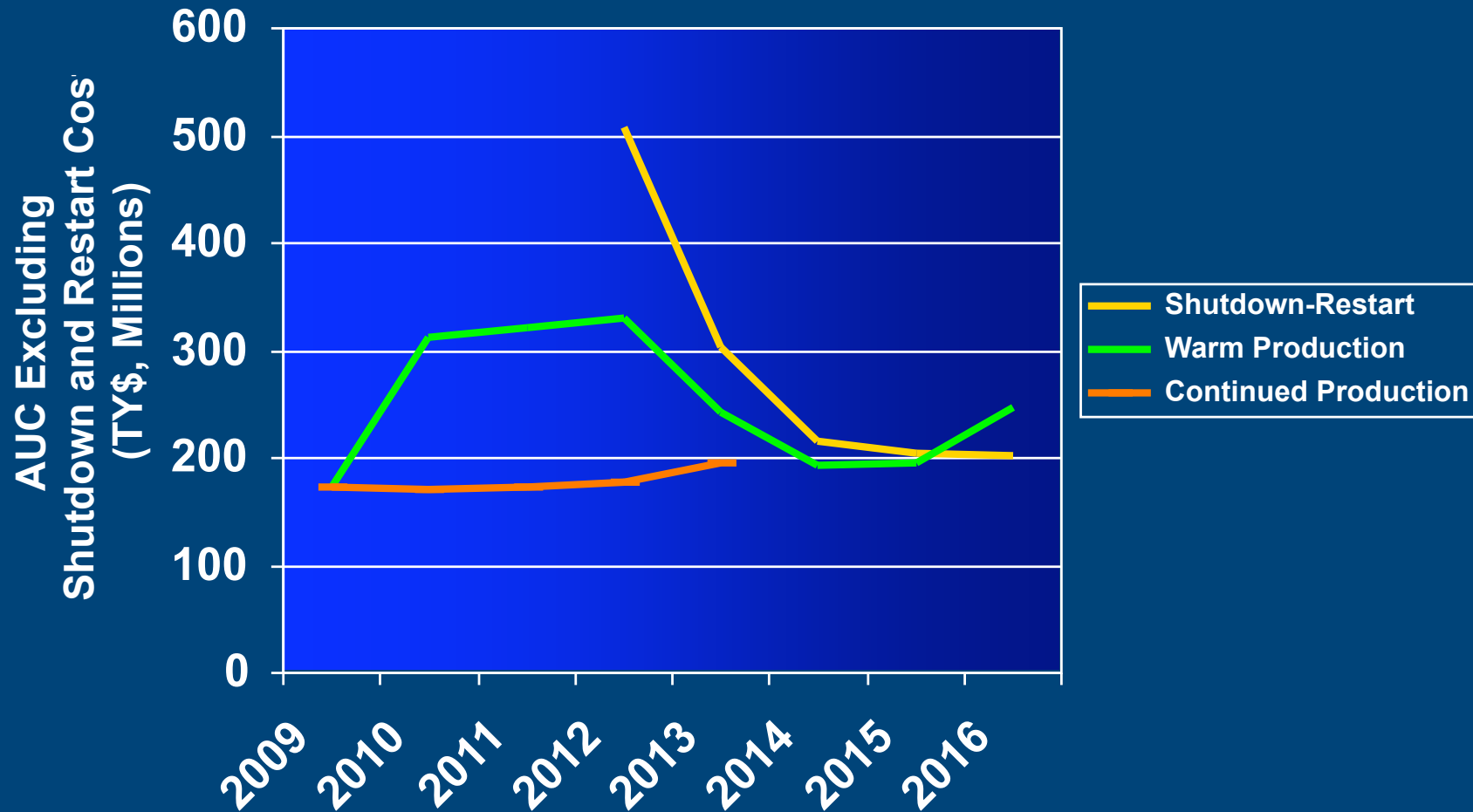
AUPC Increases Due to Low Production Rate in Warm Production Option



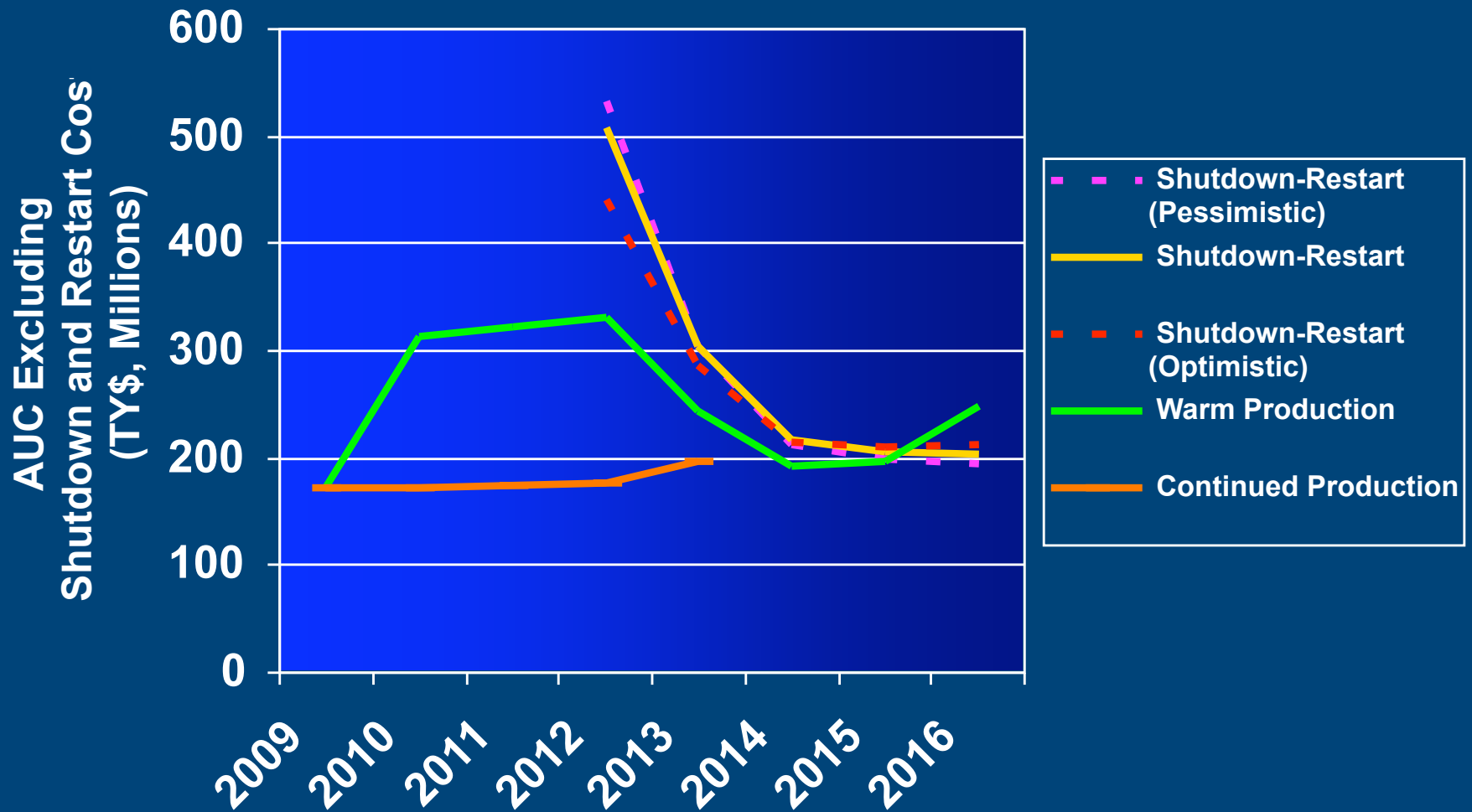
After Two Year Hiatus, Restart with Low Rate Production and then Ramp Up



AUPC Increases Substantially After 2-Year Production Gap

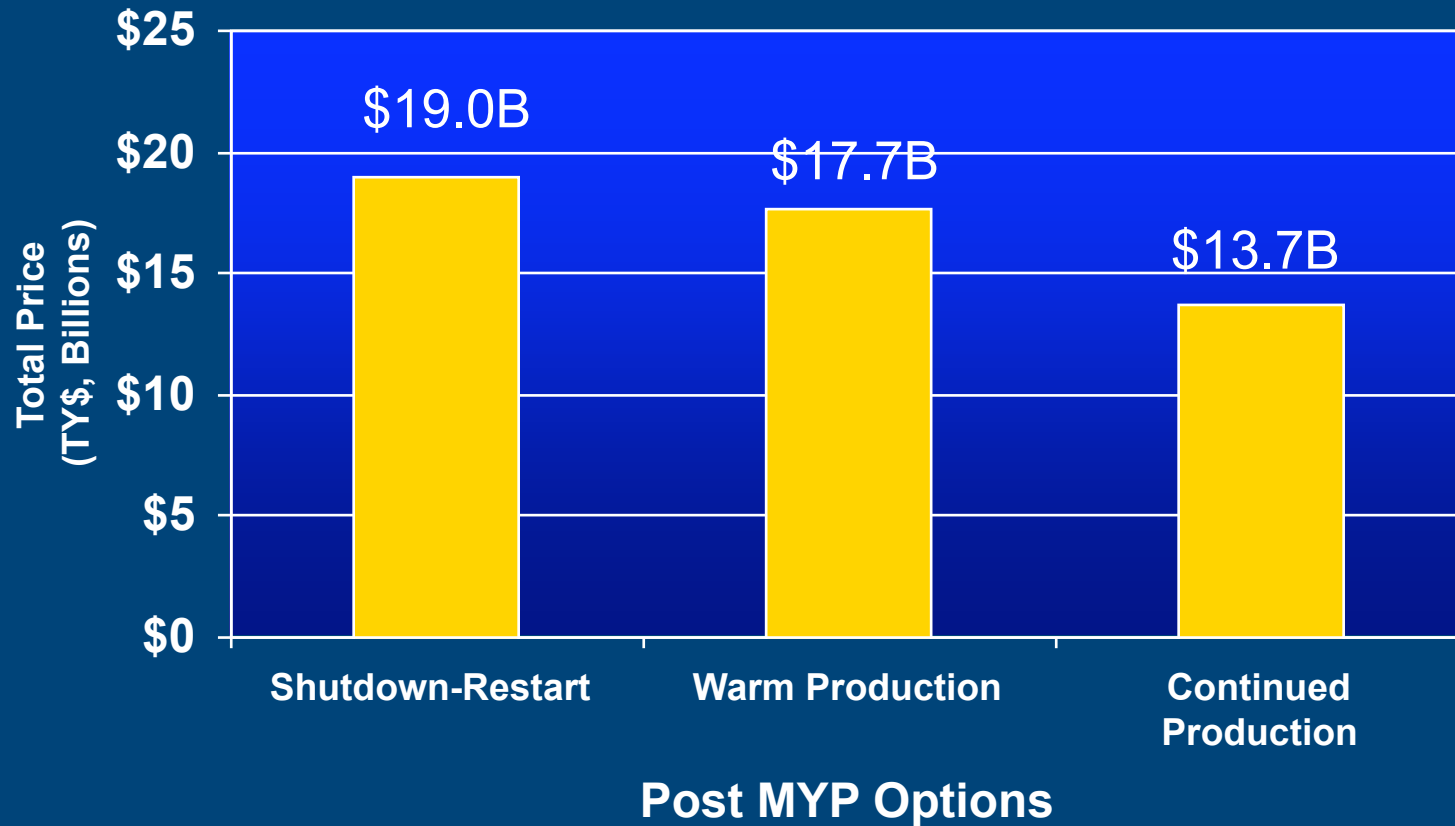


Loss-of-Learning Sensitivity Analysis After Production Gap



RAND *The range is based on historical restart experience*

Comparison of Total Price of 75 Additional Units



Note: Average Loss-of-Learning

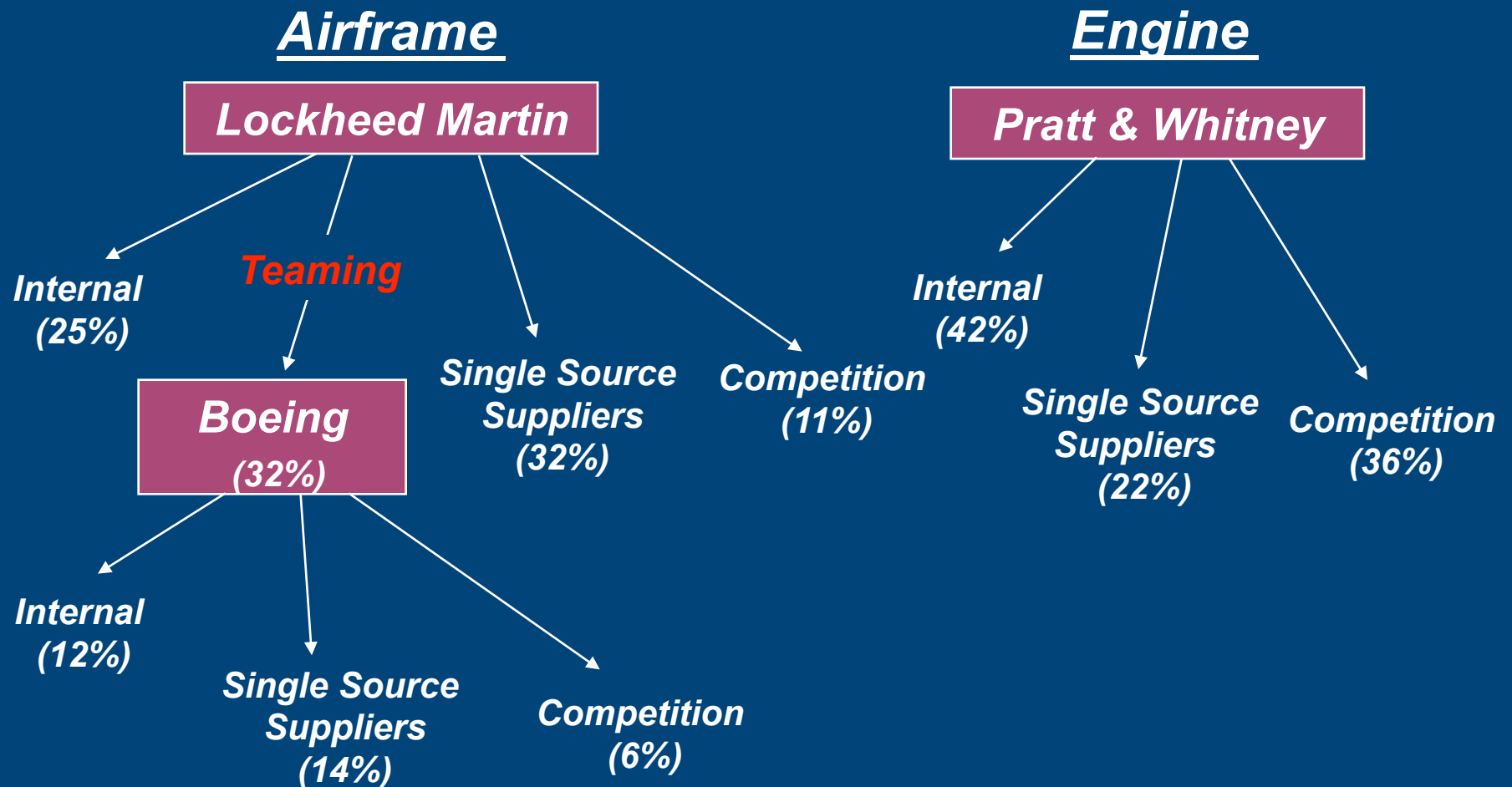
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Industrial Base Assessment Overview

- **Industrial bases assessment examines only the effect of a production hiatus**
- **Vendor assessment surveys provided to the supply managers at each prime. Survey requested information for 346 vendors (35% of the vendor base and over 90% of vendor value).**
- **Subjective vendor assessment made by supply managers at each of the primes forecasts vendor availability**
- **Considered common assessment criteria set for vendors: exit business, product redesign, process unavailable, labor/skill unavailable, security clearances issue, facility/tooling concerns**

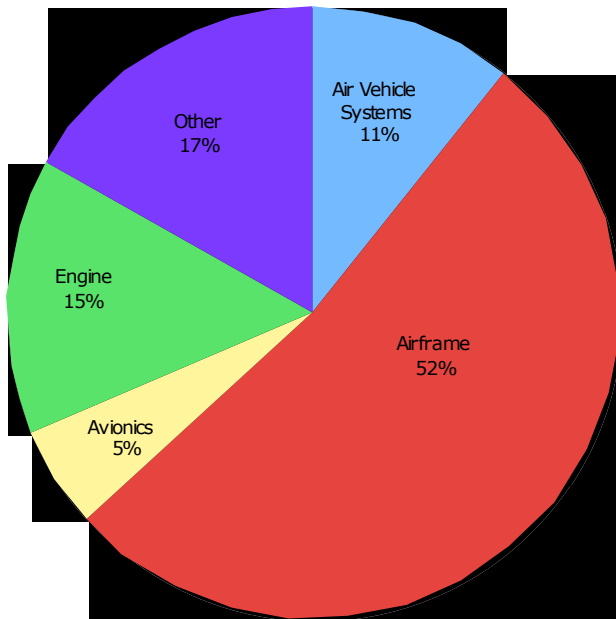
Primes Outsource About 60 Percent of the Airframe and Engine



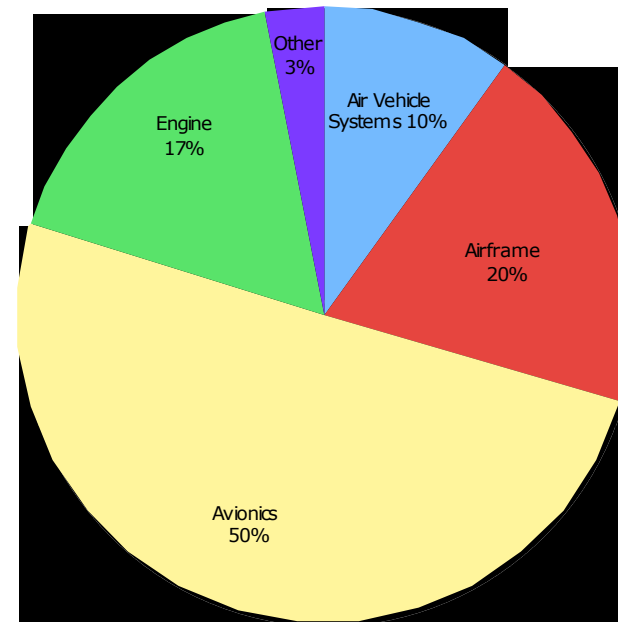
Note: Percentages based on billed material costs. Data for Lockheed Martin and Boeing taken from D. King, J. Driessnack, "Analysis of Competition in the Defense Industrial Base: An F-22 Case Study," *Contemporary Economic Policy*, Vol. 5, No. 1, January 1, 2007, 57-66. Data for Pratt & Whitney provided to RAND in December, 2007.

5% of F-22A Vendors Account for Half the Vendor Value

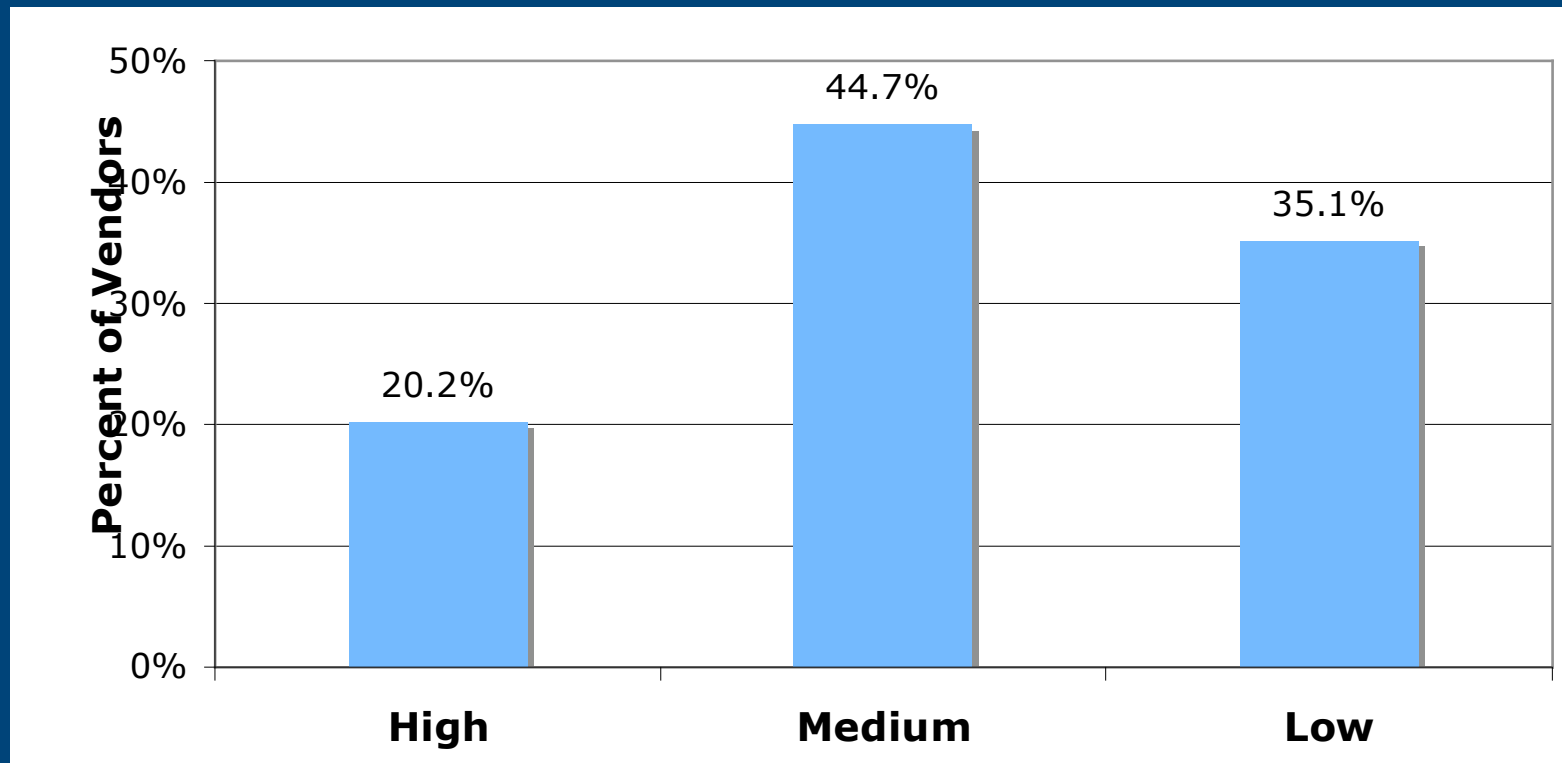
Percent of Vendors by System



Percent of Vendor Value by System



Primes See About 20% of Vendors Have Greater Chance of Issues That Compromise Their Availability Following Production Gap...

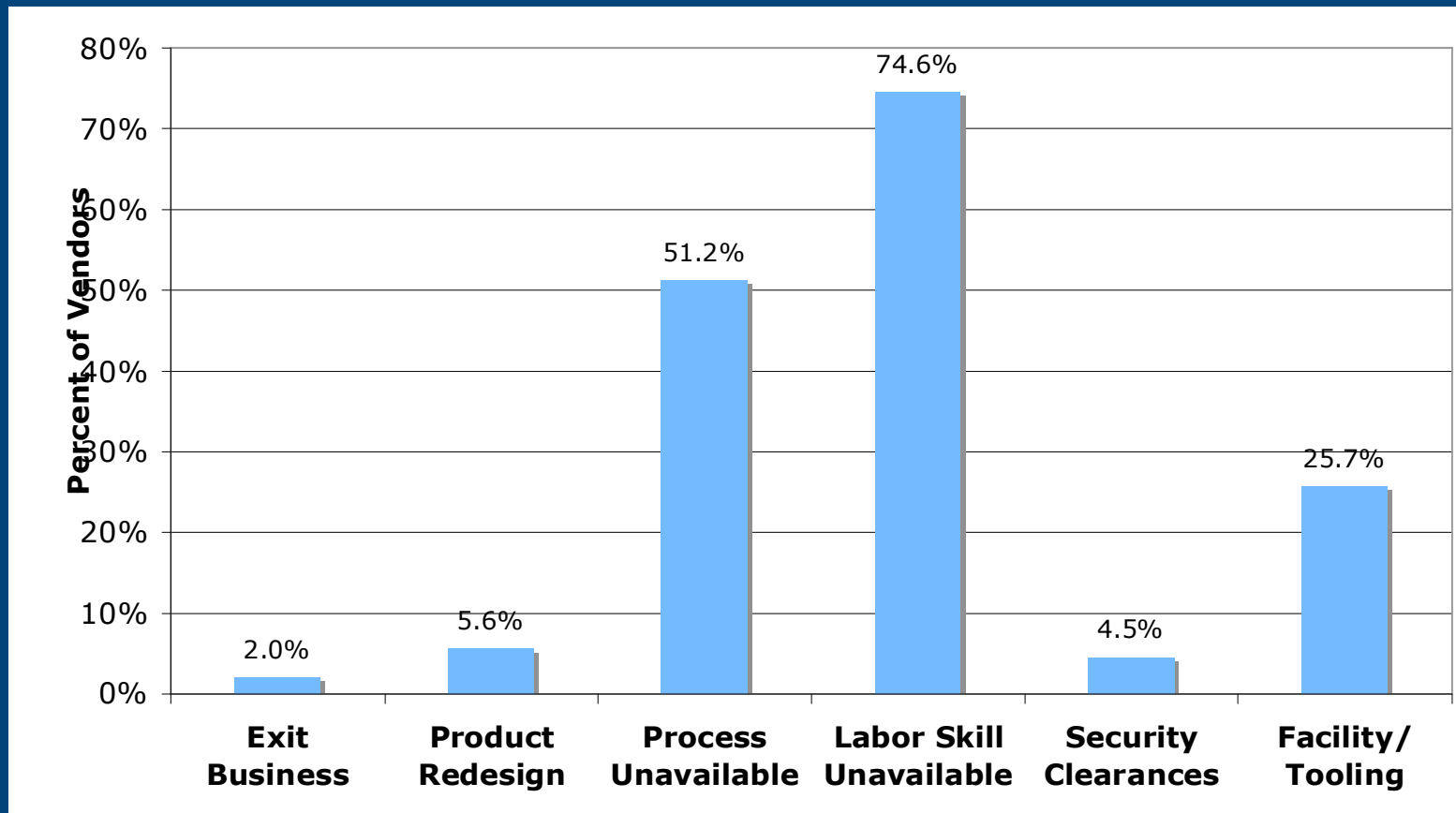


High: A 50% chance or greater of a vendor issue arising upon restart that would compromise their availability.

Medium: Approximately 10 to 50% chance of a vendor issue arising upon restart that would compromise their availability.

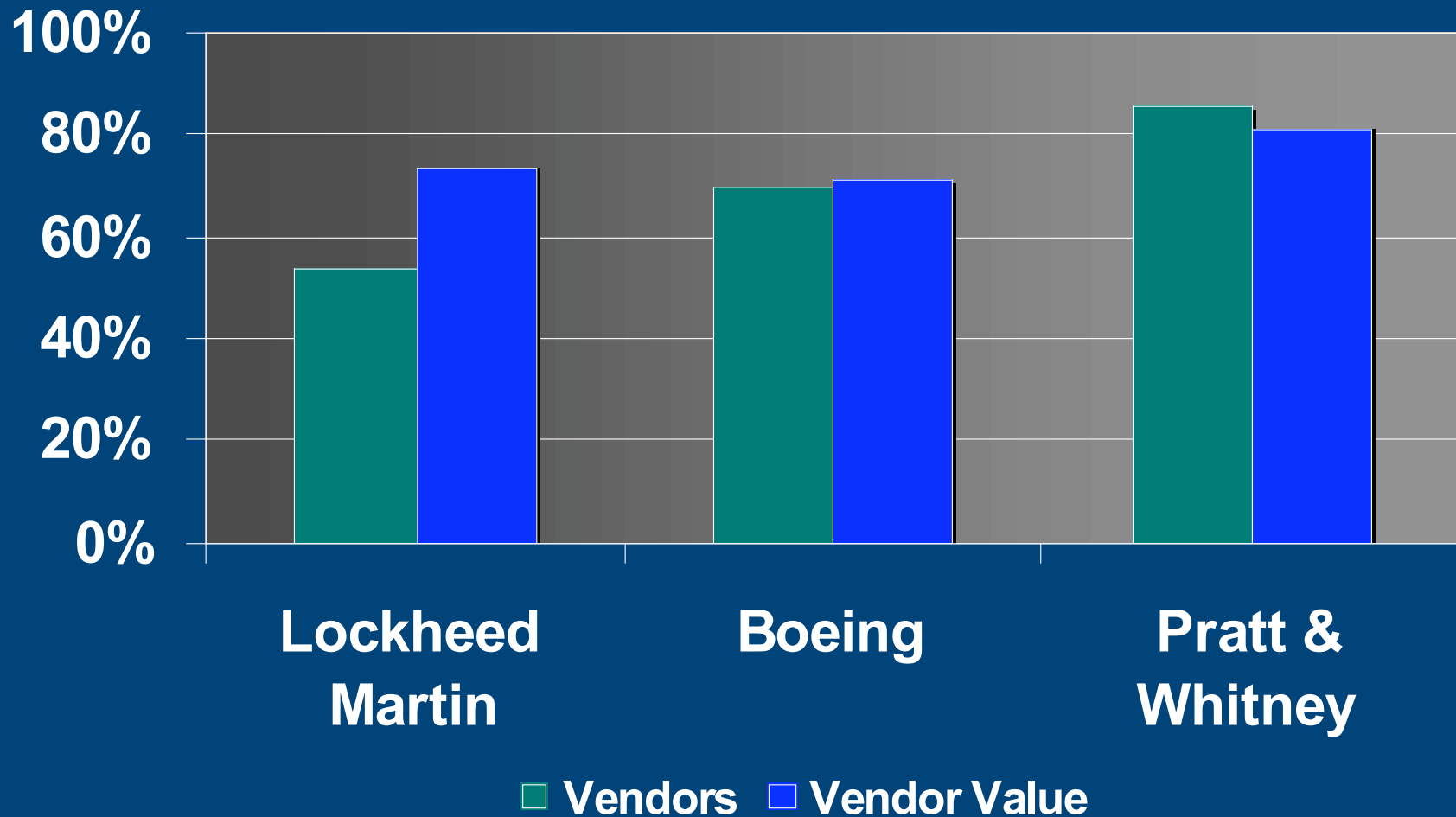
Low: Less than a 10% chance of an issue arising upon restart that would compromise their availability.

Few Vendors Likely to Exit Business But Other Issues Drive Concerns Over Availability...



Note: Figure reports concerns regarding vendor availability following a production gap. Data for Pratt & Whitney not available.

However, Many Vendors Involved in F-22A Production Are Also Involved in F-35 Program



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Summary of Our Findings

Options (2010-2016)	Shutdown and Restart Likely Direct Costs (TY\$)	Flyaway Unit Costs* (\$TY)	AUC* (\$TY)	TOTAL (\$TY)
Shutdown	85 M	—	—	0.5 B**
Shutdown -Restart	555 M	200 M	250 M	19.0 B
Warm Production	140 M	170 M	235 M	17.7 B
Continued Production	95 M	145 M	180 M	13.7 B

* Average over the last 75 units

** \$0.5B is the rounded sum of \$85M direct shutdown cost, and \$365M in sustainment costs over FY2010-FY2016

Each Option Has Different Implications for the Air Force — All Cost Money

If:

Then:

Therefore:

AF: shutdown

Cost: ~\$85M

Suppliers shutdown permanently and tooling and equipment disposed of

AF must decide if future SLEP or major mod are likely; if so, what tools, equip & data must be saved (add. \$ req.)

AF: shutdown-restart

Cost: ~\$450M

Restart planning must begin now. AF needs authorization to manage suppliers that would otherwise need to be re-qualified

Preserves production capability, but aircraft will be on average 40% more expensive over next 75 units

AF: warm production

Cost: ~\$1.5B for the first 5 aircraft

Supplier shutdown must be mitigated through advance procurement funding at start of FY2009

Keeps production line open, but aircraft will be on average 30% more expensive over next 75 units



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