



Multi-Function Phased Array Radar Symposium

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Five Operating Sectors

Aerospace Systems



Large Scale Systems Integration

C⁴ISR

Unmanned Systems

Airborne Ground Surveillance / C2

Naval BMC2

Global / Theater Strike Systems

Electronic Combat Operations

ISR Satellite Systems

Missile Defense Satellite Systems

MILSATCOM Systems

Environmental & Space Science Satellite Systems

Directed Energy Systems

Strategic Space Systems

Electronic Systems



Radar Systems

C⁴ISR

Electronic Warfare

Naval & Marine Systems

Navigation & Guidance

Military Space

Government Systems

Information Systems



Command & Control Systems

Network Communications

Intelligence, Surveillance & Reconnaissance Systems

Enterprise Systems and Security

IT/Network Outsourcing

Intelligence

Federal, State/Local & Commercial

Homeland Security & Health

Shipbuilding



Naval Systems Integrator

Surface Combatants

Expeditionary Warfare Ships

Auxiliary Ships

Marine Composite Technology

Coast Guard Cutters

Commercial Ships

Nuclear Aircraft Carriers

Nuclear Submarines

Fleet Maintenance

Aircraft Carrier Overhaul & Refueling

Technical Services



Systems Support

Base and Infrastructure Support

Range Operations

Training and Simulations

Technical and Operational Support

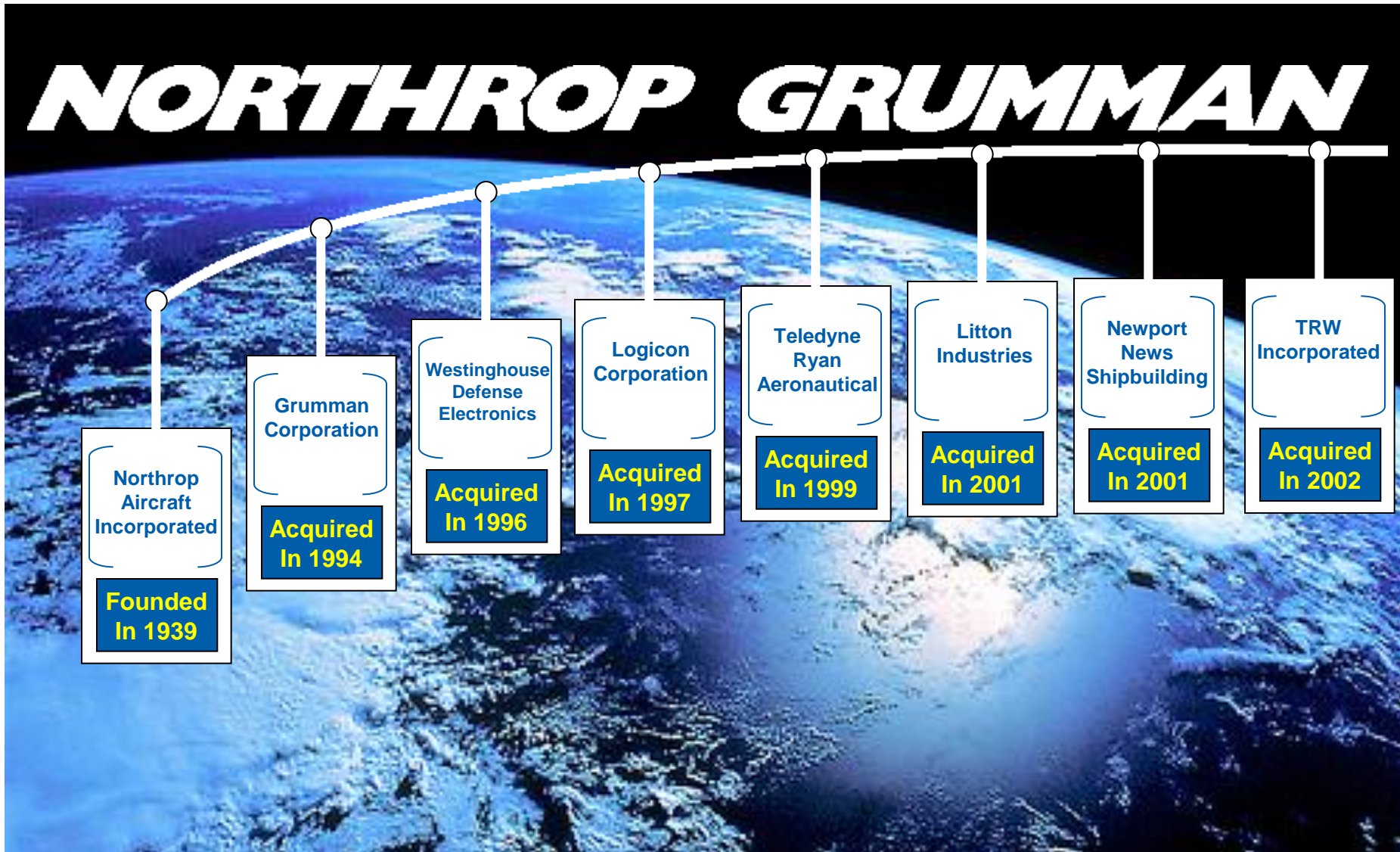
Live, Virtual and Constructive Domains

Life Cycle Optimization

Performance Based Logistics

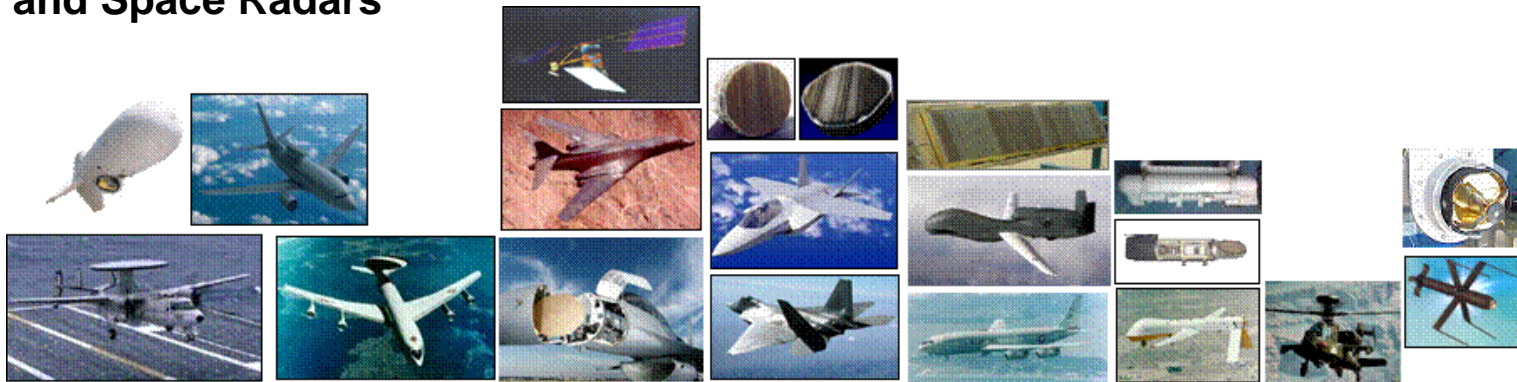
Lead Support Integrator (LSI)

Northrop Grumman Heritage

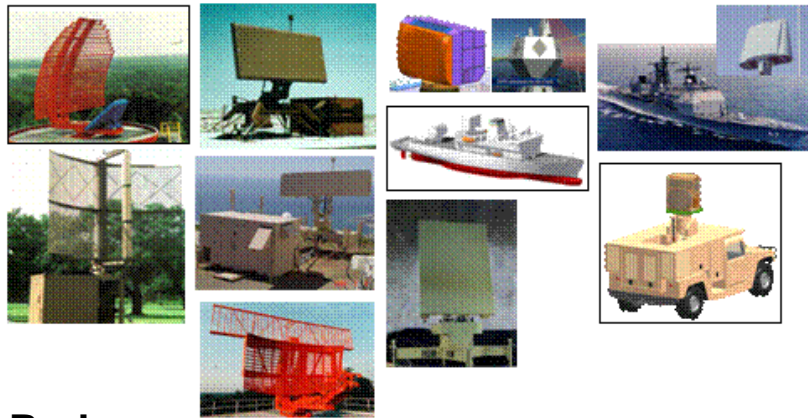


NGC Radar Products Span RF Spectrum

Air and Space Radars



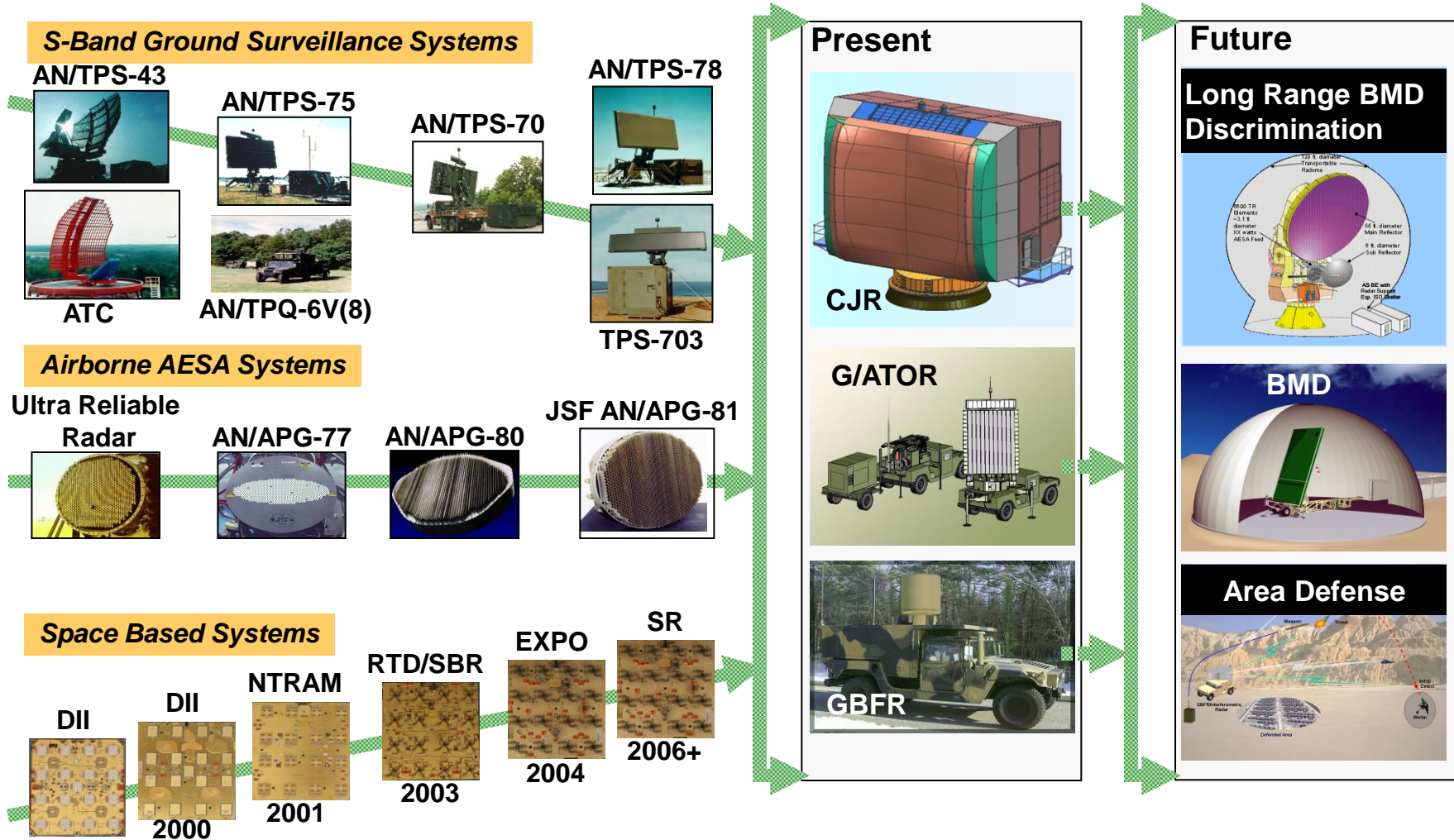
Surface Radars



Across All Missions and Domains

- Airborne Tactical Radars
- Air Surveillance Radars
- Space Surveillance Radars
- Land Based Surveillance Radars
- Naval Air/Missile Defense Radars

Multi-function RF Sensor Evolution



- Significant experience with transportable ground based radar systems
- Leveraging strong technology and low cost production with economy-of-scale benefits

Trends in Modern AESA Architecture and Operational Effect

Packaging: Thin, Lightweight, Conformal Antennas. Fewer parts, LRUs, LRMs

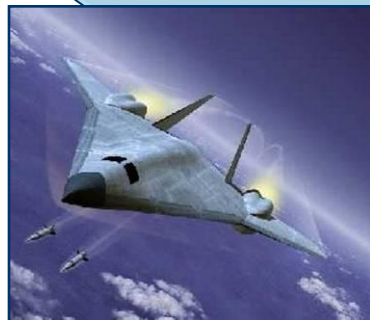
Bandwidth: Ever-increasing full and instantaneous bandwidth



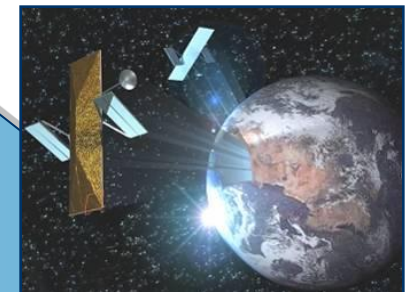
Logistics

- Reliability & Maintainability Focus
- Commonality among Systems
- Depot/Logistics tail: worldwide
- Same training manuals
- Quick & Easy LRM Access

More Mission Functions: Radar, Comms, Electronic Warfare, ISR, Passive Sensing



Dynamic S/W Modes: Adaptive modes measure the electromagnetic and target environment



Performance

- Multi-function/Multi-mission
- Adaptable mission requirements
- Hardware & Software Built-in Growth
- Scalable Performance at all levels
- Net Ready, Net Centric, Interoperable



MOSA: Modular Open System Architectures allow for “best-of-breed”

Cross-Domain Ops: Modes, Communications, & Processing Compatibility in System-of-Systems

RF Technology is Evolving to Support Multifunction RF Systems

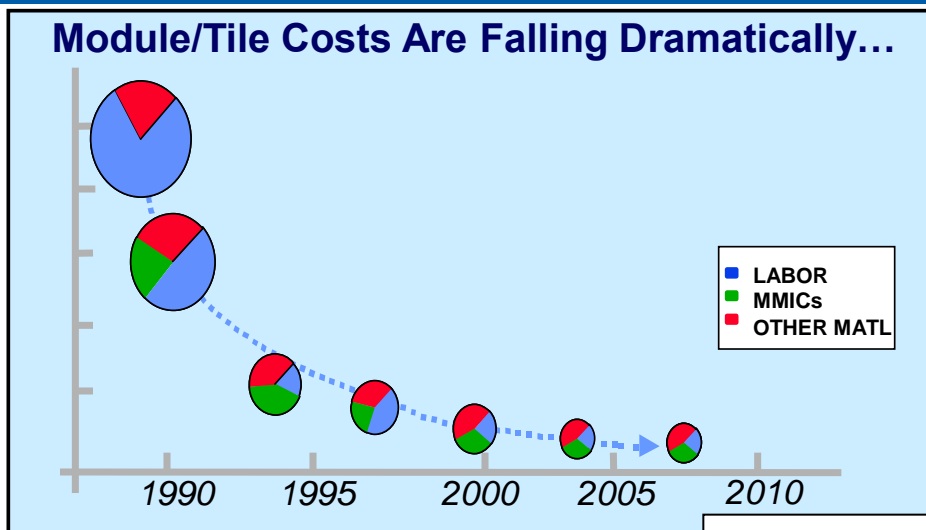


Multifunction Radar
Wide/Tailored RF coverage
“Thick” Arrays
Single manifold
Analog Beam Forming
Narrowband waveforms
Standard waveforms
~ 5 Receivers

Multifunction RF Sensor
Very Wideband RF coverage
Thin/Structural Arrays & R/Es
Multiple manifolds
Digital Beam Forming (DBF)
Wideband waveforms
Special waveforms
50/500+ Receivers

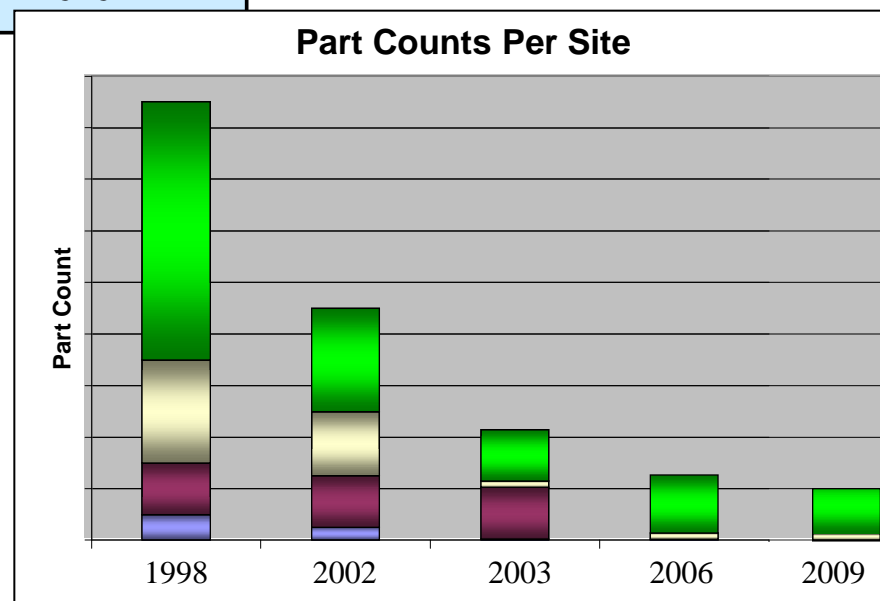


Industry trends track commercial market for affordability



Affordability achieved by:

- Leverage commercial industry RF electronics
- Processing costs continue Moore's law decline
- OSA architecture enables staged insertion of new technology



MPAR Challenges being addressed by Industry...

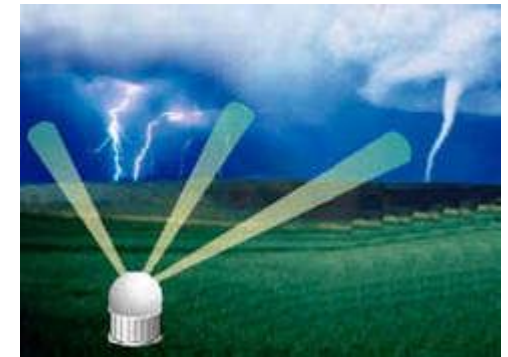
Parameter*	Technical/Cost Assessment*
# of T/R modules per face	Red
Number of Frequency Channels	Yellow
Dual Polarization	Yellow
Bandwidth	Blue
T/R RF Power	Blue
Number of Concurrent Rx Beams	Red
Software Complexity	Red
Size, Weight constraints	Blue
Prime Power Constraints	Blue

...Affordability is key

* Reference Table 6-1 from FCM-R25-2006 Federal Research and Development Needs and Priorities for Phased Array Radar June 2006

What can Government and Industry do to advance MPAR?

- MPAR system concept optimization studies
 - System concept definition
 - Establish system level performance requirements
 - Refine focus on targeted risk reduction
- Encourage industry participation



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