

***NORTHROP GRUMMAN***

DEFINING THE FUTURE

**MPAR Symposium  
Panel Discussion**

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# Northrop Grumman Corporation

## INFORMATION & SERVICES



**Command, Control and Intelligence**

**Land Forces/ Digitized Battlefield**

**ICBM Systems Management**

**Missile Defense BMC3**

**Information Warfare**



**Enterprise Systems and Security**

**IT/Network Outsourcing**

**Defense & Intelligence**

**Federal, State/Local & Commercial**

**ISR, Homeland Security & Health**



**Systems Support**

**Training and Simulations**

**Life Cycle Optimization**



**Radar Systems**

**C4ISR**

**Electronic Warfare**

**Naval & Marine Systems**

**Navigation & Guidance**

**Military Space**

**Government Systems**



**Large Scale Systems Integration**

**C4ISR**

**Unmanned Systems**

**Airborne Ground Surveillance / C2**

**Naval BMC2**

**Global / Theater Strike Systems**

**Electronic Combat Operations**

## AEROSPACE



**ISR Satellite Systems**

**Missile Defense Satellite Systems**

**MILSATCOM Systems**

**Environmental & Space Science Satellite Systems**

**Software Defined Radios**

**Directed Energy Systems**

**Strategic Space Systems**

## SHIPS



**Naval Systems Integrator**

**Surface Combatants**

**Expeditionary Warfare Ships**

**Auxiliary Ships**

**Marine Composite Technology**

**Coast Guard Cutters**

**Commercial Ships**



**Naval Systems Integrator**

**Nuclear Aircraft Carriers**

**Nuclear Submarines**

**Fleet Maintenance**

***Positioned for the Future***

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# Northrop Grumman Electronic Systems Develops an Array of Products

## At Sea



- Propulsion & Power Generation
- Sensors & Integration
- Submersibles
- Missile Launch

## On the Ground



- Air Defense
- Air Traffic Control
- Communications
- Intelligence, Surveillance & Reconnaissance Equipment

## At Home



- Sensors for Contamination Avoidance
- Collective Protection
- Counter-Proliferation Support
- Decontamination
- Postal Bio-Detection Systems

## In the Air



- Airborne Radar & Avionics
- RF/IR Countermeasures
- EO/IR Sensors & Targeting
- Surveillance & Reconnaissance
- Missiles & Submunitions

## In Space



- EO/IR/RF Sensor Payloads
- Ground Processing
- Other Space-Related Products

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# Modernization of Radar Technology...



## 1980's

Single Function  
Mechanically Scanned  
"Custom" Technology Base  
Captive Manufacturing Base  
"Single Point" Mission Critical Failures  
System BIT/FIT  
High Operation and Maintenance Costs

## Today

Multifunction  
Electronically Scanned  
Dual-use Technology Base  
Dual-use Manufacturing Base  
Distributed/Graceful Degradation  
Subsystem/Module BIT/FIT  
Lower Operation and Maintenance Costs

## ... Reducing Overall Cost of Ownership

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# Radar Evolution Leading to...

## Ground Based Surveillance Systems

AN/TPS-43



AN/TPS-70



AN/TPS-75



AN/TPS-78



## ATC Systems

ASDE-3



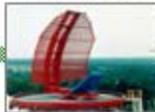
ARSR-3



MODE-S



ARSR-4



ASR-9



## Airborne Systems

APG-68



E-3A AWACS



AN/APG-77

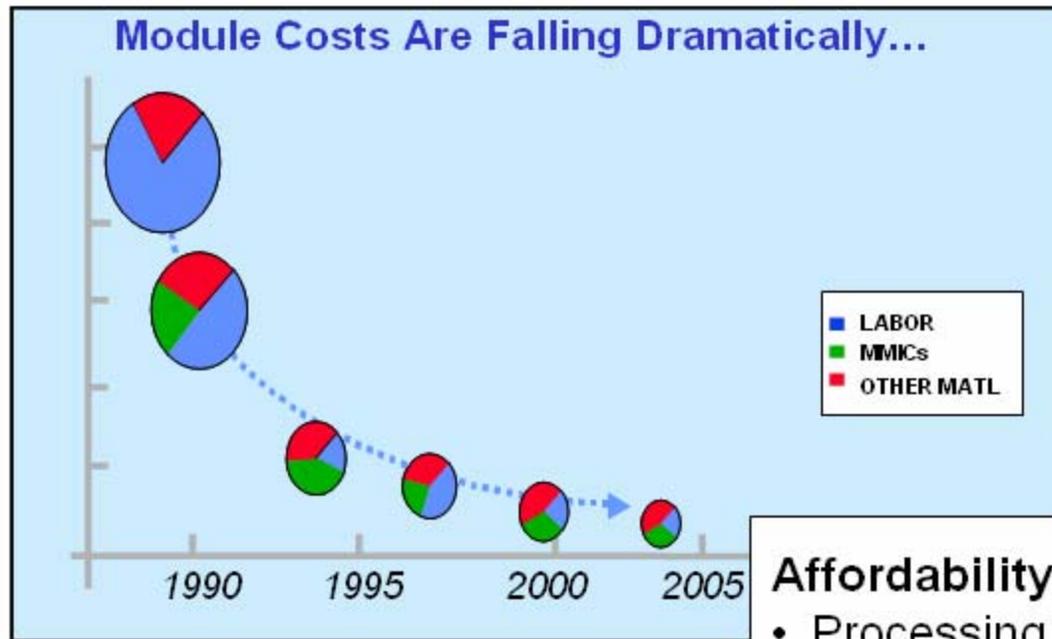


## Leverage

- Heritage Mode Re-use
- Affordable Technology Base
- Manufacturing Base
- Common Maintenance
- Reduced Upgrade Costs

## ... Affordable Future Systems

# Radar Cost Track Commercial Market for Affordability

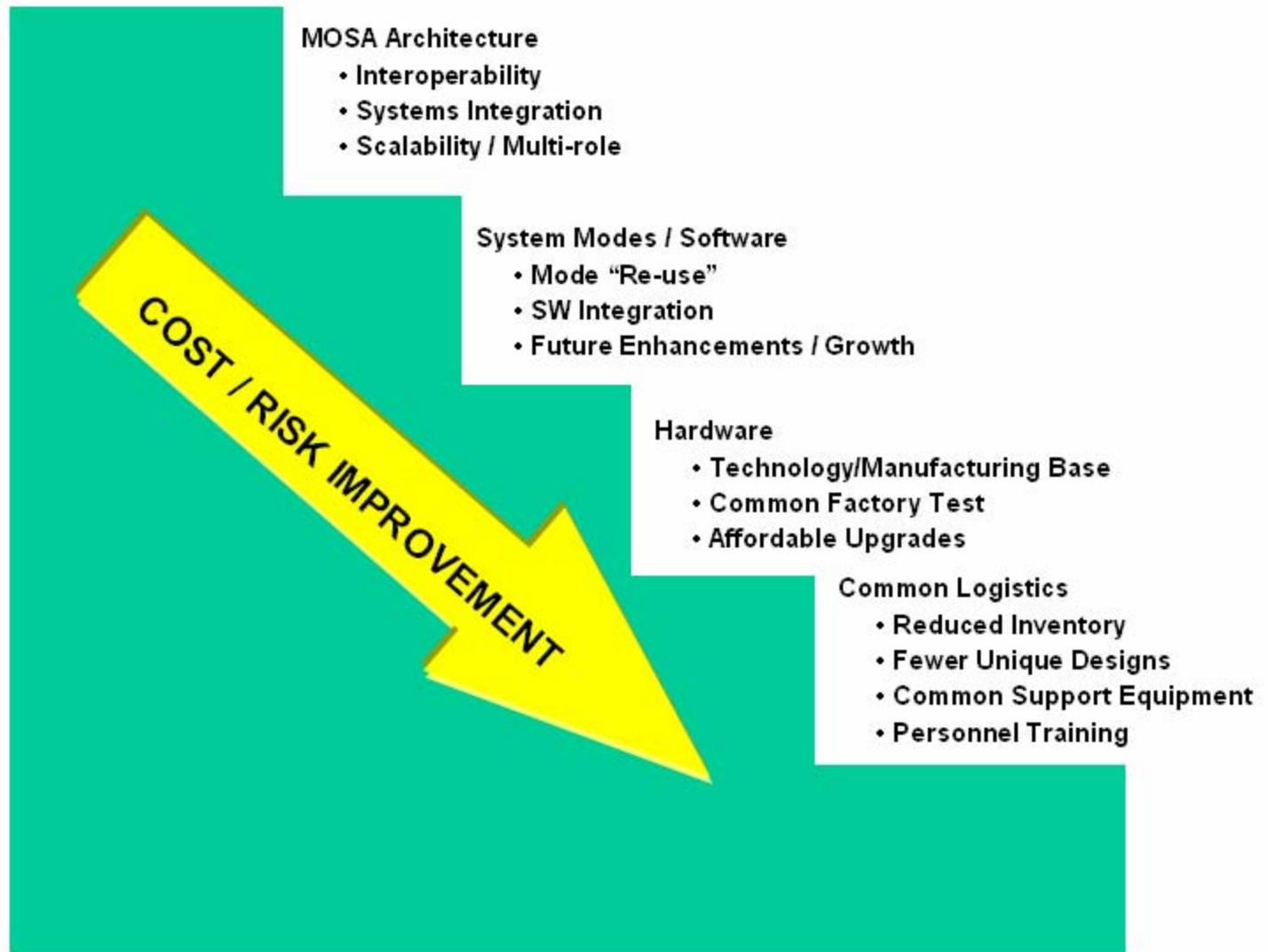


## Affordability achieved by:

- Processing costs continue Moore's law decline
- Leverage dual-use RF electronics
- OSA enables staged insertion of new technology

# Modular Open Systems Approach...

Cost & Risk  
Reduction  
Opportunities



... Reduces Cost and Risk

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# MPAR Challenges to be Addressed...

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

**...Affordability is key**

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

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# What can Government and Industry do to Advance MPAR?

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- Adopt CCR/JAG/PARP recommended next steps for collaborative R&D for MPAR risk reduction.
- Near term - MPAR system concept optimization studies
  - System concept definition
  - Establish system level performance requirements
  - Refine focus on targeted risk reduction
  - Encourage industry participation