Technology Transition Effort for a Future AFSCN Antenna System

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Agenda

- Introduction
- Overview of GDPAA Technology
- New System Payoff Dimensions and Advantages
- Technology Demonstration and Maturity
- Competitive Prototype Phase
- Transition Program and Implementation
- Conclusions
- Acknowledgments
Introduction

- Air Force Satellite Control Network (AFSCN) provides:
  - C2 connectivity between satellites and ground SATOPS Centers
  - Emergency recovery of satellites in trouble
  - Initial deployment and checkout of all new DoD and NRO satellites

- AFSCN modernization ongoing
  - AFSCN initially fielded in 1950s
  - 16 antennas at 8 worldwide ground stations
  - Remote Tracking Station Block Change (RBC) replacing AFSCN antennas, electronics cores and high power amplifiers (HPAs)

- Geodesic Dome Phased Array Antenna Program
  - Technology Advantages
  - Technology Maturation and Risk Reduction
  - Balancing Technology Development Processes with genuine Technology Risk Reduction Achievements
Overview of GDPAA Technology

Full Dome (91 panels - 85 Hex & 6 Pent)

Panel Group (5 hex & 1 pent panel)

Flat Pentagonal Panel (10 subarrays)

Flat Hexagonal Panel (21 subarrays)

TIR Module

Hex subarray (36 T/R & 1 BIT Modules)

Combine 1 Tx and 1 Rx To form one duplex link

Spatial power combining: 1 Tx and 2 Rx for each subarray, panel, or multiple panels

Control parameters for each beam:
- On/Off
- frequency
- pointing angles (θ, Φ)

Each TIR Module supports three independent beams: 1 Tx and 2 Rx

Beam Forming Network

Aperture element

Hex subarray assembly
New System Payoff Dimensions and Advantages

- GDPAA is enabled by new technologies to meet current and future AFSCN capability needs
  - High capacity – increases contact capacity
  - Continuing operation – high availability, lower life cycle cost
  - Responsiveness – on-demand satellite contact
  - Resilience – improved anti-jam capability and graceful degradation
  - Automation – remote operation, interoperability
  - Adaptability – programmable, reconfigurable
Technology Demonstration and Maturity

| FY 99 | FY 00 | FY 01 | FY 02 | FY 03 | FY 04 | FY 05 | FY 06 | FY 07 | FY 08 | FY 09 | FY 10 | FY 11 | FY 12 | FY 13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Concept & Arch Development | Technology Development | EMD |

Technology and subarray Development

AFRL Test

Critical Experiment

ATD

MUGS

TTPE

Risk Redtn Prototype

Full Dome Prototype

Full Scale GDPAAA Demonstration

TRL
Technology Demonstration and Maturity

ATD Successes

• Beam steering
• L&S band commanding
• Multiple simultaneous contacts
• T/R module demonstrated

TTPE Action Items

• Interfaces to control electronics
• Transmission Noise Reduction
• Improving Tracking Accuracy
• Improved Life Cycle Cost Estimating
Competitive Prototype Phase

- Transitioning from research to leveraging competitive production innovation
- Exploit broader industry innovation in product designs, CONOPS, producibility, Life Cycle Costs
- Fully functional prototypes
- Next Steps in tech development:
  - Increased number of simultaneous contacts
  - Beam walking
  - Beam intersections
  - Software development
Transition Program and Implementation

- Continue systems engineering as program matures
- Prepare cost benefit analysis for Program of Record decision
- Quantify requirements
- Application of innovative management tools, such as Probability of Program Success (PoPS)
Probability of Program Success

Summary

PEO: Program Name

Program Planning
Date of Review: Date

Program Success
(100)

PM: PM’s Name

Program “Fit”
Capability Vision (xx/1)
Program Planning (xx/40)
Program Resources (xx/30)
Program Requirements (xx/25)

Acquisition (10)
DoD Vision (0.5)
Warfighter (1 or 1.5)
Air Force Vision (0.5)
Congress (0.5)
OSD (0.5)
Joint Staff (0.5)
HQ Air Force (0.5)
Industry (0.5)

Program Risk Assessment (13)
Sustainability Risk Assessment (2)
Testing Risk (2)
Software (Not used for Pre-Ms B Evaluations)

Program Life Cycle Phase: XXXXXXX

LEGENDS
Colors:
G: On Track, No/Minor Issues
Y: On Track, Significant Issues
R: Off Track, Major Issues
Gray/Hashed: Not Related/Not Applicable

Asterisk carried on metric to indicate rebaselined

Trends:
Up Arrow: Situation Improving
(number): Risk Score
(based on 100 possible)
Down Arrow: Situation Deteriorating

Rebaselines: (X)
Last Rebaseline: DATE

EXAMPLE
Conclusions

- GDPAA
  - Advantageous technology solution
  - Disciplined systems engineering approach
  - Solidly addressed and tested leveraged technology
  - Created a solid foundation to address prototype phase
  - Shortly ready to address producibility and deployment
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