

Enabling Technologies for Mobile Communications

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Air Force MOIE

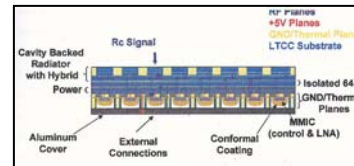
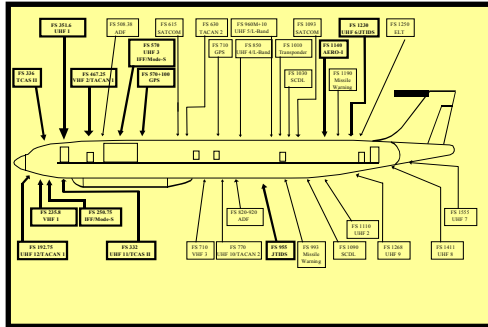
The logo for the MITRE Technology Program, featuring a stylized graphic of stacked blocks in yellow, orange, and blue to the left of the text.

MITRE
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Problem

- **The armed forces must move to network centric warfare.**
- **The physical layer to support this is currently not adequate or affordable.**
 - **The solution must be applicable for multitude of platforms.**
- **The physical layer for future mobile terminals will need to be more capable.**
 - **Emerging technology can enable electronically steered array modules for the future warfighter.**

Background



Example Array Structure



MITRE Prototype L-Band High Efficiency Solid State Power Amplifier (SSPA) for GPS

Installation Constraints

- Proliferation of apertures on aircraft
- High installation complexity and cost
- Need for multiple simultaneous connections

Multibeam apertures reduce installation cost and enable mobile platforms in the Global Grid network.

Multiple Beam ESA Technology

- Investment
 - DoD drives ESA requirement
 - Transmit array development lagged (challenges)
- SSPAs
 - Thermal dissipation dominated by SSPA efficiency (10-20%)
 - High efficiency SSPAs being developed for commercial wireless with 60-80% efficiency
 - Application to DoD ESA needed

Objectives

Verify technical feasibility of multi-beam transmit communication apertures

Mitigating installation constraints

Providing enhanced connectivity

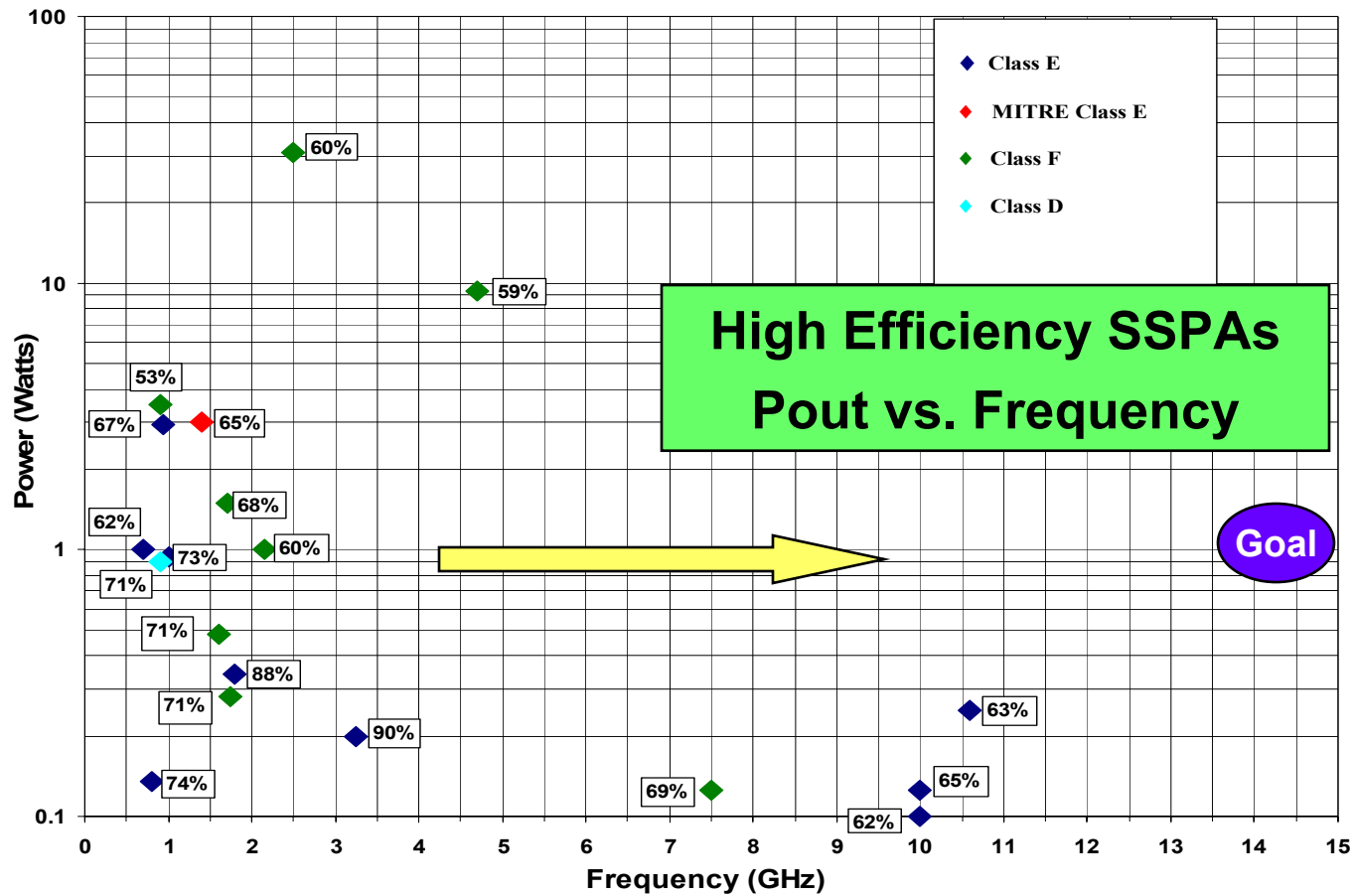
Enabling mobile platforms within the Global Grid Network

- **Ku-Band transmit array selected (MP-CDL)**
- **Perform technology assessment and system performance analyses**
 - Array architecture and radiator elements for RF aperture
 - Semiconductor devices, materials, efficient classes of operation and packaging for SSPA
- **Design key elements of RF and multi-beam apertures**
 - RF power module
 - High efficiency amplifier
 - Radiator element for electronically steered array (ESA)

Activities

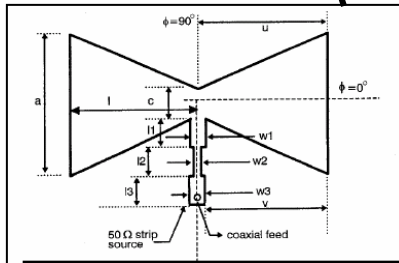
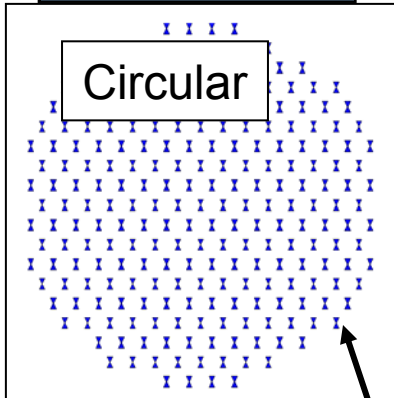
- **Array architecture calculations to set array element spacing and thermal boundaries**
 - **Cost analysis vs. reflector equivalent**
 - **Thermal analysis**
- **Array element design and prototype**
- **Amplifier design**
 - **Material/process downselection**
 - **Simulation**
 - **Packaging**
- **Amplifier and element integration**

Highlight

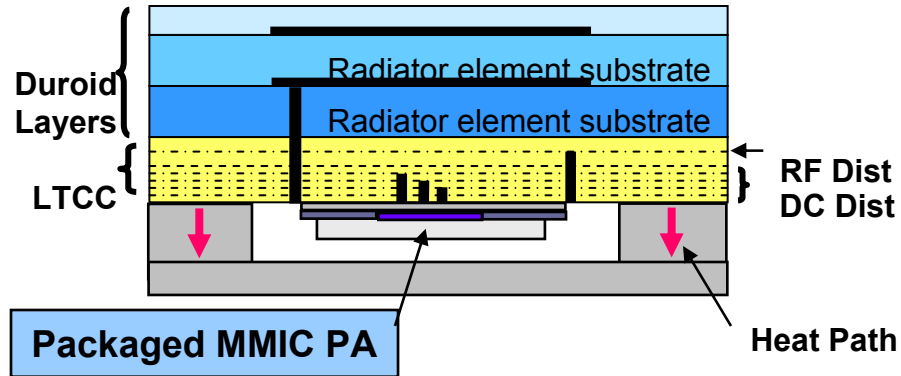


Highlight

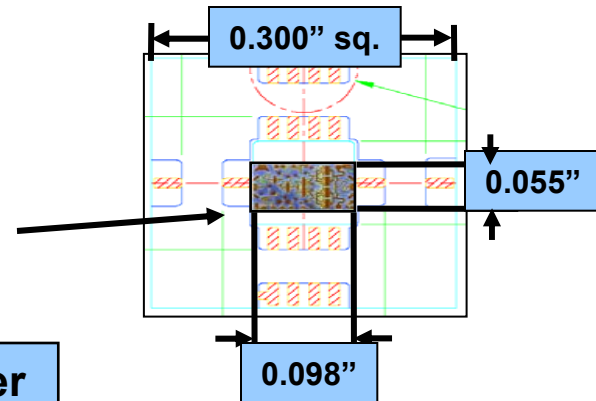
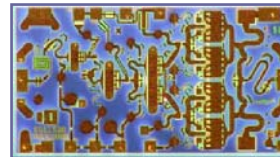
Array Layout
8" diameter



Radiator
Prototype year 1



Array
Integration



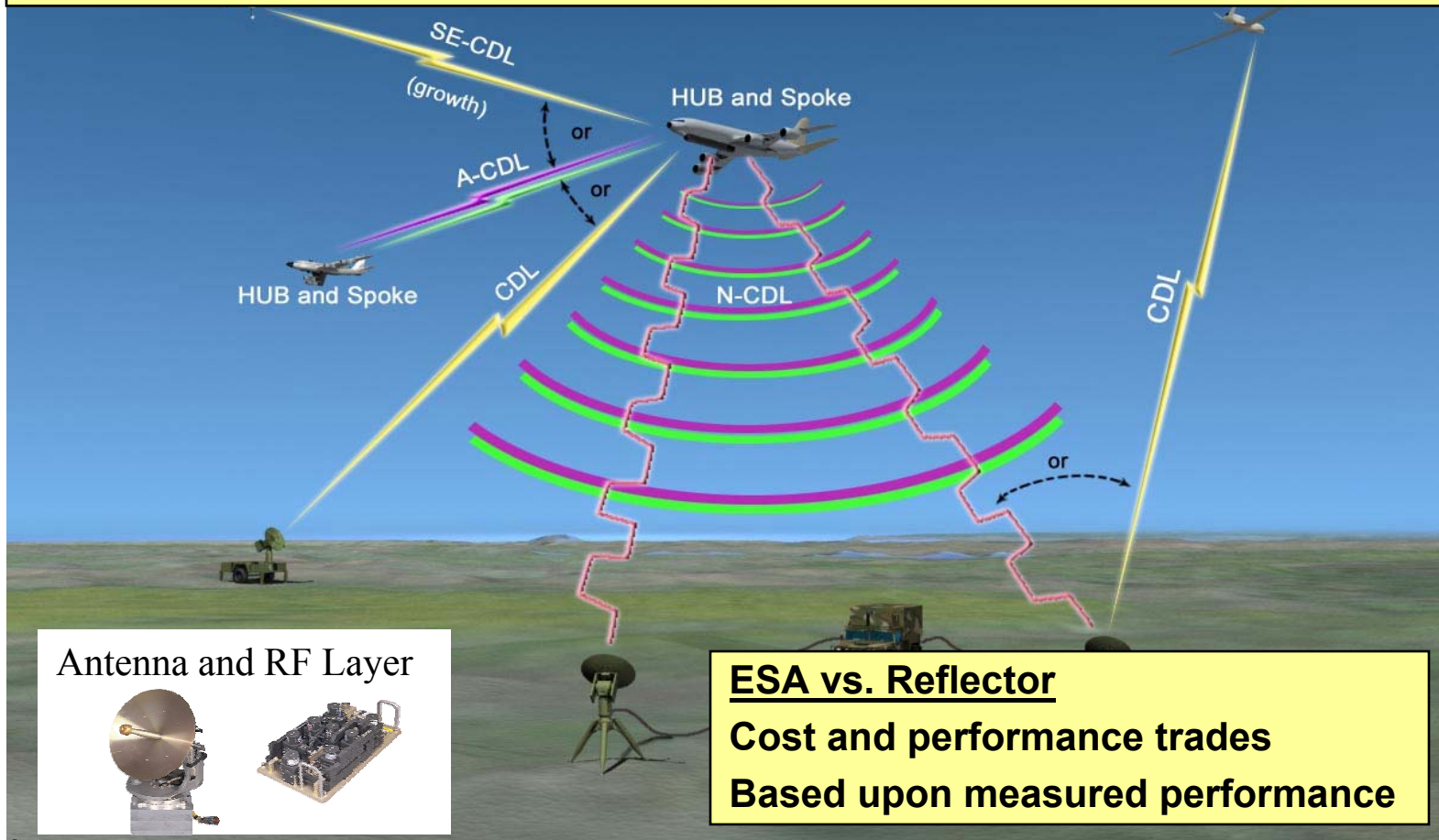
Packaged MMIC PA

Impacts

- **Develop and evaluate key elements for RF multibeam apertures to support bringing greater capacity to Air Force Task Forces and to bring airborne platforms into Global Grid**
 - **FAB-T and MP CDL terminals**
 - **MC2C and MC2A platforms**
 - **Air Force Task Forces**
 - **GSTF**
 - **Global Response**
 - **Air & Space C2ISR**

Future Plans

The anticipated requirement for the central airborne terminal is to provide a single point-to-point link operating simultaneously with an independent multi-user network.*



* <http://www.globalsecurity.org/intell/systems/mp-cdl.htm>