# Airborne Communications Node (ACN)

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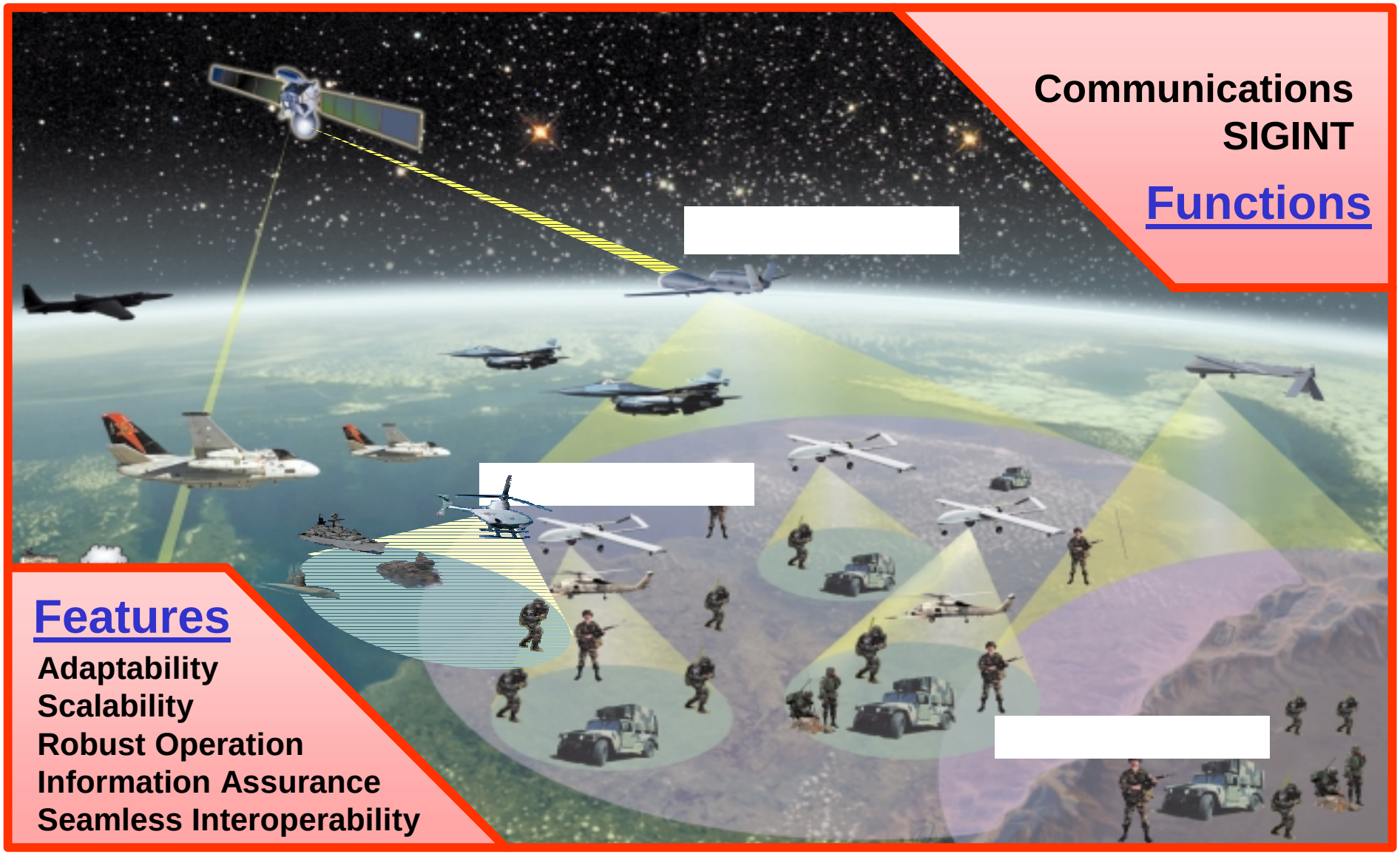
ACN390v001

# Airborne Communications Node (ACN) Concept



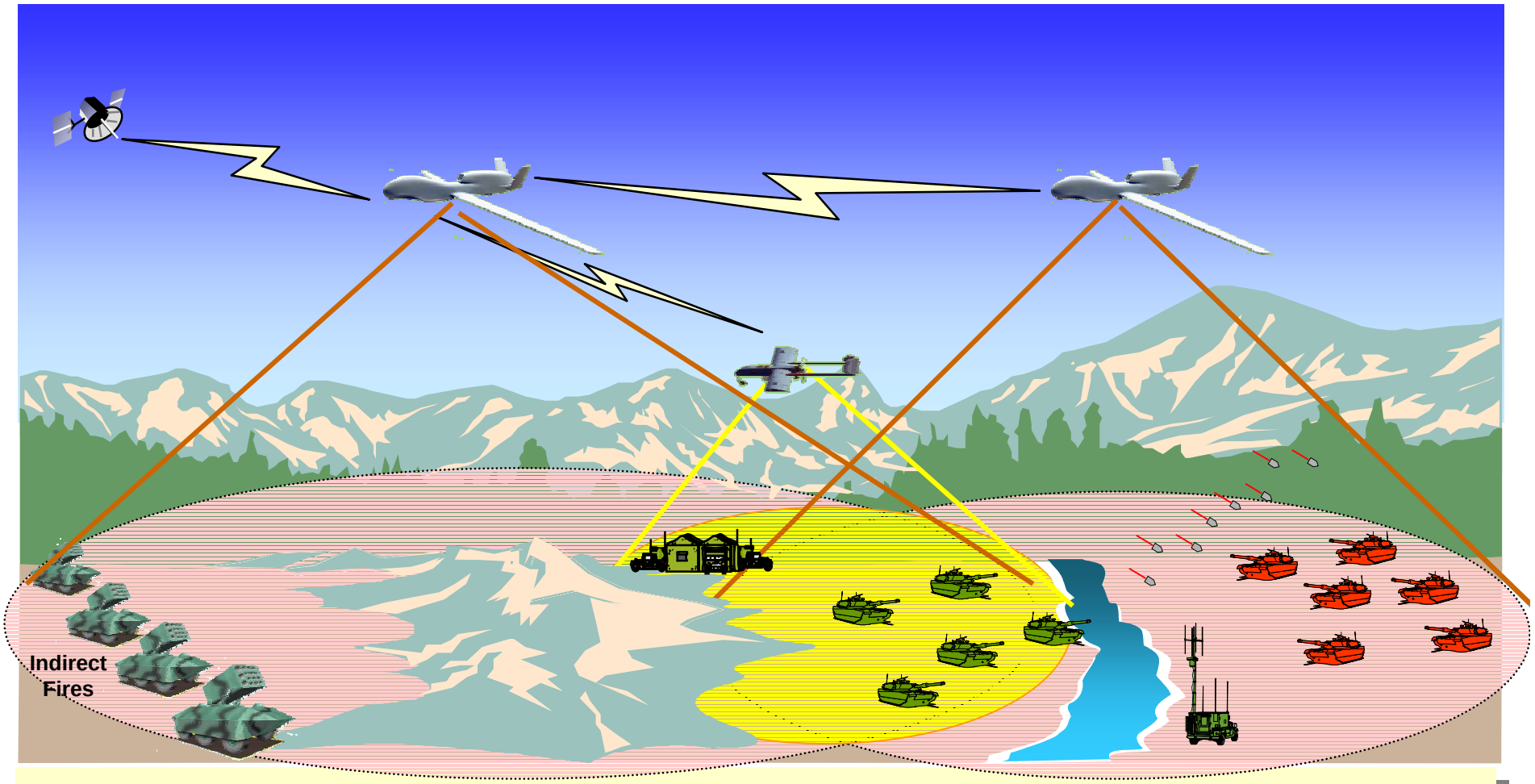
## Functions

Communications
SIGINT

## Features

Adaptability
Scalability
Robust Operation
Information Assurance
Seamless Interoperability

# ACN Utility




- BLOS Connectivity
- Relief of SATCOM Oversubscription
- "Surge" Communications and Tactical SIGINT Capacity
- Reduced Logistics for Comm Infrastructure
- Enhanced Mobility
- SIGINT / Communications Synergy

ACN377v001

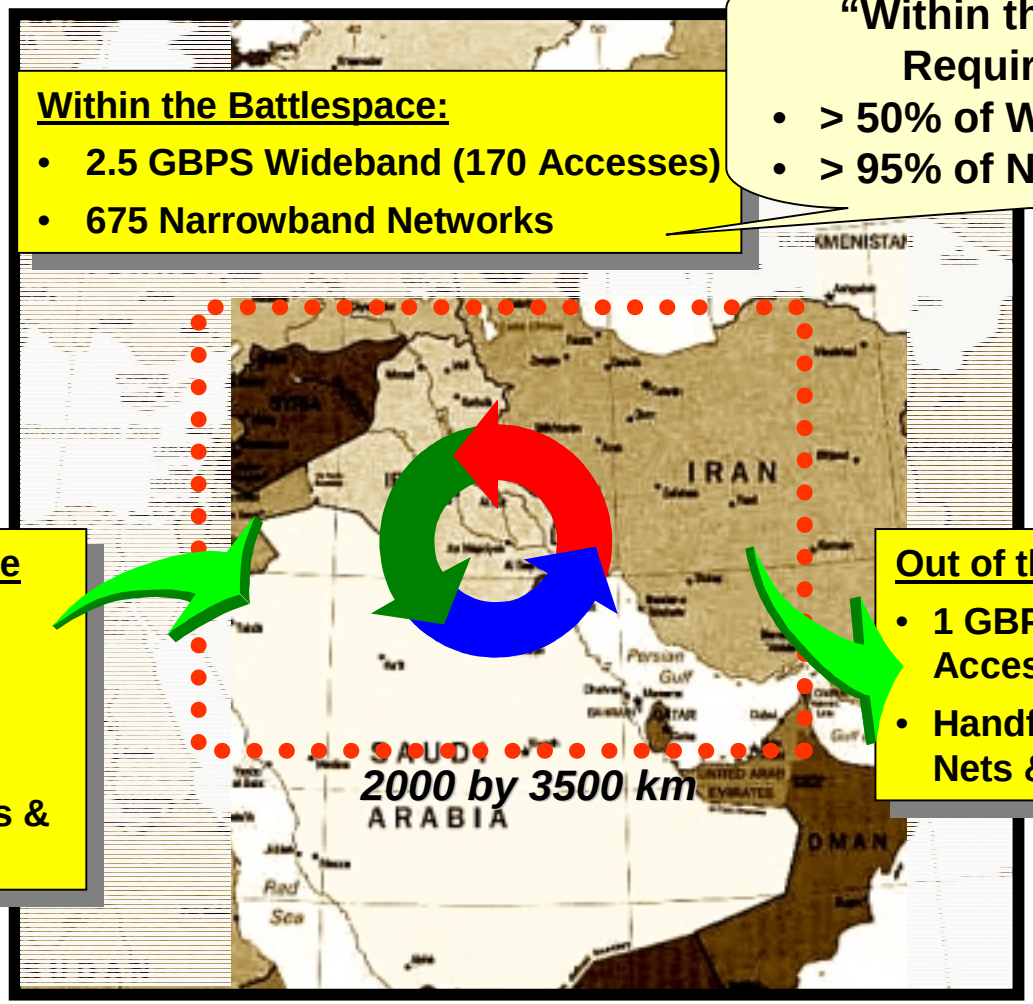
# ACN Utility: Relieve SATCOM Oversubscription

**Within the Battlespace:**

- 2.5 GBPS Wideband (170 Accesses)
- 675 Narrowband Networks

**"Within the Battlespace" Requirements are:**

- > 50% of Wideband Total
- > 95% of Narrowband Total




**Into the Battlespace**

- 1.15 GBPS Wideband (360 Accesses)
- Hand-full of Narrowband Nets & P-Ps

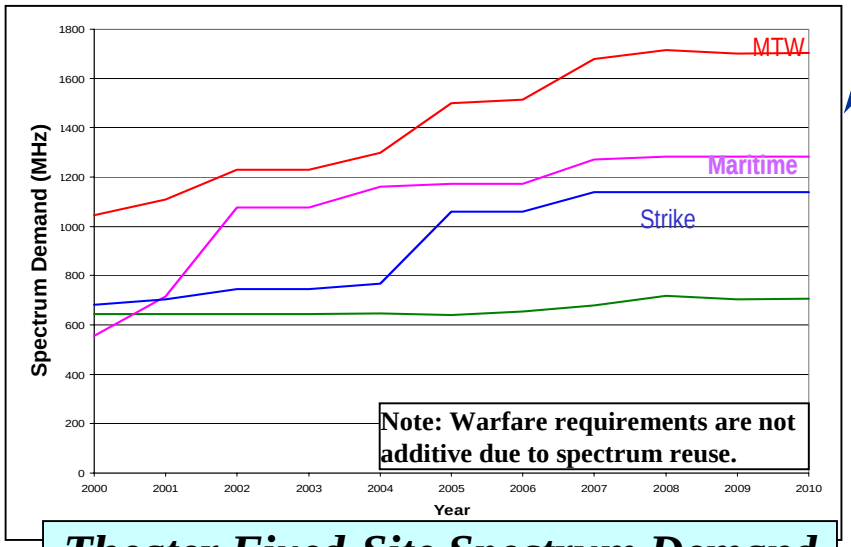
**Out of the Battlespace:**

- 1 GBPS Wideband (310 Accesses)
- Handful of Narrowband Nets & P-Ps

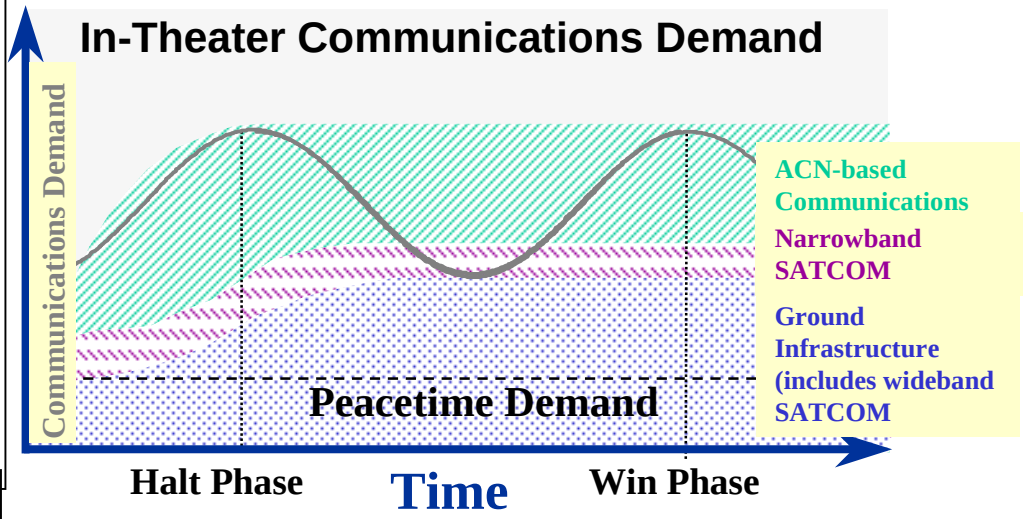
***ACN Can Offload "Within the Battlespace" Accesses and Provide BLOS Connectivity to Fiber Nodes for "Outside the Battlespace" Accesses***

***Source: "The Demand for SATCOM Today and in the Future", J6***

# "Surge" Communications Capacity




*Theater Fixed-Site Spectrum Demand*



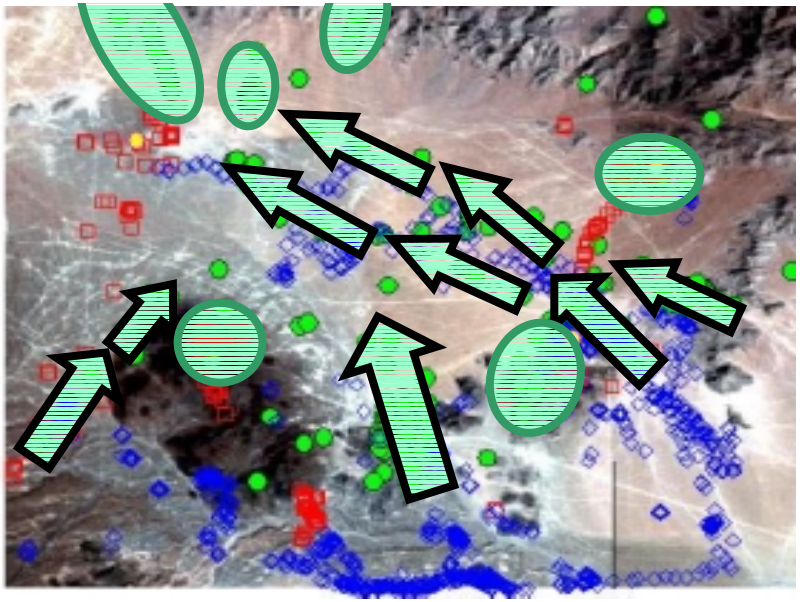

***Surge Capacity* ACN Provides Dynamic "Surge" Capacity to Meet Communications Demands**

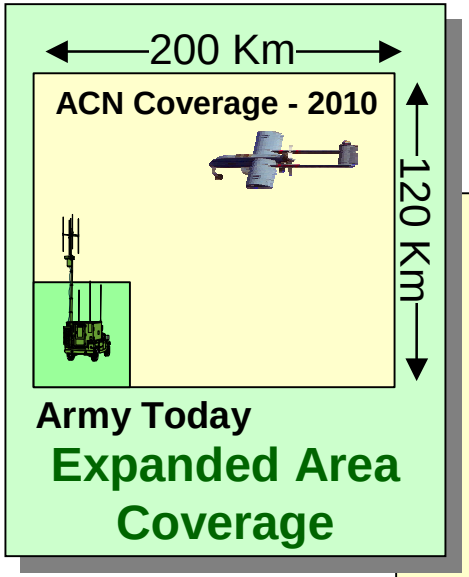
| | Global Hawk | CRTUAV | Predator |
|---|---|---|---|
| Frequency | 30 MHz - >17 GHz | 30 MHz - >2.8 GHz | 30 MHz - >17 GHz |
| BW/Ch | >40 MHz | >40 MHz | >40 MHz |
| # Channels | >100 | > 4 | 12 - 16 |
| Weight | <900 lbs | 20-25 lbs | ~100 lbs |

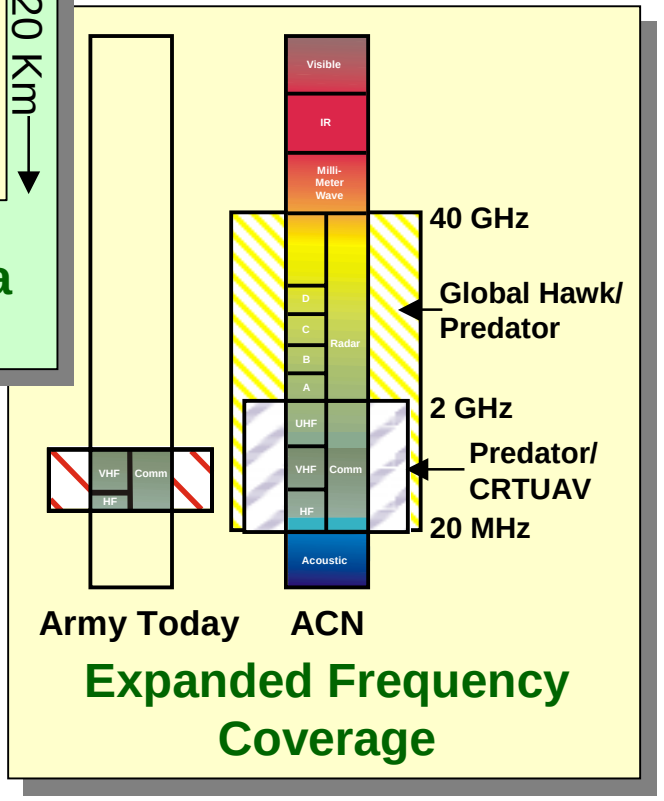
Demand from OSAM "Warfighter Spectrum Requirements Analysis", 19 April 2000

# Tactical SIGINT

## Example Tactical Situational Awareness






## Payload Functionality

- Emitter Characterization
- Emitter Geolocation
- Nodal Analysis
- Spectrum Mapping

# Reduced Logistics & Improved Mobility

## Army Gulf War Communications Infrastructure

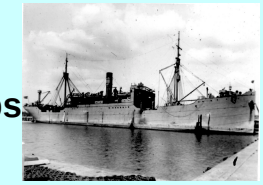
**ARMY COMMUNICATIONS**

- One Theater Signal CMD
- Three Signal Bde HQS
- One JCSE
- Five EAC Signal BNS
- Eight Corps Signal BNS
- Eight DIV Signal BNS
- ~ 13,000 Soldiers

**LIFT**

- 40 C5s

- 24 Ships

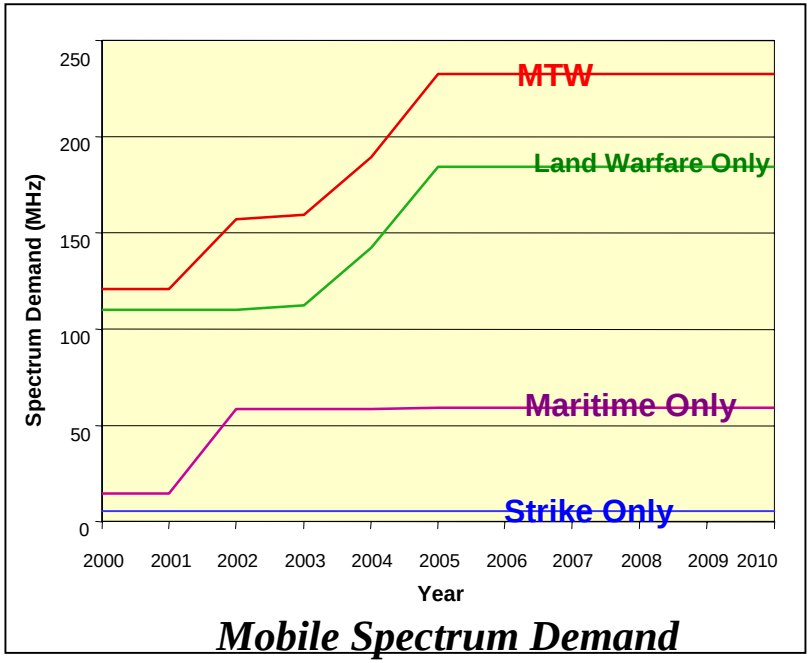


### *Mobility*

- ***Demand for Mobile Communications Services Will Increase 92% by 2005***
- ***Supports Mobile Ad Hoc Networking***

### *Logistics*

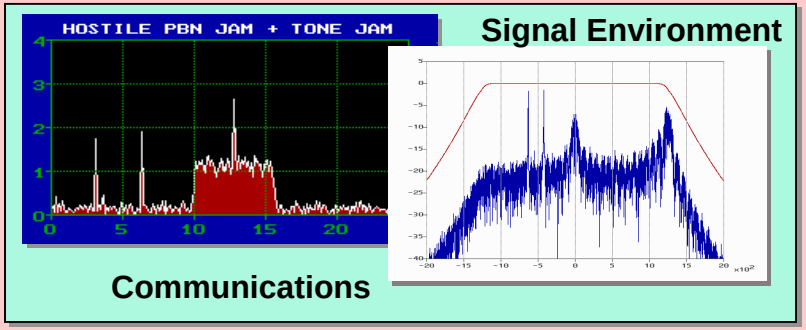
***ACN Reduces the Support Required to Build and Maintain the Comm and SIGINT Infrastructure***




*Mobile Spectrum Demand*

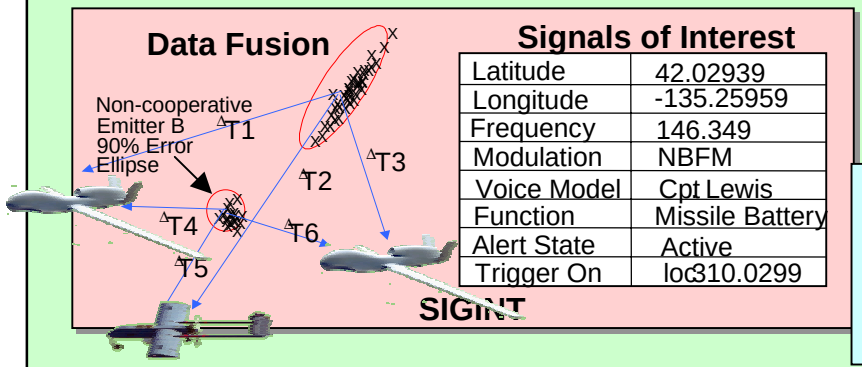
Demand from OSAM "Warfighter Spectrum Requirements Analysis", 19 April 2000

# Communications / SIGINT Synergy



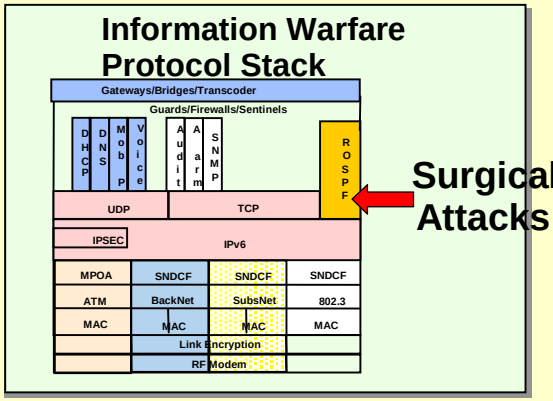

- Wideband Receiver Can Support:
  - + Dynamic Spectrum Allocation -- Transmit in the Spectrum "Holes"
  - + Signals-of-Interest (SOI) Detection

- Onboard Assets Can Track SOI
  - + Crosslinks for Precise Geolocation
  - + Antenna and Signal Processing Supports Tracking with a Single Platform




**Signals of Interest**

| | |
|---|---|
| Latitude | 42.02939 |
| Longitude | -135.25959 |
| Frequency | 146.349 |
| Modulation | NBFM |
| Voice Model | Cpt Lewis |
| Function | Missile Battery |
| Alert State | Active |
| Trigger On | loc310.0299 |



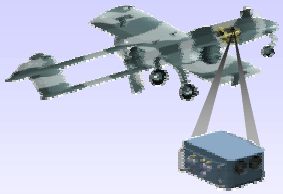

- Modify the SOI and Retransmit the Signal for Information Warfare

- Common Hardware & Software Reduces:
  - + Size, Weight, and Power
  - + Life Cycle Cost

# Technical Challenge: Modularity and Scaleability

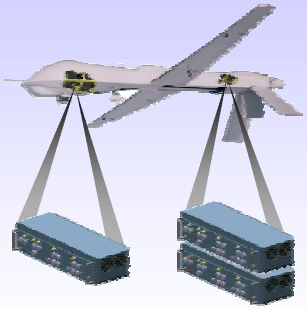
## Notional Concept for Scaleable Payload Design

**Shadow 200 Package**



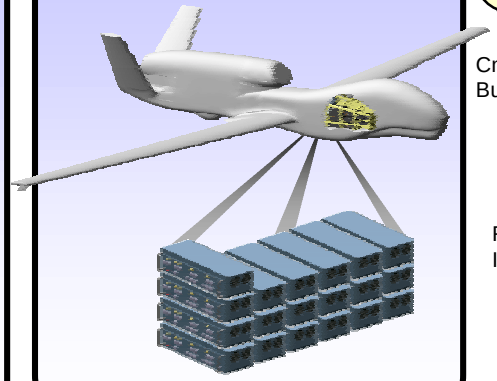
< 25 lb. System

**Predator Package**



< 100 lb. System

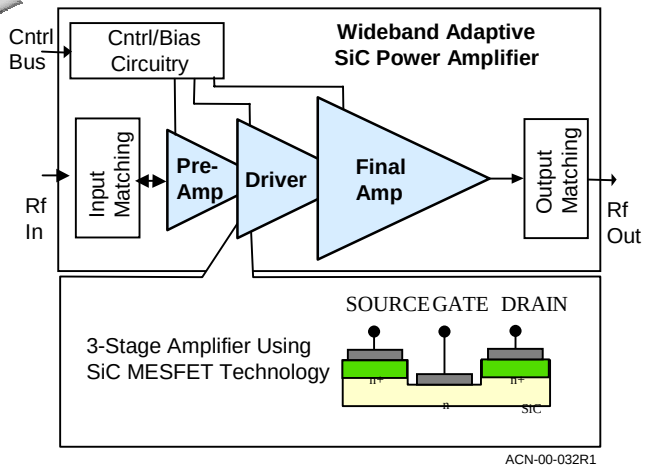
**Global Hawk Package**



< 900 lb. System

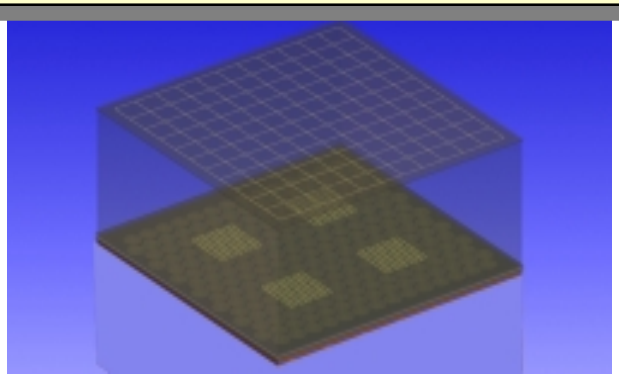
## Wideband SiC Power Amplifier

- High Gain & Wide Bandwidth
- Small Size, Weight & Power

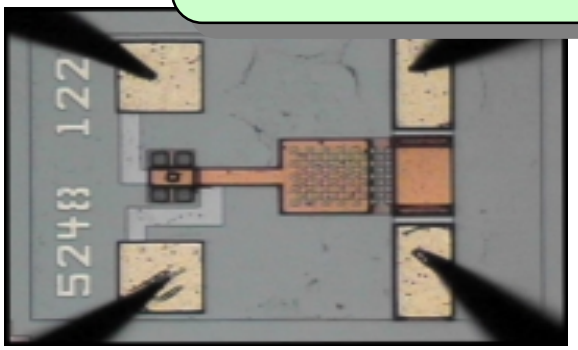



## Advanced Antenna Technology

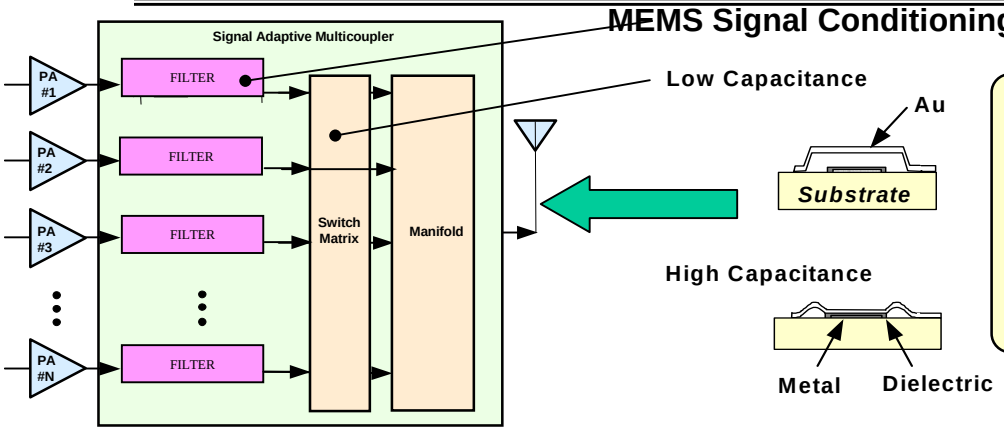
Development of Reconfigurable Antenna Elements and Stacked Apertures



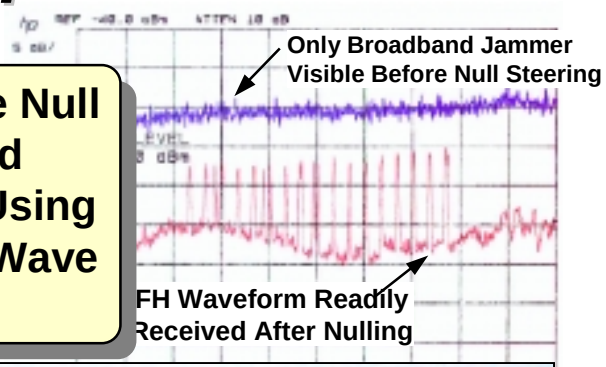
## High Power MEMS Switches Enable Reduced SWaP for Wideband Power Amplifiers



# Technical Challenge: Simultaneous Multimission Operation

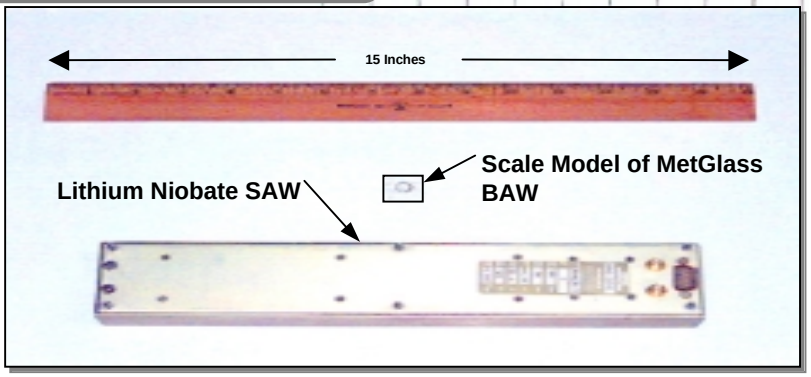



**Signal Adaptive Null Steering and Beamforming Using Bulk Acoustic Wave Device**




**Signal Adaptive Multicoupler**

- Low-Loss Broadband Power Combining
- Adapts to Signal Bandwidth

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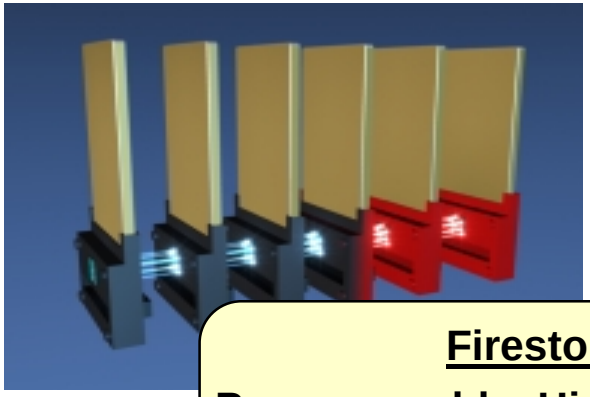
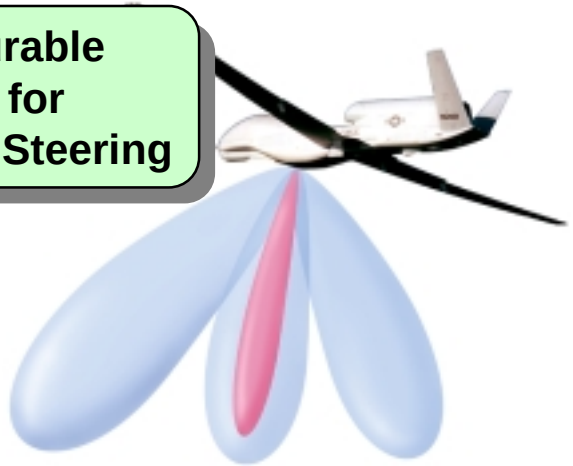


**Firestorm**

Programmable, High Bandwidth Interconnect Utilizing VCSEL Technology

**Adaptive Reconfigurable Array Processing for Beamforming and Null Steering**



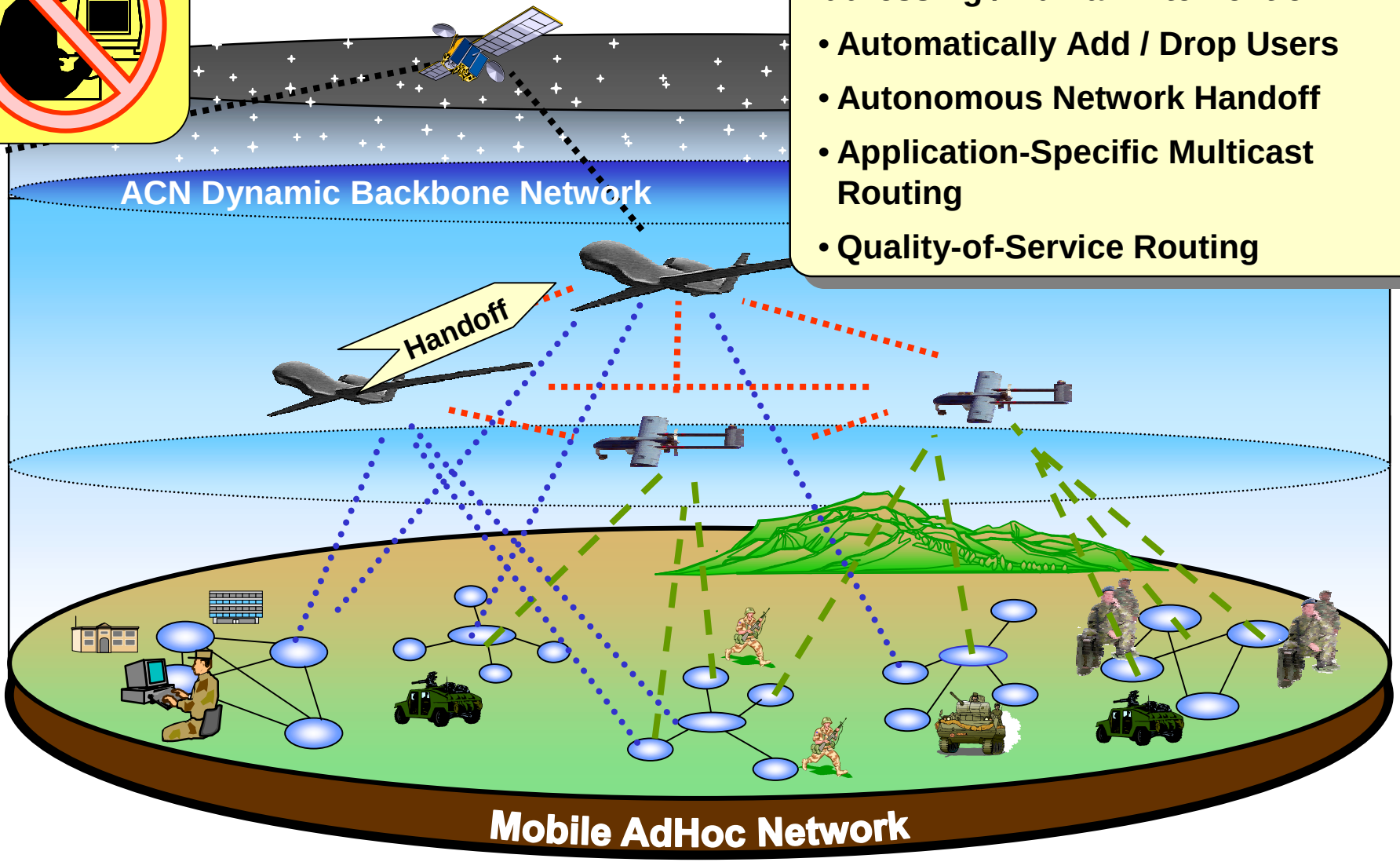
# Technical Challenge: Mobile Ad-Hoc Networking

DARPA

ATO

**Configure Network Without Preset Addressing / Human Intervention**

- **Automatically Add / Drop Users**
- **Autonomous Network Handoff**
- **Application-Specific Multicast Routing**
- **Quality-of-Service Routing**



# ACN Opportunities

| Major Program Events | |
|---|---|
| Phase II Program Kickoff | May 2000 |
| Architecture Review | Sep 2000 |
| System Performance Review | Sep 2001 |
| System Design Review (“PDR”) | Jan 2002 |
| Phase III Readiness Review (“CDR”) | Aug 2002 |