Mr. Mark Stevens  
Greenpeace  
1436 U Street NW  
Washington, DC 20009  

Dear Mr. Stevens:  

This responds to your September 13, 1996, Freedom of Information Act (FOIA) request. Our September 20, 1996, interim response refers.  

The enclosed documents are provided as responsive to your request. There are no charges for processing this request in this instance.  

Sincerely,  

A. H. Passarella  
Director  
Freedom of Information and Security Review  

Enclosures:  
As stated
Space Communications Architecture Development Overview

Background

The DoD Space Architect was established 27 September 1995 by the Under Secretary of Defense for Acquisition and Technology to consolidate the responsibilities for space missions and system architecture development into a single organization. I was directed that the immediate effort of the DoD Space Architect shall be to develop a future Military Satellite Communications architecture which encompasses core DoD capabilities; allied, civil, and commercial augmentation; and global broadcast capabilities. The DoD Space Architect will provide a set of alternatives to the Joint Space Management Board (JSMB) in July 1996 for their decision on the future MILSATCOM architecture.

The Joint Space Management Board (JSMB) was established on 13 December 1995 by the Secretary of Defense and the Director of Central Intelligence to ensure that defense and intelligence needs for space systems (including associated terrestrial-based subsystems) are satisfied within available resources, using integrated architectures to the maximum extent possible.

The DoD Space Architect established a MILSATCOM Architecture Development Team (ADT) to develop:

- Alternative architectures for a JSMB decision in July 1996
- Life cycle cost estimates for space, ground, and control systems
- Cost estimates and schedule opportunities for system transition
- Impacts, and interfaces to other architectures

Architecture Development Process

The DoD Space Architect's MILSATCOM Architecture Development Team (ADT) is developing multiple architecture alternatives, which will be refined into several distinct architecture constructs for detailed analysis and comparison. These will be presented to the JSMB in July 1996 for selection of the single DoD space communications architecture concept. The development process involves the engineers, analysts, planners, and war-fighters; as well as the senior managers of your organization. In addition, to support the significant and major architecture selection decision in July at the JSMB the DoD Space Architect will coordinate with the decision makers of organizations with interest or equities in space communications.
Joint Space Management Board

AGENDA

1030-1035 Opening Remarks
1035-1040 Administrative Remarks
   Approval of Minutes
   Action Items

  Co-chairs
  Exec Sec’s

MILSATCOM

1040-1045 Introduction
1045-1055 Role of MilSatCom in DISN
1055-1105 MilSatCom Requirements
1105-1205 MilSatCom Architecture Alternatives
1205-1225 MilSatCom Plan and Recommendation
1225-1230 Closing Remarks

  Mr. Davis
  LtGen Edmonds
  MajGen Donahue
  MajGen Dickman
  Mr. Davis
  Co-chairs
Space Communications Architecture
Department of Defense

Space Architect

DOD
NASA - National systems
Other government systems •
Commercially owned & operated (Commercial)
Military owned & operated (MILSATCOM)
Future Objectives (2010-2025)

Scope
Be user friendly, interoperable

- Reduce common communications footprint (terminals)

- Fully integrate with the DISN

“From protected voice to Information Superiority”

- Information services driven

- Right comm, right user, at the right time

- Provide assured, secure communications

MILSATCOM Objectives 2010-2025
<table>
<thead>
<tr>
<th>Legacy SATCOM 2003</th>
<th>DSCS</th>
<th>SHF</th>
<th>X-Band</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total estimated cost, 1983-2003 ≥ $50B (FY'96$)</td>
<td>UFO-E</td>
<td>UHF</td>
<td>Milstar</td>
<td>EHF</td>
</tr>
<tr>
<td>• Manpack, ships, aircraft</td>
<td>• Low capacity</td>
<td>• Low-median capacity</td>
<td>• High Capacity</td>
<td>• Low-median capacity</td>
</tr>
<tr>
<td>• No protection, 1,000s of mobile terminals</td>
<td>• Approximately 1,000 terminals</td>
<td>• Approximately 1,000 terminals</td>
<td>• Little protection</td>
<td>• Manportable, transportable, fixed</td>
</tr>
<tr>
<td>• Limited capacity</td>
<td>• Approximately 1,000 terminals</td>
<td>• Handhelds, vehicles, fixed</td>
<td>• Served with Ku, C-Band, L</td>
<td></td>
</tr>
</tbody>
</table>
Gap analysis (70%)

Current MILSATCOM Satellite Inventory

(Calendar Year)

Number of Satellites (stacked MMD)

DSG (includes SLEP)

UFO (includes EHF & GBS)

Mister I & II

Polar Adjunct

Mean Mission Duration - 100% Launch Success

(58x656)
Architecture Considerations
Objectives

Open Discussions

Objectives and Transition Roadmap

JSMB Direction

Recommendations

Transition Strategies

Goals and Objectives

Assess and Debate Alternatives

Architecture Options

Integrate and Combine Concepts

Requirements Based Opportunities

Based Develop Architecture Concepts

Development of MILSATCOM Objectives
Requirements - Warfighters Vision/CRD

O&G
- Smaller footprint/skillset, less manning and
  Focused Logistics

Survivable

Protected &

High Capacity

Mobile

Full-Dimensional Protection
- Secure, AI, LPI/LPD, Assured Access

Precision Engagement
- Information driven, sensor-to-shooter

Dominant Maneuver
- Wide area, all echelons, networked

Interoperability
- Joint & Coalition

Vision/CRD
Acquisition Reform

- Information handing
- Phased array antenna
- "Slice technology"

Breakthroughs in related fields

- Migration to Ka frequencies (adjacent to military Ka)
- Smaller, low cost terminals
- Frequency reuse (cellular), on-board processing, crosslinks
- Larger constellations of simpler S/C at lower altitudes
- Higher power, higher capability, higher weight, GEO S/C

Breakthroughs in Commercial SATCOM

Opportunities
Own unique military capability
Alternative D

Alternative C

Alternative B

Alternative A

Look at components (e.g. UAVs)
Expand commercial role
Retain core military capability

Design for Info Dominance
Press Technology

Commercialize MILSATCOM

Modernize current systems
Capitalize on investment

Architecture Alternatives
<table>
<thead>
<tr>
<th>$61B</th>
<th>$51B</th>
<th>$67B</th>
<th>$55B</th>
<th>20 Year LCC (FY96 $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Green</td>
<td>Yellow</td>
<td>Green</td>
<td>Acquisition Risk</td>
</tr>
<tr>
<td>Red/Red</td>
<td>Red/Red</td>
<td>Blue</td>
<td>Green</td>
<td>Performance &amp; Utility</td>
</tr>
<tr>
<td>Centered Commercial D</td>
<td>Core Military C</td>
<td>Optimized Performance B</td>
<td>Modernized Baseline A</td>
<td></td>
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</tbody>
</table>

Comparative Analyses
Varied earth orbits, large constellations
Switched, crosslinked, processed systems

Significant technology will be demonstrated over the next 5-10 years

Military requirements
Lowest cost attained through procurement of a commercial-like system with
Cost can be somewhat reduced with long-term leasing

LCC of buying a system > 1/2 the cost of leasing the same system

Survivable communications services
Commercial market will not support Mobile, Protected or

Industry Findings
Cost Example - Modernized Baseline
Operational Management is fragmented.

"Today's" types of services will not be reflected in "weapon system" CONOPS. "Bandwidth on Demand," such as MS/GPS, and assured access, protection, protection (AALP), survivability and survivability are critical to wartime planning.

2003-2010 Force Structures presume availability of emerging capabilities such as MSS/GPS, and
O & S Costs are significant and not visible

Transitions, architectures

Terminals have not been treated as a "variable" in

Most terminals have been single-purpose, single-user class

- Force structure drives quantities, types

- Over 100 types of terminals are fielded today

Findings

Requirements/Operations

Terminals

Space

Spectrum
possible "gapfiller" satellites

Timing will require operational management, risk trade-offs and
capabilities will be needed in 2003-2008

Replenishment for DSCE, UHO, Polar, and Mi Lester II

Finding 3:

a constraint of cost driver

Because of commercial demands and ELV, launch will not be

etc., are med-high risk and not yet demonstrated

Many revolutionary systems (Triumph, Spaceway, TELDISC,

Some technologies will continue to be militarily led

Technology growth is faster than our acquisition timeline

| Spectrum | Space | Terminals | Requirements/Operations |

Findings
<table>
<thead>
<tr>
<th>Spectrum</th>
<th>Space</th>
<th>Terminals</th>
<th>Operations/Requirements</th>
</tr>
</thead>
</table>

Findings

(COTS, CRAF, Wideband Services)

- KA provides great potential for commercial synergy
- Military/commercial bands today's frequencies have attributes not available in other
- New allocations very unlikely
Summary Findings

- Objective architecture
  Transition systems will be needed between the present and the satellites
  Changes to the ground segment are as critical as changes to
  Evolution will provide
  Future vision of doctrine will require more SATCOM than
  Significant changes in "how we fight" are enormous
  Potential for improved capability, lower "unit cost" and
Take advantage of international cooperative opportunities

• Fully integrate into the overall communications architecture

• Flexibility, system efficiency

• Accelerate on-going changes in terminal developments toward

• Facilitate demonstrations and operational use

• Enable evolution to new warfighting visions

• Unleash objectives, with no barriers to evolution

• Fund, take significant steps toward MILSATCOM

• Within limits of low-medium acquisition risk and acceptable

• Operations management, or risk trade-offs

• Ensure continuity of service through Satellite replenishment,

Transition Goals
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<tbody>
<tr>
<td><strong>X</strong></td>
<td><strong>X</strong></td>
<td><strong>X</strong></td>
</tr>
</tbody>
</table>

- **High Capacity Users**
  - Up to 1.5 Mbits
  - At 10.6 Mbits
  - At 100.4 Mbits

- **Mobile Users**
  - Up to 64 Kbps
  - Up to 1.5 Mbits
  - Above 1.5 Mbits

- **Protected & Survivable**
  - Up to 1.5 Mbits
  - Up to 10 Mbits
  - Above 10 Mbits

**Integration with DISN**

**Services and Attributes**

**Evolution to MILSATCOM Objectives**
Investigate international cooperative efforts –
Sustain EHF Polar capability through about 2010 (24 hr)
Sustain Mater III through DFS-6, new vehicle in 2005

Architects' Recommendations

- Improved capability
  - Continue to field a processed and crosslinked EHF system with

Transition Strategy

- Freedom of action during deployment, maneuver, and engagement
- Ensure adequate protected communications to maintain

Architecture Goal

Protected & Survivable Service
Decision point in 2005 on polar system - EHF or UHF LPI
- Interoperable with KA MILSATCOM systems «
- Higher capacity protected service - 10's of Mbps
- 'Common' waveform
- Objective EHF System
- 2 and 6th polar systems launch 2002 & 2003
- Incremental development toward 'objective' EHF system
- Backward compatible with MILSTAR II
- MDR waveform supporting 6-8 Mbps
- First launch in 2005

Transition EHF System
- First polar launch in 1997
- Operational management until transition EHF lives
- MILSTAR I & II through 2004
- 4 satellite constellation at geosynchronous orbit; 2 at HEO (polar)

EHF Space Systems Proposal
Transition Plan

(Protected/Survivable Service)
Use DOD Mobile Satellite Services for cell phone/data/paging
- Fully commercial service
- UHF capability complemented by theater UAV
- Improved GEO system
- Enhanced military systems at lower altitude

Examine future architecture alternatives:
- Fly additional UHF spectrum to ensure service

Architectures Recommendations
- Transition Strategy
  - Dominant maneuver & information superiority
  - Ensure adequate communications to forces on the move to support

Mobile Services
Geosynchronous orbit UHF with UAV complement

Mid-earth orbit UHF-cellular

- Alternatives are:
  - Geosynchronous orbit UHF-cellular system costed
  - Support 2010 First Launch
  - Transition to 2003-2005

Objective UHF System

Commercial acquisition

3 satellites

UHF "gapfiller" system 2003-2010

Transition UHF System

9 satellites constellation at geosynchronous orbit

MILSATCOM UHF Systems Proposal
(Mobile Services)

Transition Plan
Investigate CRAF-like commercial agreements for military/commercial Ka
-
Use Ka for Global Broadcast, High Capacity, some protection
Ka/GbS capability sooner
Launch to replenish DSCS or earlier to expand constellation and
Continue DSCS Service Life Enhancement Program

Architect’s Recommendations •

Communications and Global Broadcast
System to meet significant demand for High Capacity
Field a transponded, “Commercial Like” X-band and Ka

Transition Strategy •

Transition Engagement
Ensure adequate communications to all echelons to support

Architect’s Goal •

High Capacity Service
- Processed X/Ka system
- Support 2010 terminal acquisition
- Decision point in 2007 timeframe
- Objective X/Ka System
- Earlier start possible for GBS and/or high capacity demand
- Ka is backward compatible with LFO-GBS
- Commercial acquisitions for 2006 launch costed
- X/Ka transponded system 2003/2006-2014

Transition X/Ka System
- Operational management until transition X/Ka fleet
- 4 satellites of SLEP
- 1 satellite of DSCS III
- DSCS through 2005
- 5 satellite constellation at geosynchronous orbit

MILSATCOM X/Ka System Proposal
Transition Plan (High Capacity/Broadcast Services)
Establish measurable goals to reduce O & S costs
- Reduce inventory of service unique, limited purpose terminals
- Provide higher data rate, protected services on mobile platforms

Architect's Recommendations
- MILSATCOM objectives, C4ISR Architecture
- Assess terminal acquisitions and designs to facilitate transition

Transition Strategy
- Infrastructure
- Provide superior information services at all levels with reduced

Architecture Goal
User operated (no MILSATCOM unique OGS)
- Remotely reprogrammable "Slice" radios
- Leverage commercial technology
  - Military Ka/Commercial Ka
  - EHF/Ka
- Multi-band terminals

Objective
- Implement terminal OGS costs reductions
- Maintain backward compatibility with pre-2005 terminals
- Revise current terminal strategies
- Terminal numbers increase from 6,000 to 29,000

Transition 2003-2015
- 9 Army, 7 Navy, 5 Air Force, 1 DISA
- 22 terminal programs

MILSATCOM Terminals Proposal
Provide a user-focused network management & control system
vision, weapons system communications needs
Support assessment of communication architecture, warfare
be distributed on protected EHF/MDS, KA GBS, etc
Implement a standard broadcast "module" (e.g., 6 Mbps) that could
Integrate DISN, SATCOM and GBS nodes

Architectural Recommendations

Integrate SATCOM systems with the DISN at all levels

Transition Strategy

Significantly reduce the communication "footprint"

Architecture Goal

Related Infrastructure
"Networks over PCS handhelds
"Standard integrated network management and control
Operations
- Rad-hard chips
Components
- Breakthrough reduction in QoS
Software reconfigurable to different waveforms
- Multi-band (e.g., X, Ka, EHF) - including commercial frequencies
Terminals
- Enable wideband communications to mobile users
CFAR implementation
- Enable global access at high data rates, protection via nulling
Antennas

Technology Investment Recommendations
Fiscal Year

Cost Profile

FY96 $s Billion

$ 5.4.6 Billion

Ground 25.7%

Space 20.0%

Pivot 2.9%

Lease 6.0%

FY96 $s Billion