OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
1400 DEFENSE PENTAGON
WASHINGTON, DC 20301-1400

PUBLIC AFFAIRS

OCT 28 1996

Ref: 96-F-1828
GP96-110m

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

#840

# 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 conslidate 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.

#840

# Joint Space Management Board

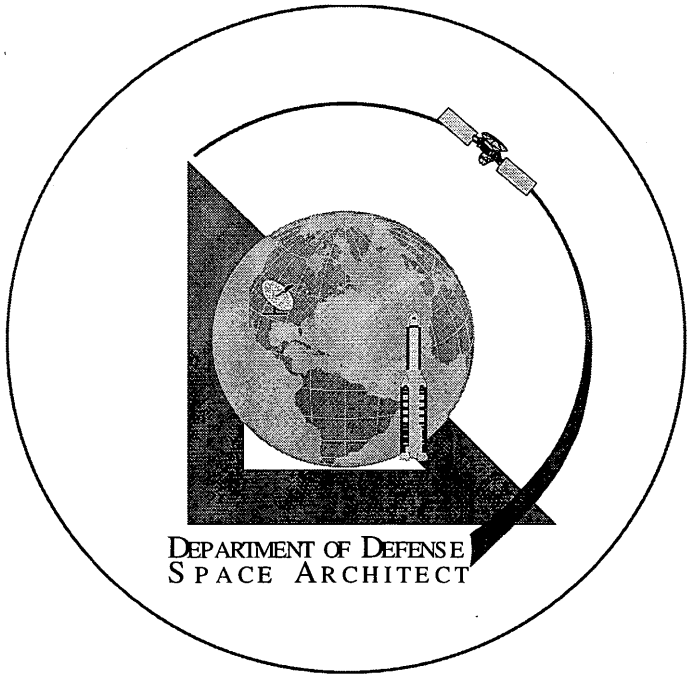
## AGENDA

| | | |
|---|---|---|
| 1030-1035 | Opening Remarks | Co-chairs |
| 1035-1040 | Administrative Remarks<br>Approval of Minutes<br>Action Items | Exec Sec's |

MILSATCOM

| | | |
|---|---|---|
| 1040-1045 | Introduction | Mr. Davis |
| 1045-1055 | Role of MilSatCom in DISN | LtGen Edmonds |
| 1055-1105 | MilSatCom Requirements | MajGen Donahue |
| 1105-1205 | MilSatCom Architecture Alternatives | MajGen Dickman |
| 1205-1225 | MilSatCom Plan and Recommendation | Mr. Davis |
| 1225-1230 | Closing Remarks | Co-chairs |

#840




*DoD Space Architect*

# Department of Defense Space Communications Architecture

# Scope

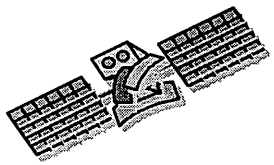
- Future Objectives (2010-2025)
- Transition Goals & Strategies (2003-2015)
- Military owned & operated (MILSATCOM)
- Commercially owned & operated (Commercial)
- Other government systems
  - National systems
  - NASA

# MILSATCOM Objectives 2010-2025

- Provide assured, secure communications
  - Right comm, right user, at the right time
  - Information services driven
    - » From protected voice to "Information Superiority"
- Fully integrate with the DISN
- Reduce communications "footprint" (terminals radios, antenna, RF signature, people, etc.)
- Be user friendly, interoperable

# Legacy SATCOM 2003

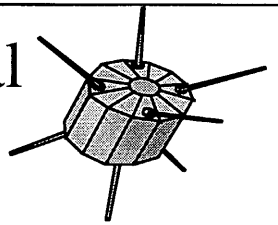
## DSCS



SHF
X-Band

- Med capacity
- Limited protection
- Approximately 1,000 terminals
- Vehicle, ship/sub, fixed

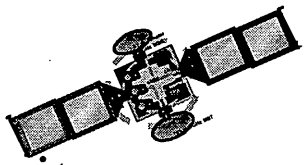
## Commercial



Ka, C-Band,
Ku, L

- High Capacity
- Little protection
- Handhelds, vehicles, fixed

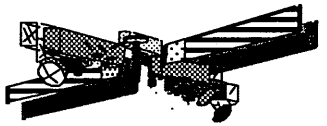
## UFO-E



UHF

- Low capacity
- GBS
- No protection
- 1,000s of mobile terminals
- Manpack, ships, aircraft

## Milstar



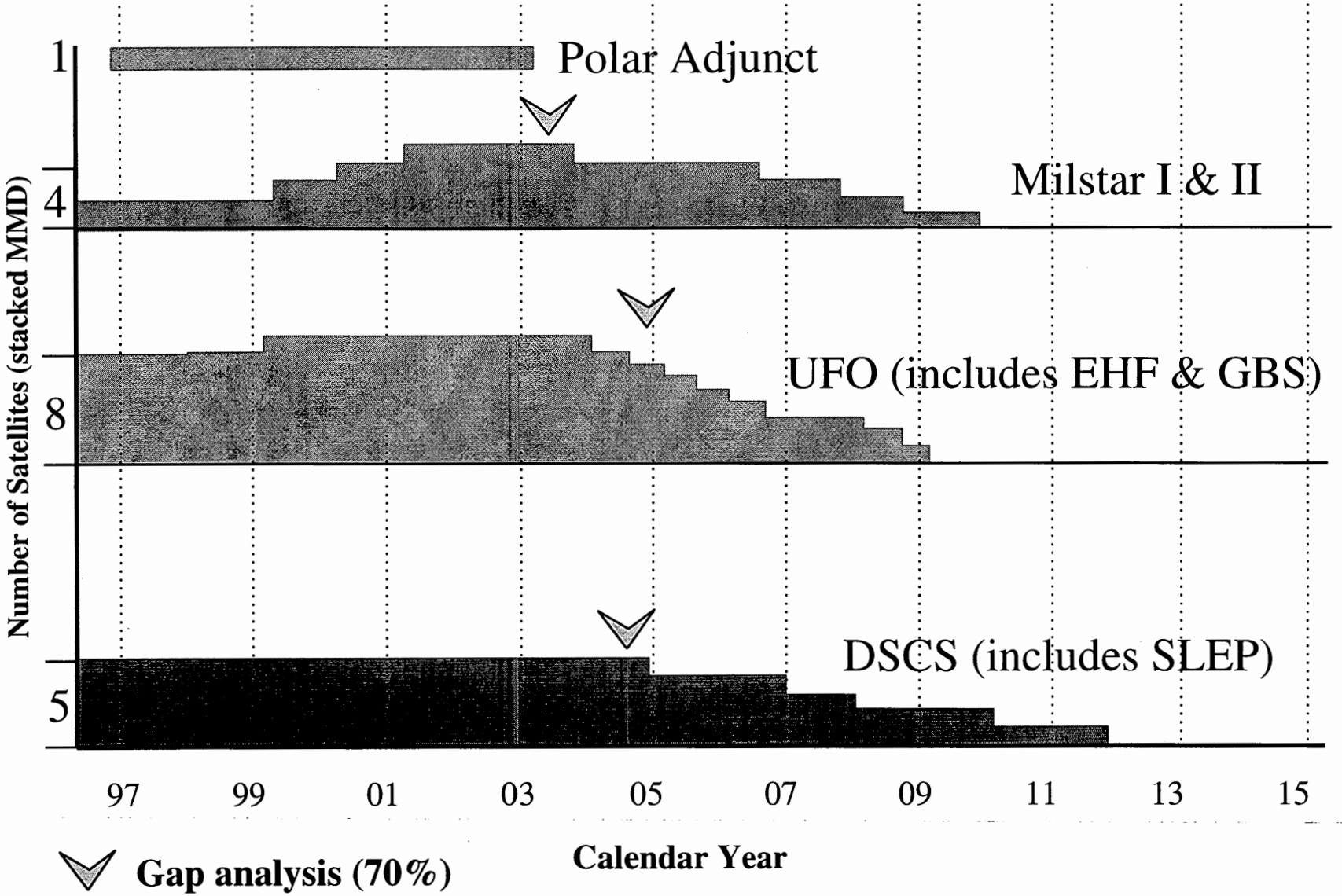
EHF

- Low-medium capacity
- Switched, protected, survivable
- Approximately 1,000 terminals
- Manportable, transportable, fixed

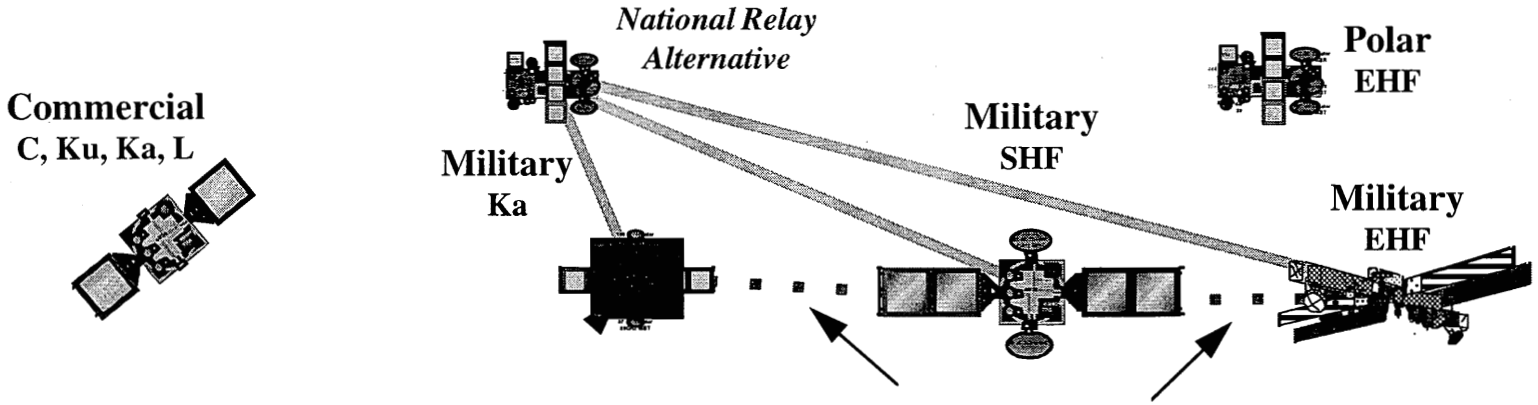
**Total estimated cost, 1983-2003 $\geq$ $50B (FY96$)**

# Current MILSATCOM Satellite Inventory

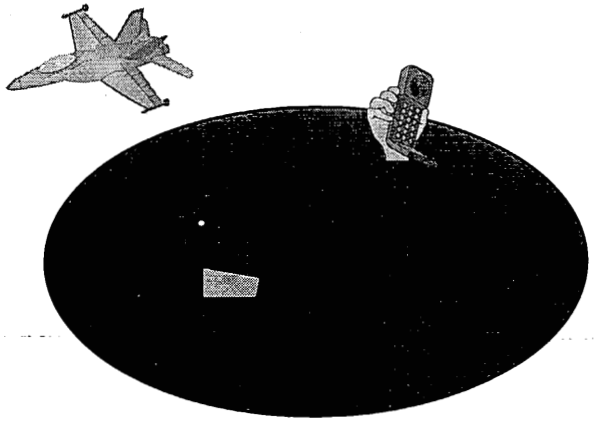
(Mean Mission Duration - 100% Launch Success)



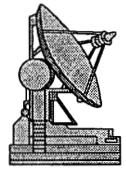
# Architecture Considerations

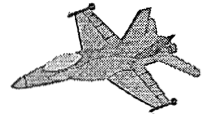


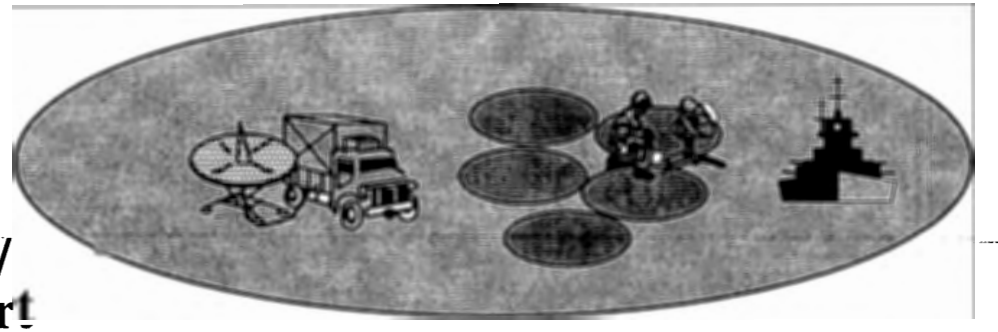


Mobile Service

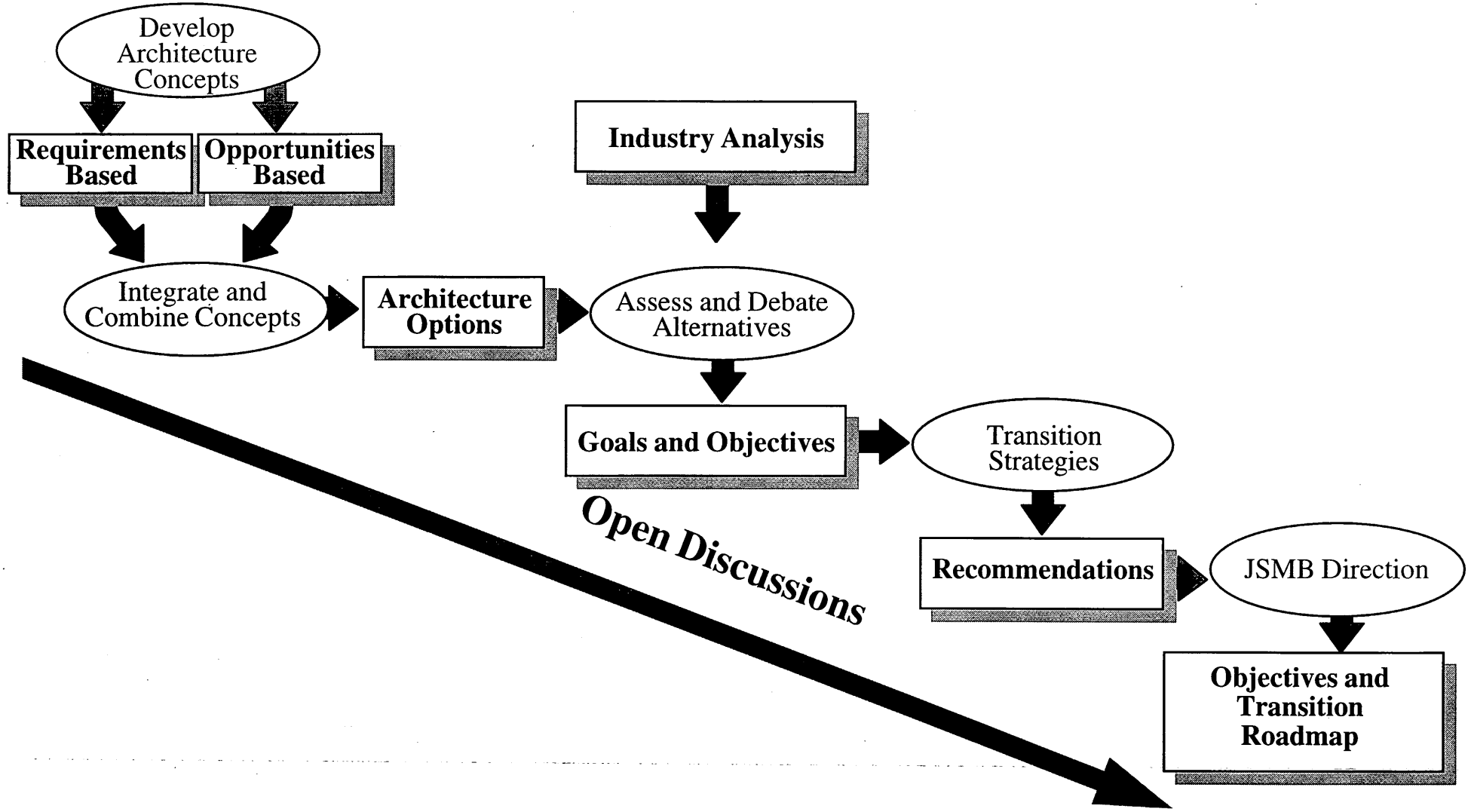




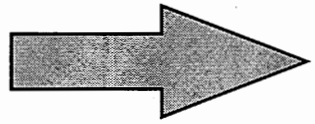
High Capacity Service

# Development of MILSATCOM Objectives



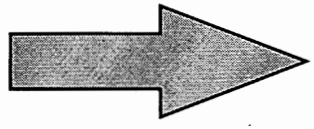
# Requirements - Warfighters Vision/CRD

- Joint & Coalition
  - Interoperability
- Dominant Maneuver
  - Wide area, all echelons, netted



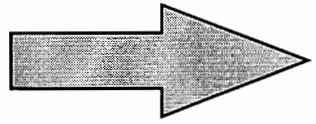
**Mobile**

- Precision Engagement
  - Information driven, sensor-to-shooter



**High Capacity**

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



**Protected & Survivable**

- Focused logistics
  - Smaller footprint/airlift, less manning and O&S

# Opportunities

- Breakthroughs in commercial SATCOM
  - Higher power, higher capability, higher weight, GEO S/C
  - Large constellations of simpler S/C at lower altitudes
  - Frequency reuse (cellular), on-board processing, crosslinks
  - Smaller, low cost terminals
  - Migration to Ka frequencies (adjacent to military Ka)
- Breakthroughs in related fields
  - "Slice technology"
  - Phased array antenna
  - Information handling
- Acquisition Reform

# Architecture Alternatives

**Alternative B**

**Press Technology**

**Design for Info Dominance**

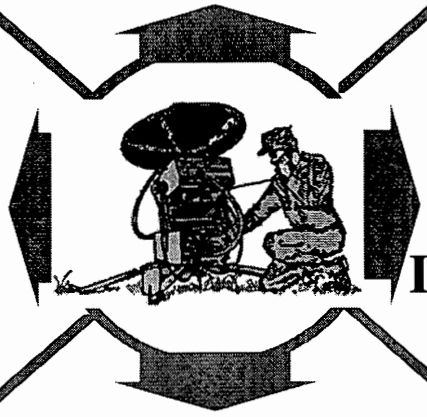
**$=X+20%**

**Alternative A**

**Capitalize on investment**

**Modernize current systems**

**$=X**



**Alternative C**

**Retain core military capability**

**Expand commercial role**

**Look at complements (e.g. UAV)**

**$=X-20%**

**Alternative D**

**Own unique military capability**

**Commercialize MILSATCOM**

# Comparative Analysis

| | A<br>Modernized<br>Baseline | B<br>Performance<br>Optimized | C<br>Military<br>Core | D<br>Commercial<br>Centered |
|---|---|---|---|---|
| **Performance & Utility** | **Green** | **Blue** | **Grn/Yel** | **Yel/Red** |
| **Acquisition Risk** | **Green** | **Yellow** | **Green** | **Green** |
| **20 Year LCC (FY96 $)** | **$55B** | **$67B** | **$51B** | **$61B** |

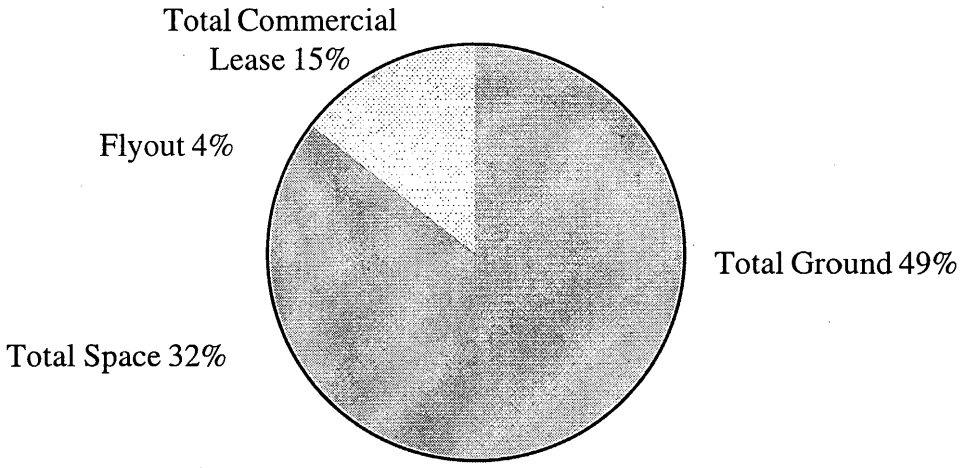
# Industry Findings

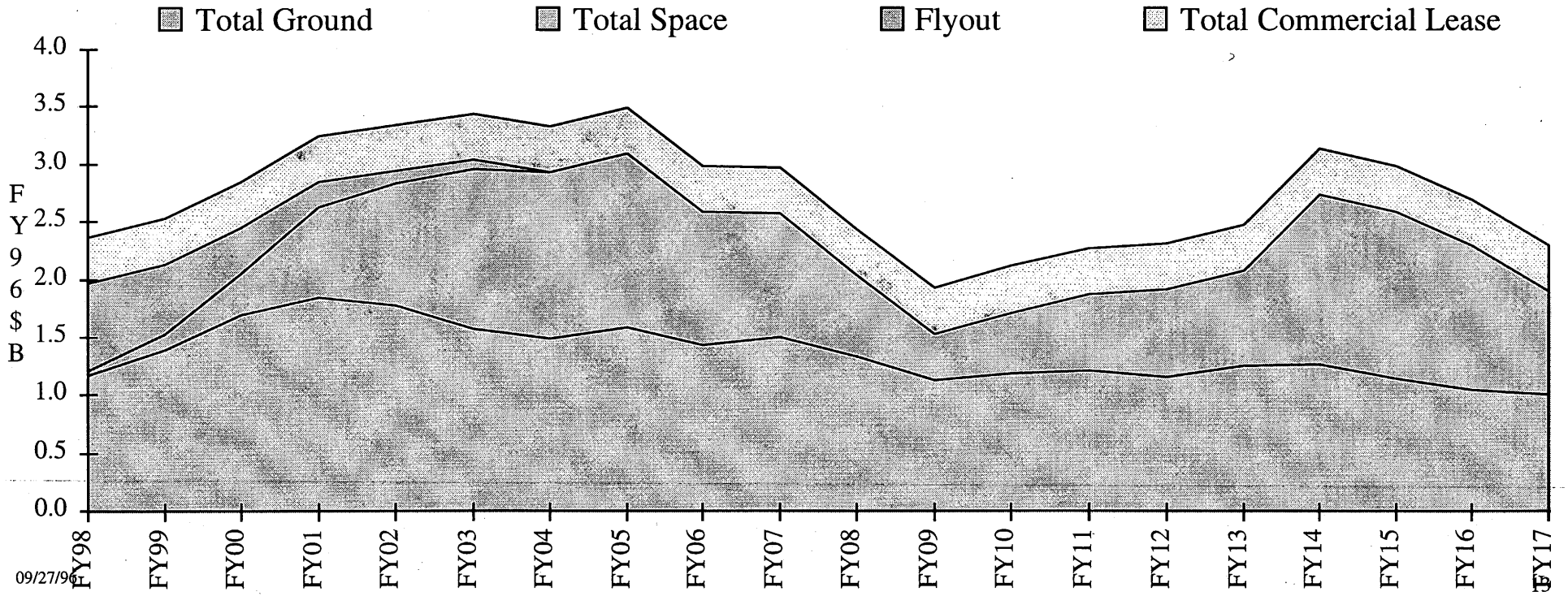
- Commercial market will not support Mobile Netted, Protected or Survivable communications services

- LCC of buying a system <1/2 the cost of leasing the same system
  - Cost can be somewhat reduced with long-term leasing
  - Lowest cost attained through procurement of a commercial-like system with military frequencies

- Significant technology will be demonstrated over the next 5-10 years
  - Switched, crosslinked, processed systems
  - Varied earth orbits, large constellations
  - Dynamic communications control, low cost/low O&M terminals

# Cost Example - Modernized Baseline



# Findings

| **Requirements/ Operations** | Terminals | Space | Spectrum |
|---|---|---|---|

- Assured access, protection (AJ & LPI), survivability and netted mobile services are critical to warfighting
- Emerging Capabilities , such as MSS/GBS, and "Bandwidth on Demand," are not reflected in "Weapon system" CONOPS
- 2003-2010 Force Structures presume availability of "today's" types of services
- Operational Management is fragmented

# Findings

| Requirements/ Operations | **Terminals** | Space | Spectrum |
|---|---|---|---|

- Over 100 types of terminals are fielded today
  - Force Structure drives quantities, types
  - Most terminals have been single purpose, single user class
- Terminals have not been treated as a " variable" in transitions, architectures
- O & S Costs are significant and not visible

# Findings

| Requirements/ Operations | Terminals | **Space** | Spectrum |
|---|---|---|---|

- Technology growth is faster than our acquisition timeline
  - Some technologies will continue to be military led
- Many revolutionary systems (Iridium, Spaceway, TELEDISC, etc.) are med-high risk and not yet demonstrated
- Because of commercial demands and EELV, launch will not be a constraint or cost driver
- Replenishment for DSCS, UFO, Polar and Milstar II capabilities will be needed in 2003-2008
  - Timing will require operational management, risk trade-offs and possible "gapfiller" satellites

# Findings

| Requirements/ Operations | Terminals | Space | **Spectrum** |
|---|---|---|---|

- New allocations very unlikely
- Today's frequencies have attributes not available in other military/commercial bands
- Ka provides great potential for commercial synergy (COTS, CRAF, Wideband Services)

# Summary Findings

- Potential for improved capability, lower "unit cost" and significant changes in "how we fight" are enormous
- Future vision & doctrine will require more SATCOM than "evolution" will provide
- Changes to the ground segment are as critical as changes to the satellites
- Transition systems will be needed between the present and objective architecture

# Transition Goals

- Ensure Continuity of Service through Satellite replenishment, operations management, or risk trade-offs
- Within limits of low-medium acquisition risk and acceptable funding, take significant steps toward MILSATCOM objectives, with no barriers to evolution
- Enable evolution to new Warfighting visions
  - Facilitate demonstrations and operational use
- Accelerate on-going changes in terminal developments toward flexibility, system efficiency
- Fully integrate into the overall communications architecture
- Take advantage of international cooperative opportunities

# Evolution to MILSATCOM Objectives

| Services and Attributes | | 2003 | Transition 2003-2015 | Objective 2010-2025 |
|---|---|---|---|---|
| Integration with DISN | | | X | X |
| Protected & Survivable | Above 10 Mbps | | | X |
| | Up to 10 Mbps | | X | |
| | Up to 1.5 Mbps | X | | |
| Mobile Users | Above 1.5 Mbps | | | X |
| | Up to 1.5 Mbps | | X | |
| | Up to 64 Kbps | X | | |
| High Capacity Users | At 100's Mbps | | | X |
| | At 10's Mbps | | X | |
| | Up to 1.5 Mbps | X | | |

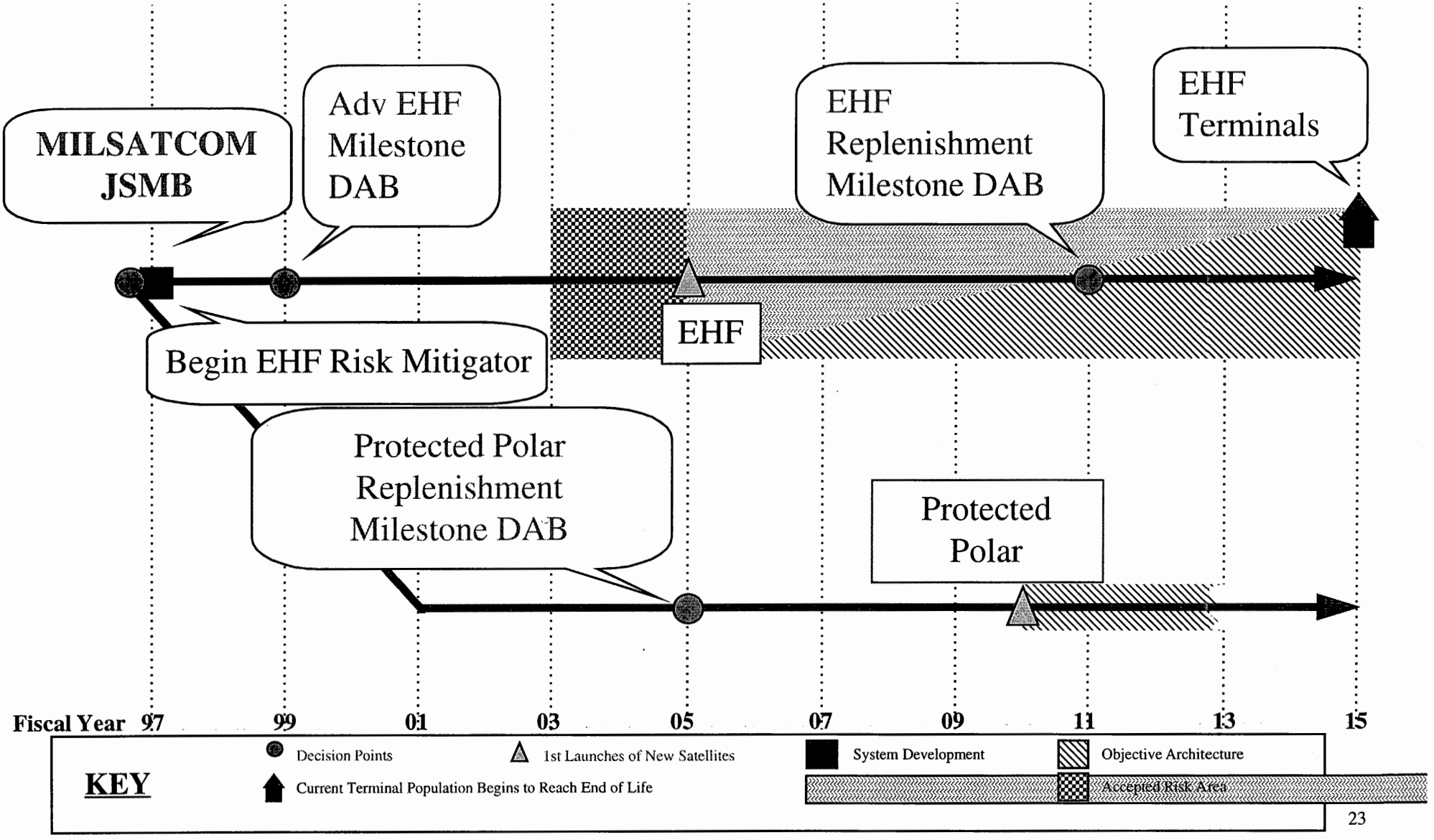
# Protected & Survivable Service

- Architecture Goal
  - **Ensure adequate protected communications to maintain freedom of action during deployment, maneuver, & engagement**
- Transition Strategy
  - **Continue to field a processed and crosslinked EHF system with improved capability**
- Architect's Recommendations
  - Sustain Milstar II through DFS-6, new vehicle in 2005
  - Sustain EHF Polar capability through about 2010 (24 hr)
  - Investigate international cooperative efforts

# EHF Space Systems Proposal

- 4 satellite constellation at geosynchronous orbit; 2 at HEO (polar)
  - MILSTAR I & II through 2004
  - Operational management until transistion EHF flies
  - First polar launch in 1997
- Transition EHF System
  - First launch in 2005
  - MDR waveform supporting 6-8 Mbps
  - Backward compatible with MILSTAR II
  - Incremental development toward "objective" EHF system
  - 2nd & 3rd polar systems launch 2002 & 2003
- Objective EHF System
  - "Common" waveform
    - » Higher capacity protected service - 10's of Mbps
    - » Interoperable with Ka MILSATCOM systems
  - Decision point in 2005 on polar system - EHF or UHF LPI

# Transition Plan
# (Protected/Survivable Service)



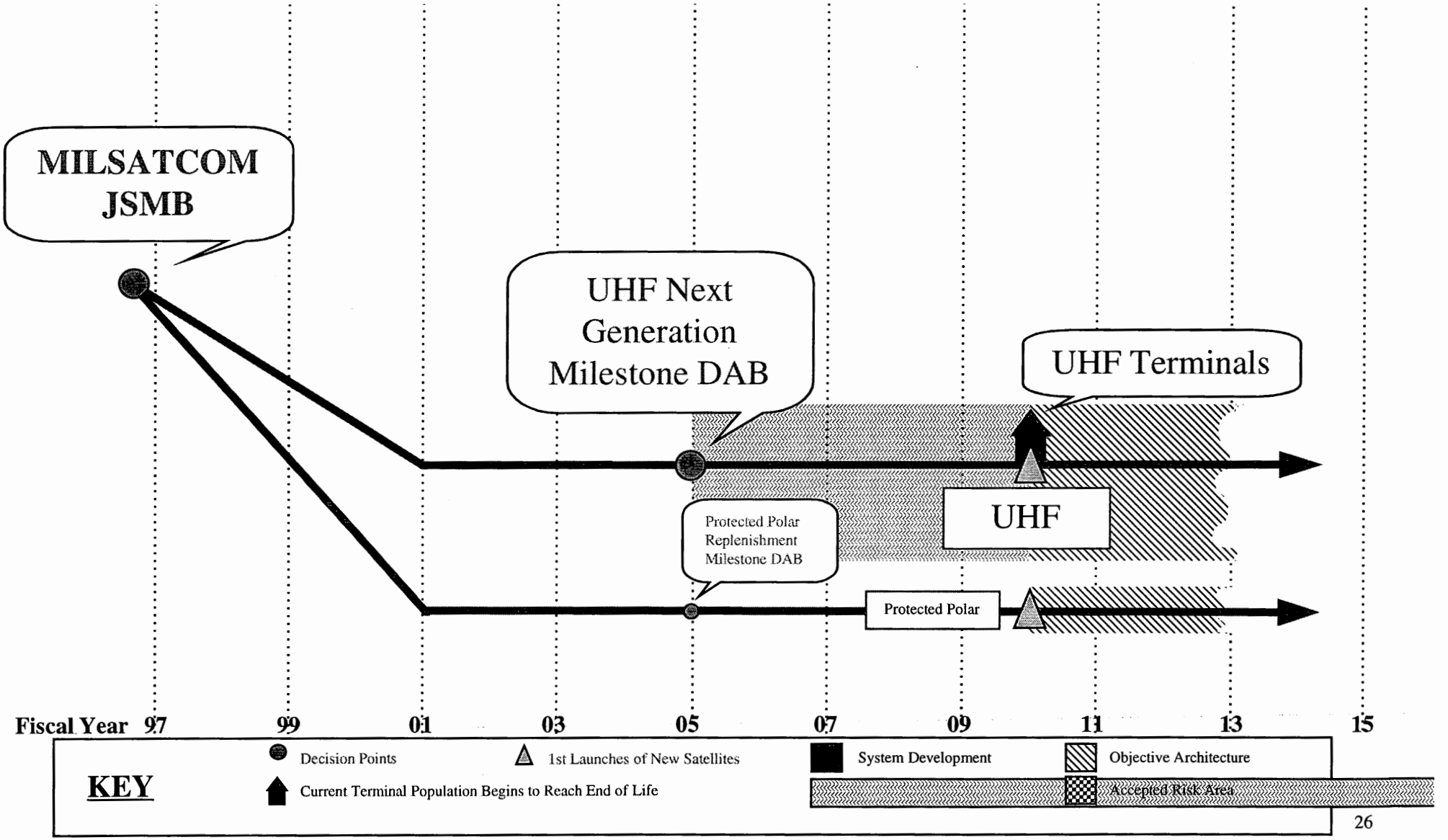
# Mobile Services

- Architecture Goal
  - **Ensure adequate communications to forces on the move to support dominant maneuver & information superiority**
- Transition Strategy
  - **Sustain UHF through transition, decide in 2003-2005 on objective architecture for netted mobile, handheld, paging, and LDR broadcast**
- Architect's Recommendations
  - Fly additional UHF spacecraft to ensure service
  - Examine future architecture alternatives:
    - » Enhanced military systems at lower altitude
    - » Improved GEO system
    - » UHF capability complemented by theater UAV
    - » Fully commercial service
  - Use DoD Mobile Satellite Services for cell phone/data/paging

# MILSATCOM UHF Systems Proposal

- 8 satellite constellation at geosynchronous orbit
  - UFO through 2005
- Transition UHF System
  - UHF "gapfiller" system 2005-2010
    - » 3 satellites
    - » "Commercial" acquisition
- Objective UHF System
  - Decision point - 2003-2005
    - » Support 2010 first launch
  - Geosynchronous orbit UHF-Cellular system costed
  - Alternatives are:
    - » Mid-earth orbit UHF-cellular
    - » Geosynchronous orbit UHF with UAV complement

# Transition Plan
# (Mobile Services)



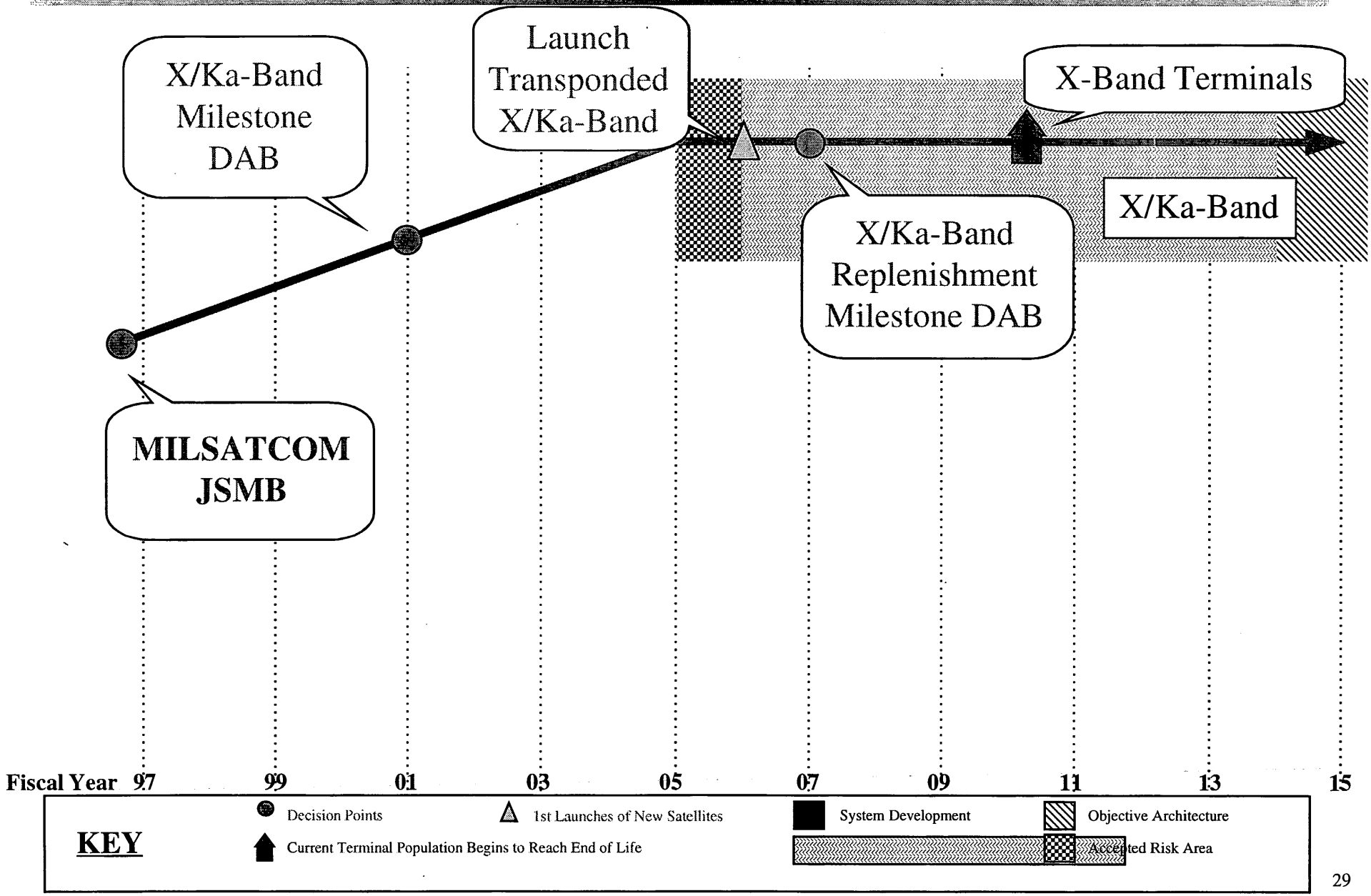
# High Capacity Service

- Architecture Goal
  - **Ensure adequate communications to all echelons to support precision engagement**
- Transition Strategy
  - **Field a transponded, "Commercial Like" X-band and Ka system to meet significant demand for high capacity communications and global broadcast**
- Architect's Recommendations
  - Continue DSCS Service Life Enhancement Program
  - Launch to replenish DSCS or earlier to expand constellation and Ka/GBS capability sooner
    - » Use Ka for Global Broadcast, High Capacity, some protection
  - Investigate CRAF-like commercial agreements for military/commercial Ka

# MILSATCOM X/Ka System Proposal

- 5 satellite constellation at geosynchronous orbit
  - DSCS through 2005
    - » 1 satellite of DSCS III
    - » 4 satellites of SLEP
  - Operational management until transisiton X/Ka flies
- Transition X/Ka System
  - X/Ka transponded system 2003/2006-2014
    - » "Commercial" acquisition for 2006 launch costed
  - Ka is backward compatible with UFO-GBS
  - Earlier start possible for GBS and/or high capacity demand
- Objective X/Ka System
  - Decision point in 2007 timeframe
    - » Support 2010 terminal acquisition
  - Processed X/Ka system

# Transition Plan
# (High Capacity/Broadcast Services)



# Terminals

- Architecture Goal
  - **Provide superior information services at all levels with reduced infrastructure**
- Transition Strategy
  - **Assess terminal acquisitions and designs to facilitate transition to MILSATCOM objectives, C4ISR Architecture**
- Architect's Recommendations
  - Provide higher data rate, protected services on mobile platforms
  - Reduce inventory of service unique, limited purpose terminals
  - Establish measurable goals to reduce O & S costs

# MILSATCOM Terminals Proposal

- 22 terminal programs
  - 9 Army, 7 Navy, 5 Air Force, 1 DISA
- Transition 2003-2015
  - Terminal numbers increase from 6,000 to 29,000
  - Revisit current terminal strategies
  - Maintain backward compatibility with pre-2005 terminals
  - Implement terminal O&S costs reductions
- Objective
  - Multi-band terminals
    - » EHF/Ka
    - » Military Ka/Commercial Ka
  - Leverage commercial technology
    - » "Slice" radios
    - » Remotely reprogramable
  - User operated (no SATCOM unique O&S)

# Related Infrastructure

- Architecture Goal
  - **Significantly reduce the communications "footprint"**
- Transition Strategy
  - **Integrate SATCOM systems with the DISN at all levels**
- Architect's Recommendations
  - Integrate DISN, SATCOM and GBS nodes
  - Implement a standard broadcast "module" (e.g 6 Mbps) that could be distributed on protected EHF/MDR, Ka GBS, fiber, etc
  - Support assessment of communication architecture, warfighting visions, weapons system communications needs
  - Provide a user-focused network management & control system

# Technology Investment Recommendations

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

# Cost Profile