N95- 14159

22233 p.16 1995107745

GENERIC ARCHITECTURES FOR FUTURE FLIGHT SYSTEMS

RICHARD J. WOOD
USAF/ROME LABORATORY

ABSTRACT

Generic architectures for future flight systems must be based upon Open System Architectures (OSA). This provides the developer and integrator the flexibility to optimize the hardare and software systems to match diverse and unique applications requirements. When developed properly OSA provides interoperability, commonality, graceful upgradeability, survivability and hardware/software transportability to greatly minimize Life Cycle Costs and supportability. Architecture flexibility can be achieved to take advantage of commercial developments by basing these developments on vendor-neutral commercially accepted standards and protocols. Rome Laboratory presently has a program that addresses requirements for OSA as will be presented.

BIOGRAPHY

Mr. Richard J. Wood is the Laboratory Program Manager for the Architecture for Survivable Systems Processing (ASSP) program. He has managed several R & D programs such as Advanced On-Board Signal Processors and Passive Tactical Target Identification Development. Prior work includes development of automatic navigation and landing systems for the Naval Aviation Facilities Experimental Center and the Federal Aviation Agency.

GENERIC ARCHITECTURE FOR FUTURE FLIGHT SYSTEMS

THE ASSP

RICHARD WOOD
ROME LAB/OCTS
GRIFFISS AFB NY 13441-5700
COMMERCIAL (315) 330-2215
DSN 587-2215

INTRODUCTION

- → Background
- → Issues
- → ASSP Profile
- → Products/Benefits
- → Synergism
- → Summary

NUMEROUS PROGRAMS ADDRESSING PORTIONS OF OSA/OSI

→ AF / RL - Architecture for Survivable System Processing (ASSP)

→ Corporate Information Management (CIM)

→ Modular Open System Architecture Standard (MOSAS)

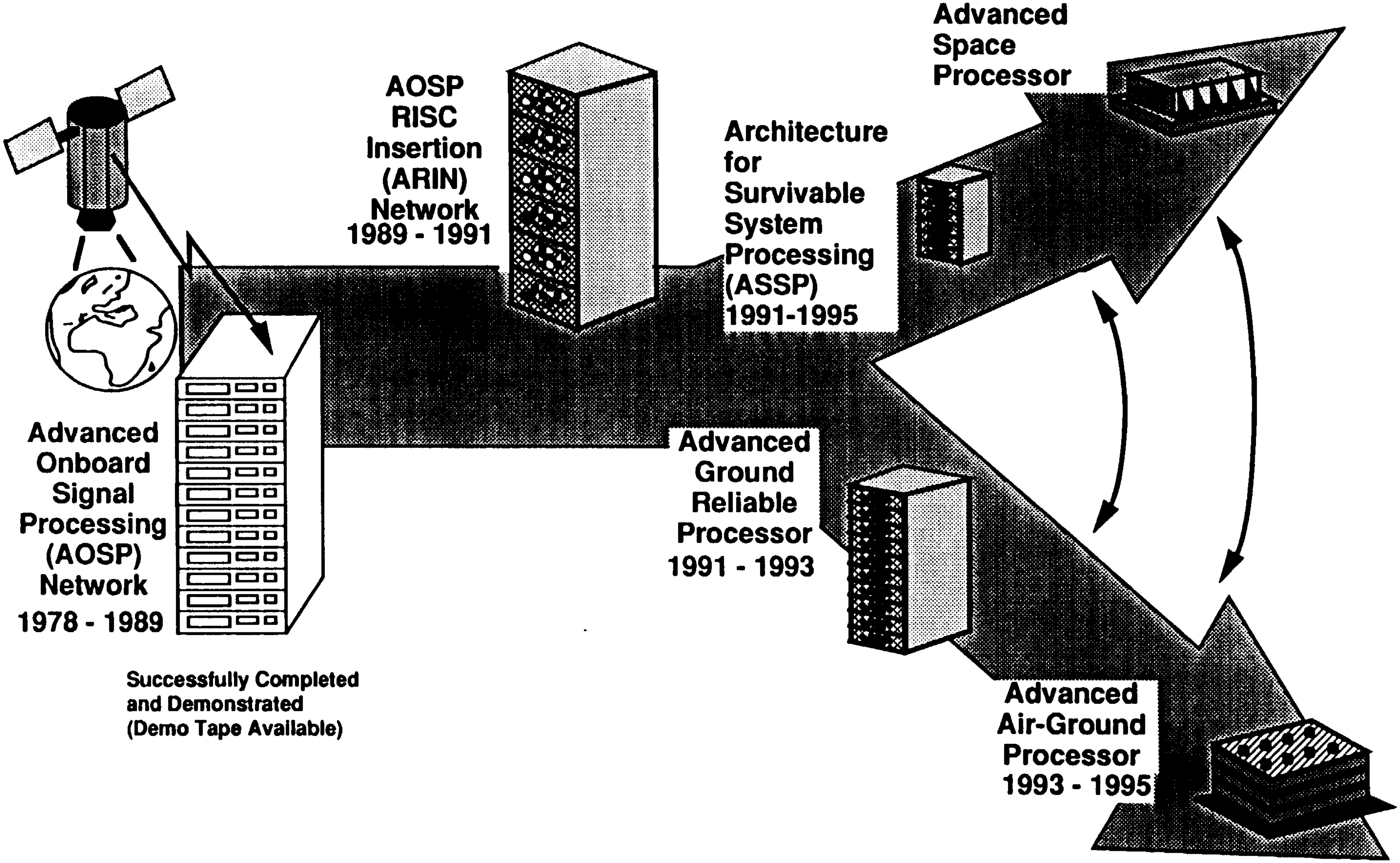
→ Consultive Committee for Space Data Systems (CCSDS)

→ Common Communication Components (Com^3)

→ Next Generation Computer Resources (NGCR) Program

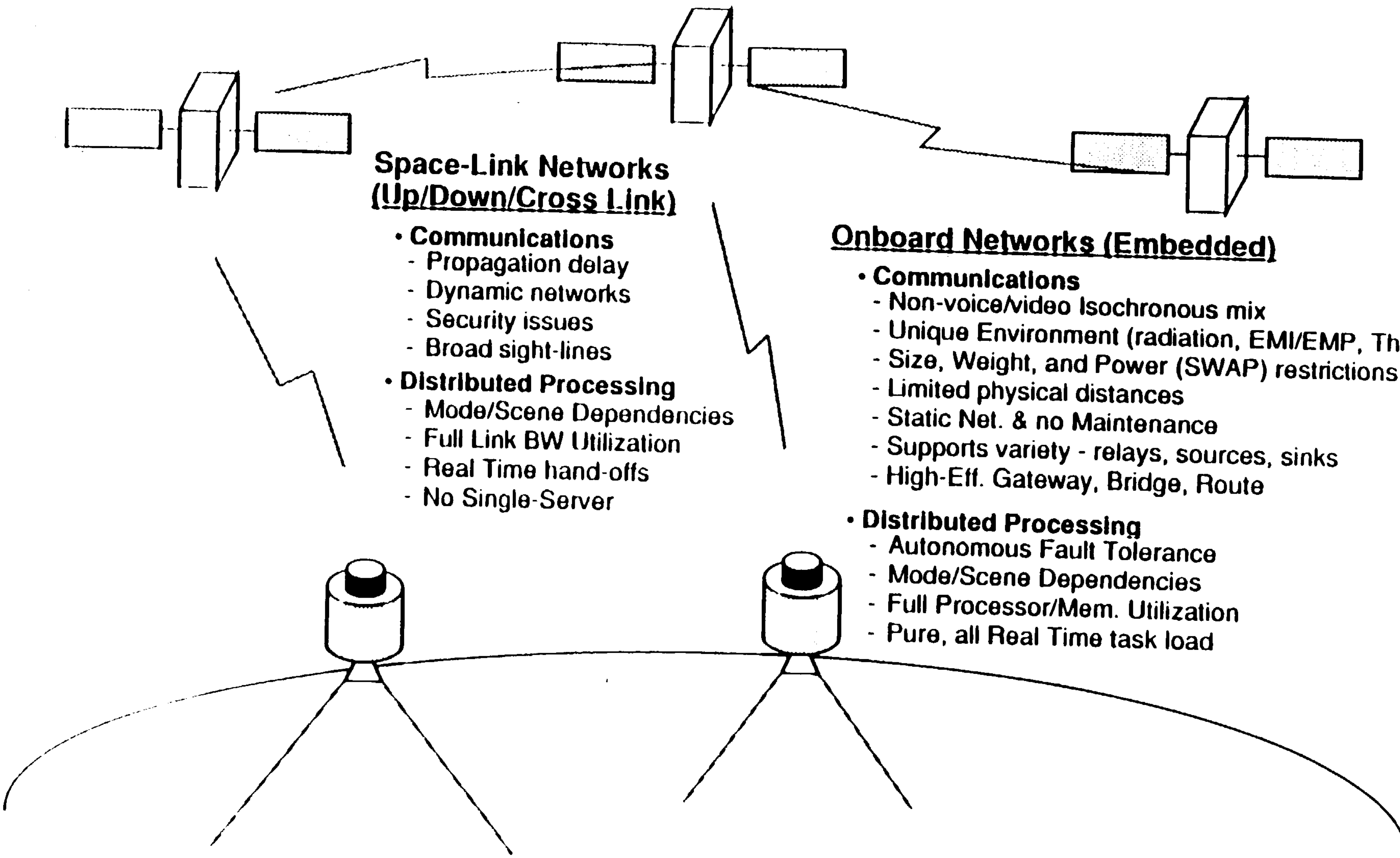
→ NORAD - US Space Command Integrated Command and Control System (NUICCS)

SURVIVABLE SYSTEM PROCESSING TECHNOLOGY OPPORTUNITY



VG0555j 19 Jul 92

Unique Space and Onboard Issues



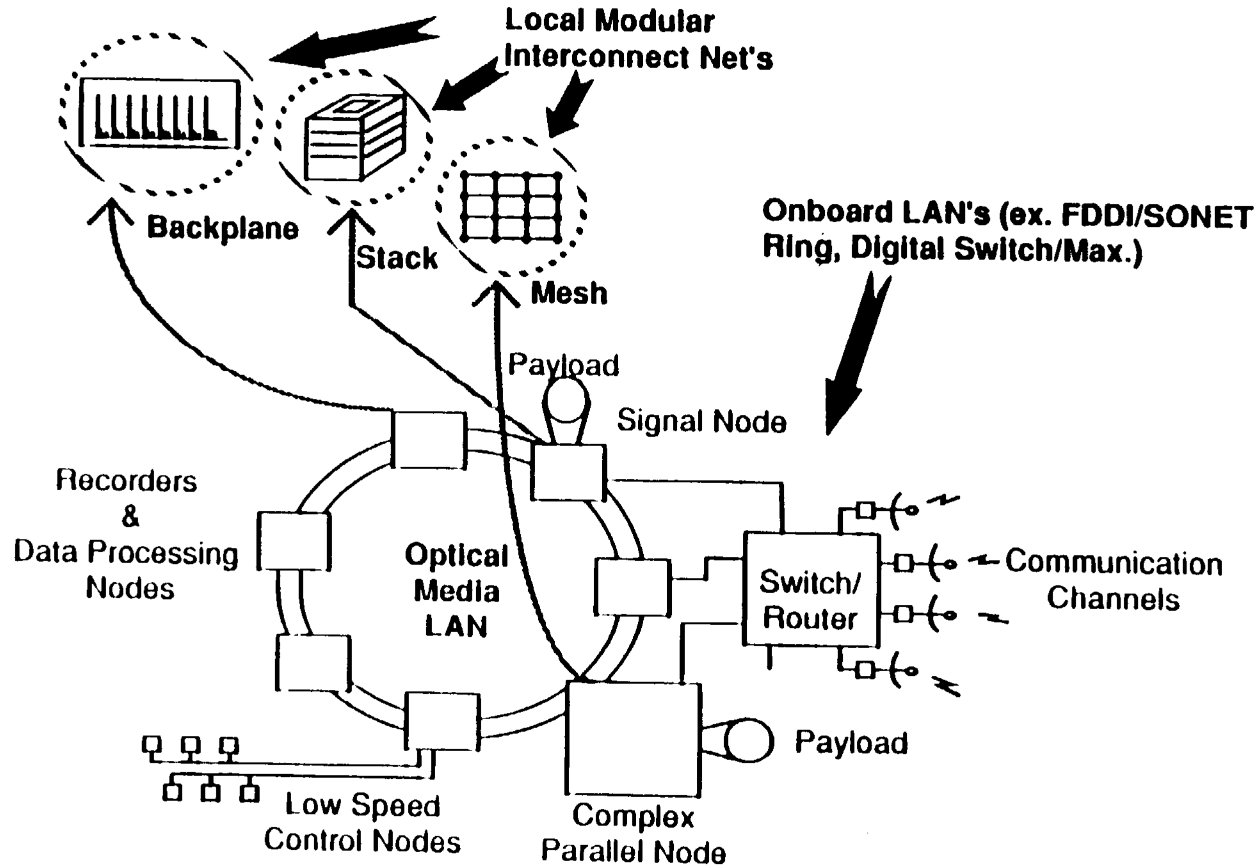
Space-Link Networks
(Up/Down/Cross Link)

- **Communications**
  - Propagation delay
  - Dynamic networks
  - Security issues
  - Broad sight-lines
- **Distributed Processing**
  - Mode/Scene Dependencies
  - Full Link BW Utilization
  - Real Time hand-offs
  - No Single-Server

Onboard Networks (Embedded)

- **Communications**
  - Non-voice/video Isochronous mix
  - Unique Environment (radiation, EMI/EMP, Thermal)
  - Size, Weight, and Power (SWAP) restrictions
  - Limited physical distances
  - Static Net. & no Maintenance
  - Supports variety - relays, sources, sinks
  - High-Eff. Gateway, Bridge, Route
- **Distributed Processing**
  - Autonomous Fault Tolerance
  - Mode/Scene Dependencies
  - Full Processor/Mem. Utilization
  - Pure, all Real Time task load

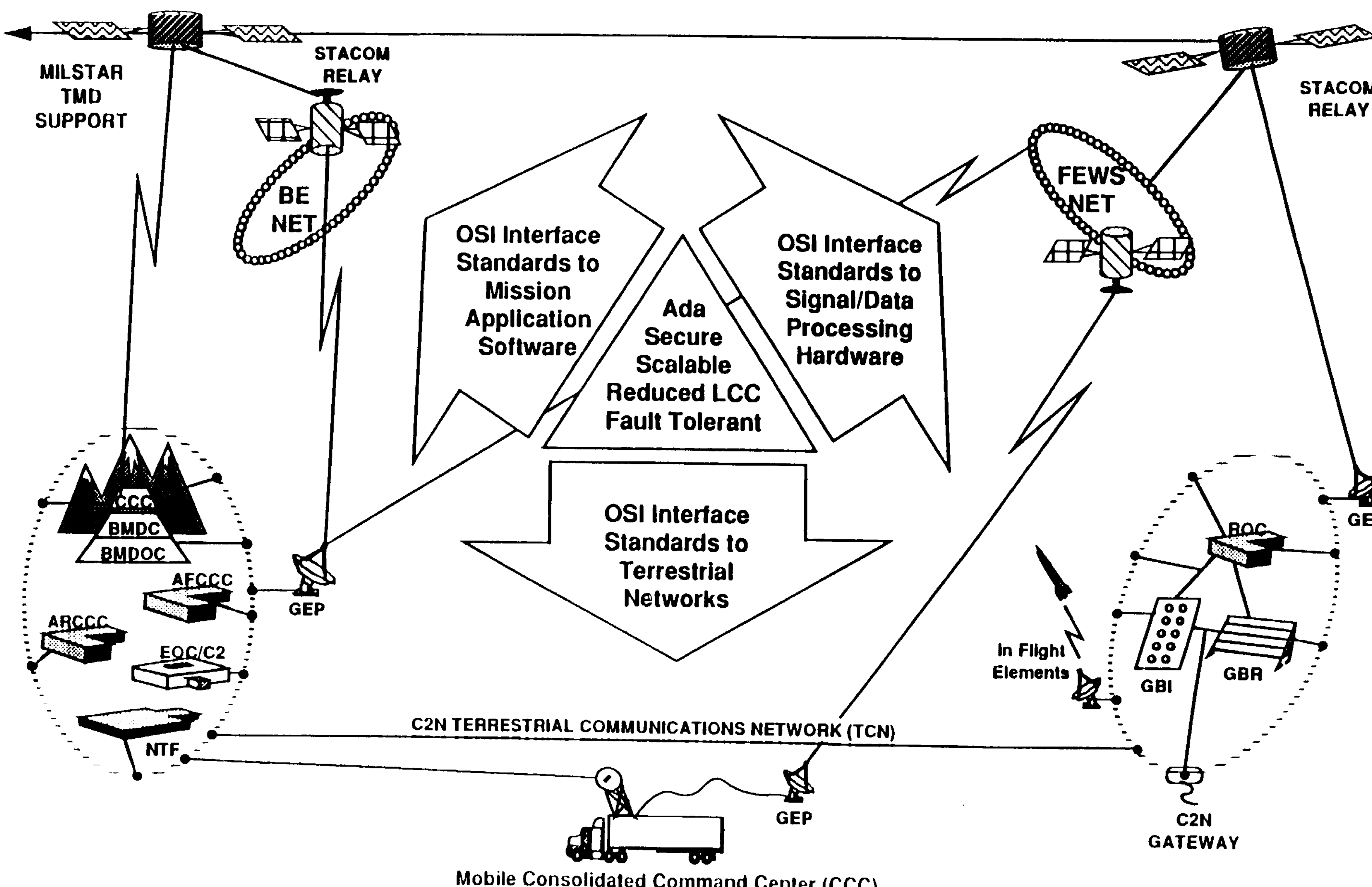
Complex Onboard Networking Scenario



Future satellites will incorporate a wide variety of functionality implying the need for varied processors and subnetworks.

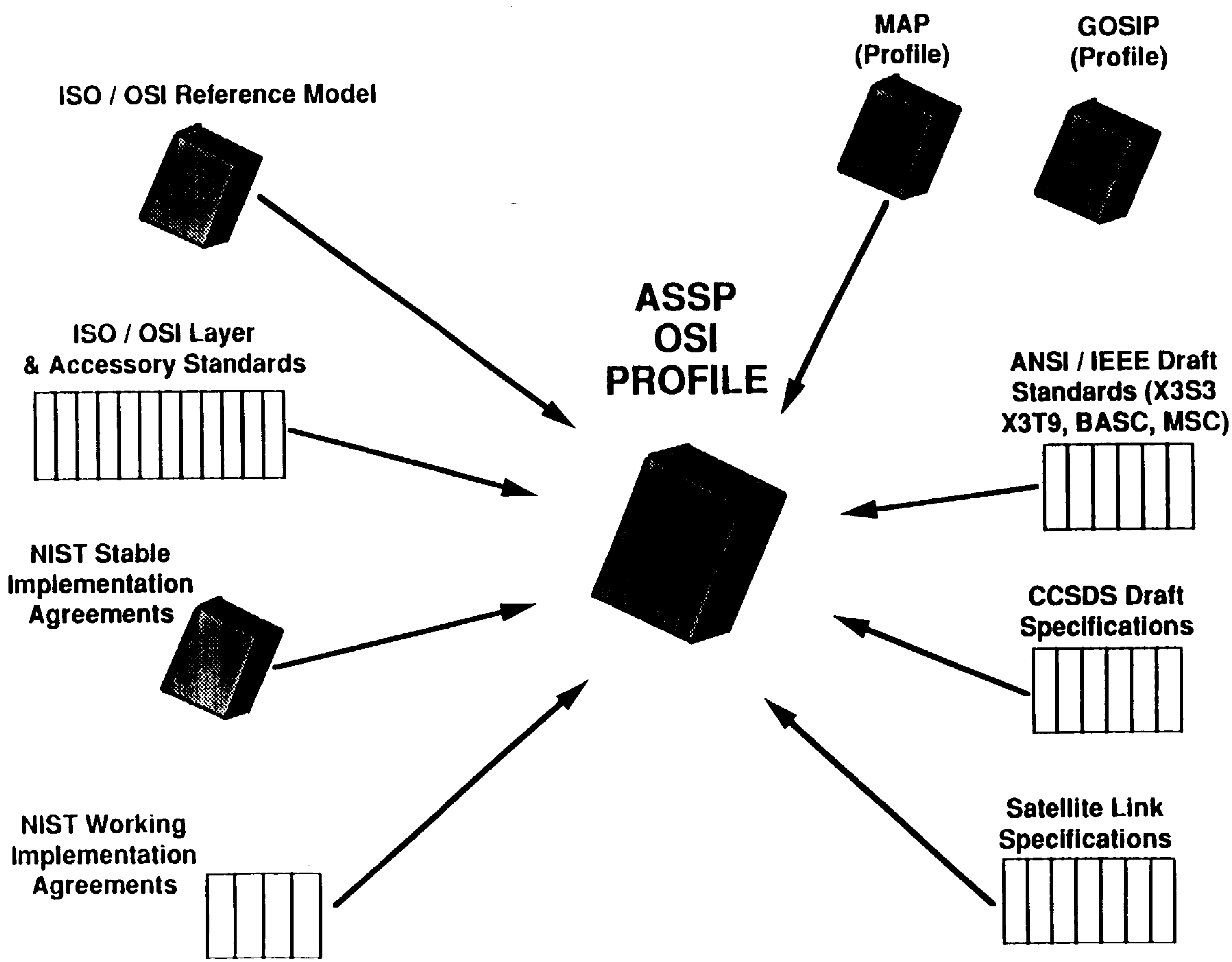
ARCHITECTURE FOR SURVIVABLE SYSTEM PROCESSING (ASSP)

Objective: Develop Standards Based OSA to Ensure Interoperability, Commonality Among Processor Components

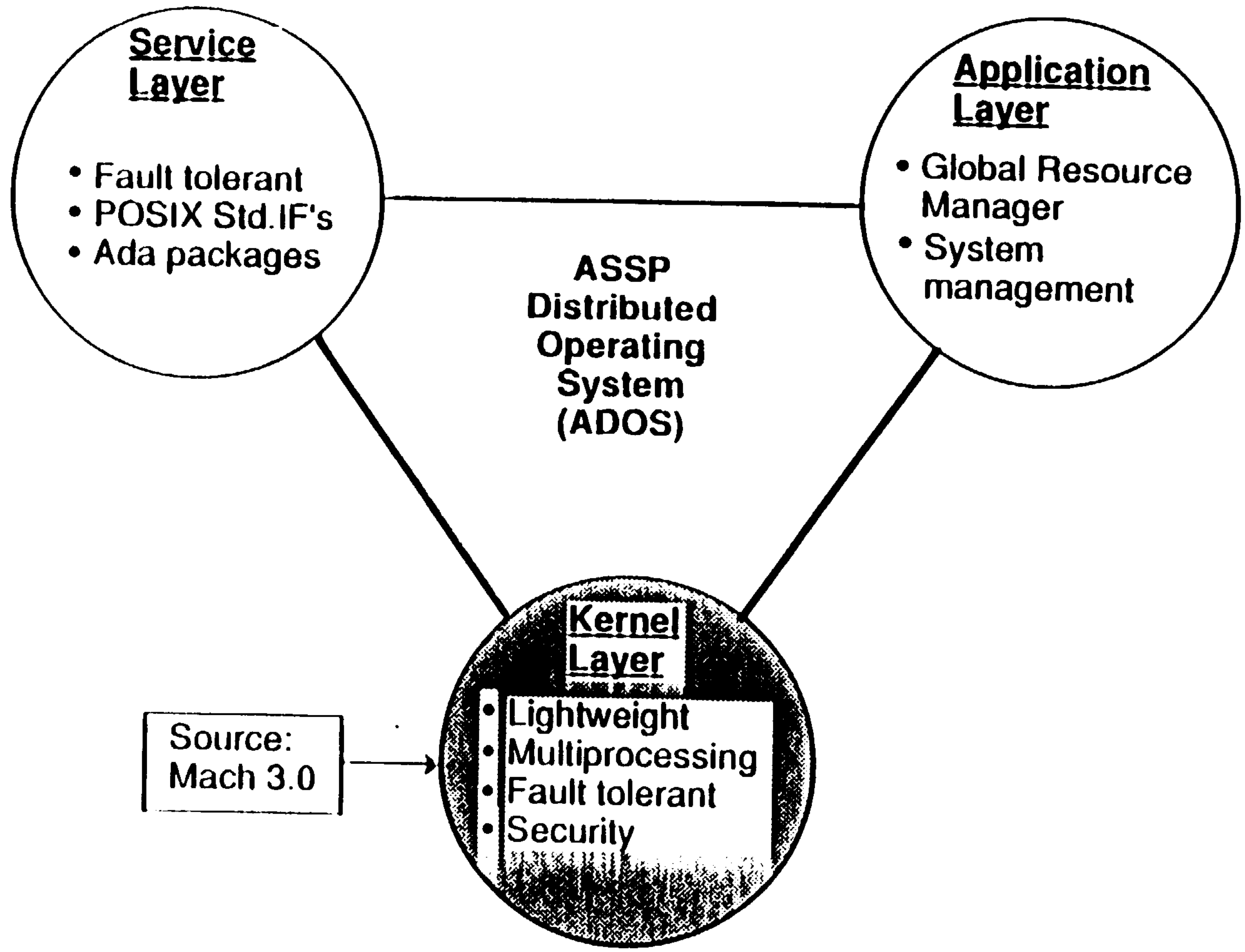


VG1888 12 Jun 92

ASSP OSI PROFILE CREATION



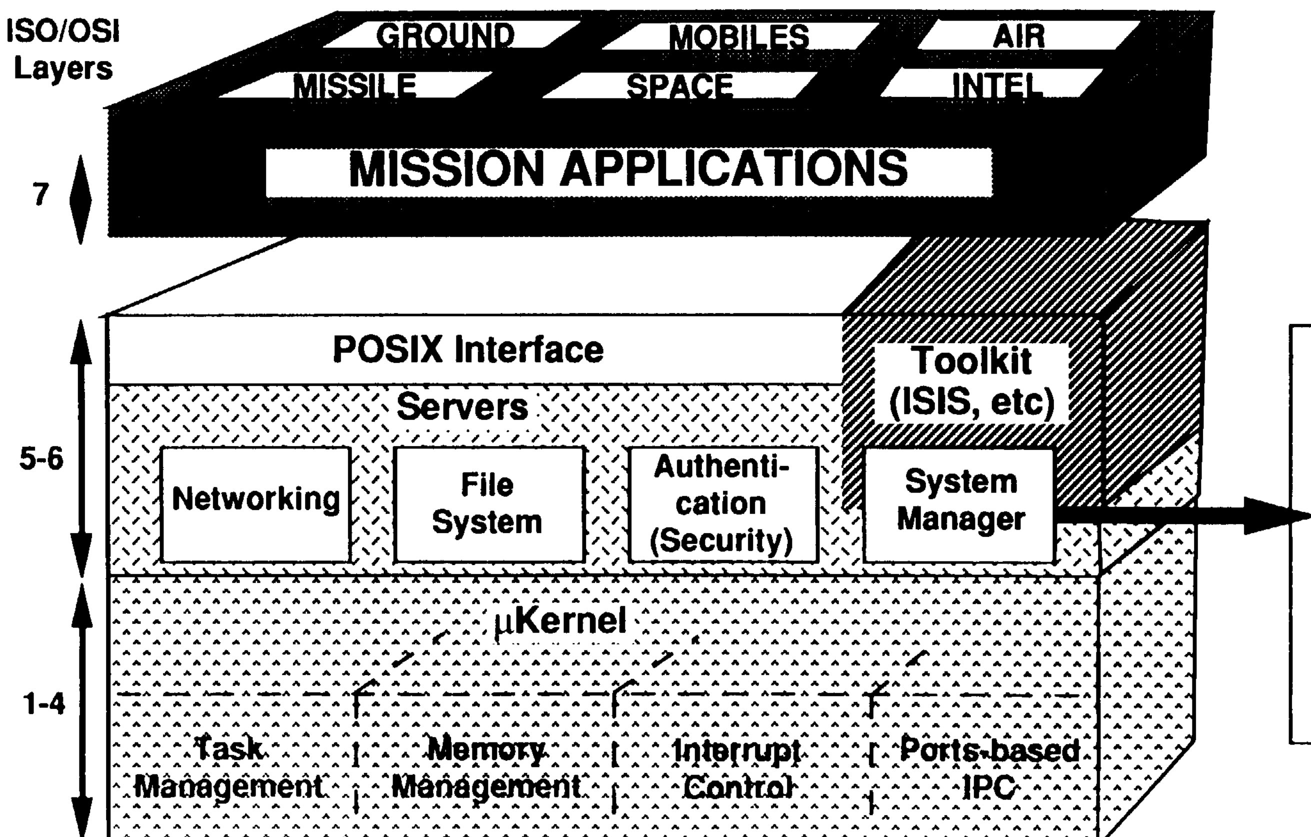
Baseline Kernel



ASSP DISTRIBUTED OPERATING SYSTEM (ADOS)

- Layered ADOS Architecture provides optimal mixture of features vs. efficiency
  - Microkernel provides efficient, real time, distributed functionality
  - Services provide rich networking, security, and file system management

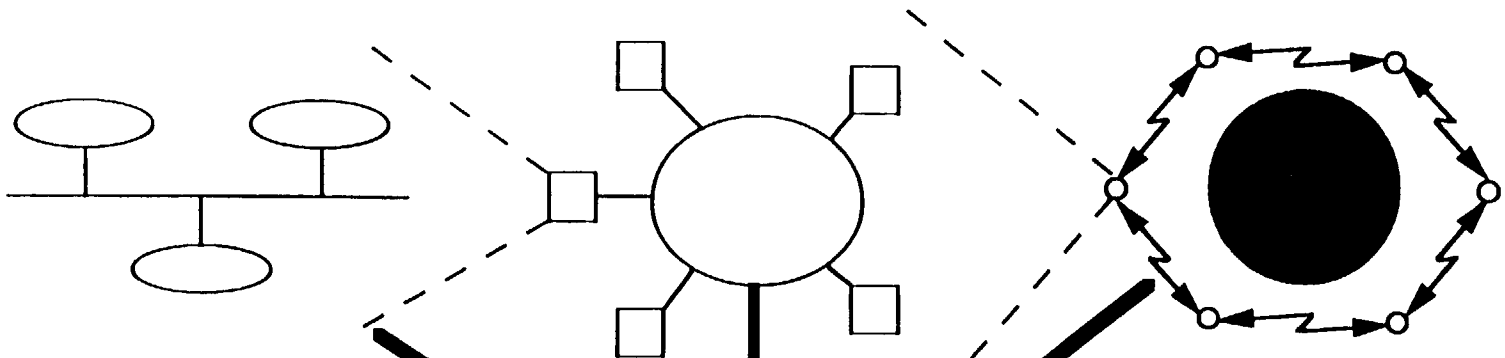
- ASSP-specific requirements implemented using application and system manager functions when possible

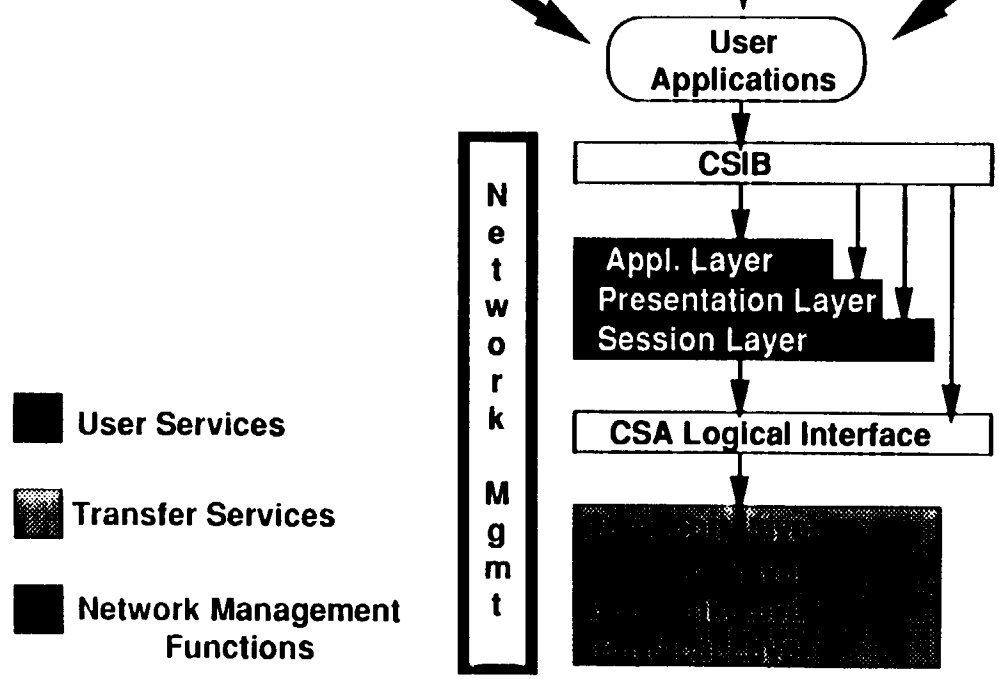


SYSTEM MANAGER

- Distributed Process Management
- Global fault management/ reallocation
- Real-time scheduling support across loosely coupled heterogeneous nodes

NEXT GENERATION OSI PERFORMANCE





ASSP User Services Advances:

- C2B1 Security
- Standard, network independent interfaces
- Minimal and complete OSI functionality available, based on overhead requirements

ASSP Network/Transport Advances:

- New high speed transport protocol development
- Standard network configurations and options

ASSP Network Management Advances:

- Autonomous/semi-autonomous network reconfiguration
- Fault tolerance and real time support

ASSP will take advantage of discrete advancements in protocol, service, and management to provide verified open specifications that facilitate interoperability and next-generation performance.

VG1893*
19 Jul 92

ASSP PRODUCTS

- Survivable Systems OSI Architecture Specification
  - Profiles composed of standards
  - Options and enhancements tailored to space systems
- Flexible/Adaptable Distributed, Real Time Operating System
  - Modular and tailorable
  - Fault tolerance support
  - OSI communication support
  - Standard Interface
- Simulations
  - Support for specific system/application designs
  - Users' manual
  - Model libraries
- Breadboard and Advanced Technology Testbeds
  - Configuration platform for realtime testing, prototyping, and conformance testing
- Hardware Specifications and VHDL Designs
  - Space-qualifiable networking components

ASSP STANDARDIZATION BENEFITS

* INTEROPERABILITY (Commonality)
  - Satisfies data/communication message passing requirements between intra-platform components and ground assets as well as inter-platform (via GPALS standards).
  - Provides interoperability with other system constellations FEWS, GPS, BP, MILSTAR, BE, GBR, GBI

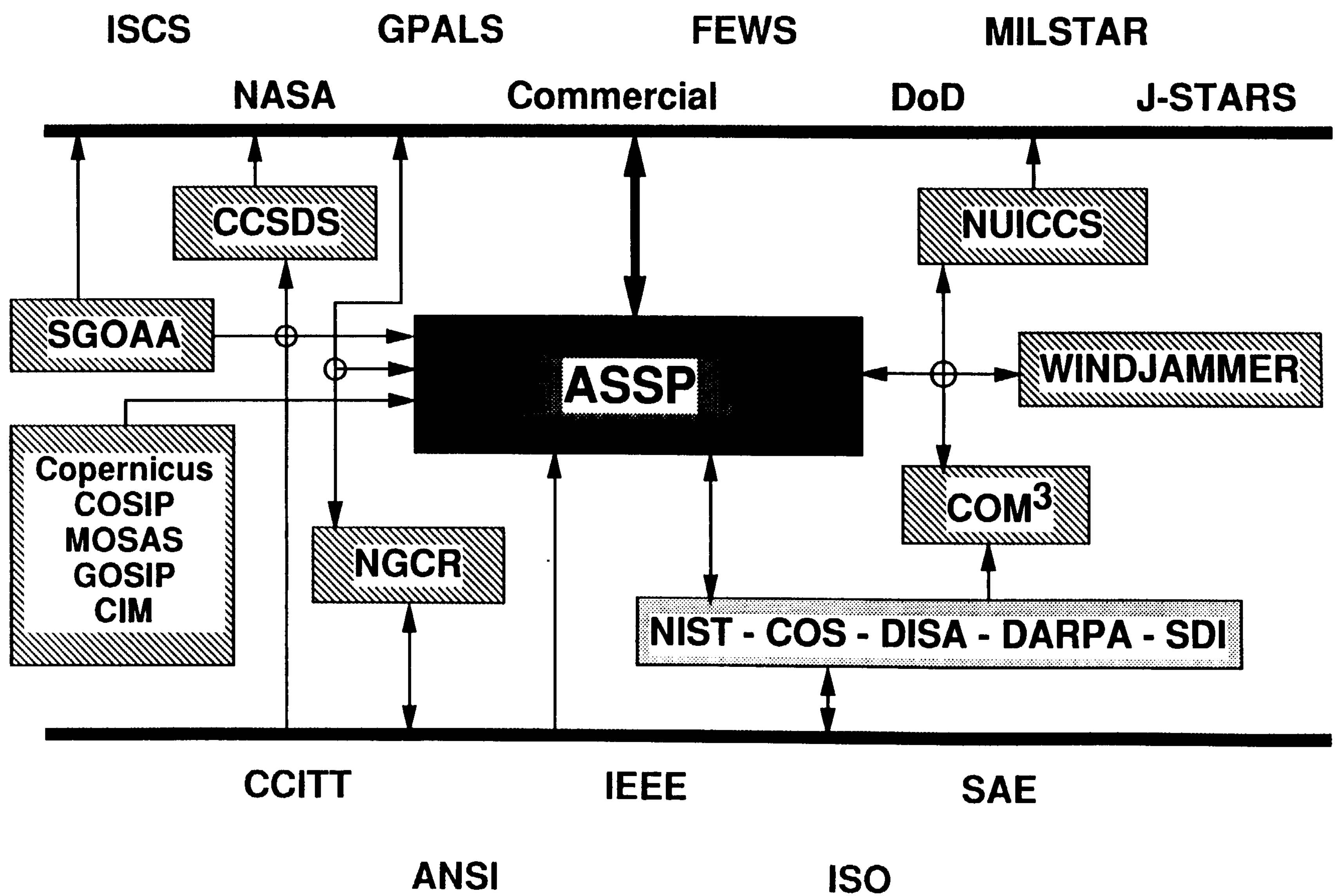
* SUPPORTABILITY
  - Reduces system Life Cycle Cost (LCC)
  - Enhances logistics requirements for maintainability and readiness.

* UPGRADEABILITY
  - Reduces machine dependency, promotes portability, enhances software reuse, elminates conforming to obsolete systems.

* LONGEVITY
  - Provides means for new generation components to incrementally upgrade older but still operational systems with no impact on operational status

* AFFORDABILITY
  - Reduces LCC.
  - Eliminates sole source costs.
  - Eliminates system obsolecence.
  - Maintains system effectiveness throughout long term requirements.
  - Leverages on commercial developments

ASSP SYNERGISM



VG1916* 16 Sep 92

ASSP SUMMARY

THE ARCHITECTURE FOR SURVIVABLE SYSTEM PROCESSING PROGRAM ADDRESSES THE KEY TECHNICAL CHALLENGES OF:

→ INTEROPERABILITY/INTERCHANGEABILITY OF HETEROGENEOUS PROCESSING NODES

→ OPEN SYSTEMS ARCHITECTURES FOR SPACE, AVIONICS AND GROUND ALLOWING RAPID INSERTION OF NEW MILITARY AND COMMERCIAL TECHNOLOGY

→ GOSIP COMPATIBLE / COMPLIENT

→ ISO / OSI REFERENCE MODEL BASELINE