

National Airspace System Architecture CNS/ATM Highlights

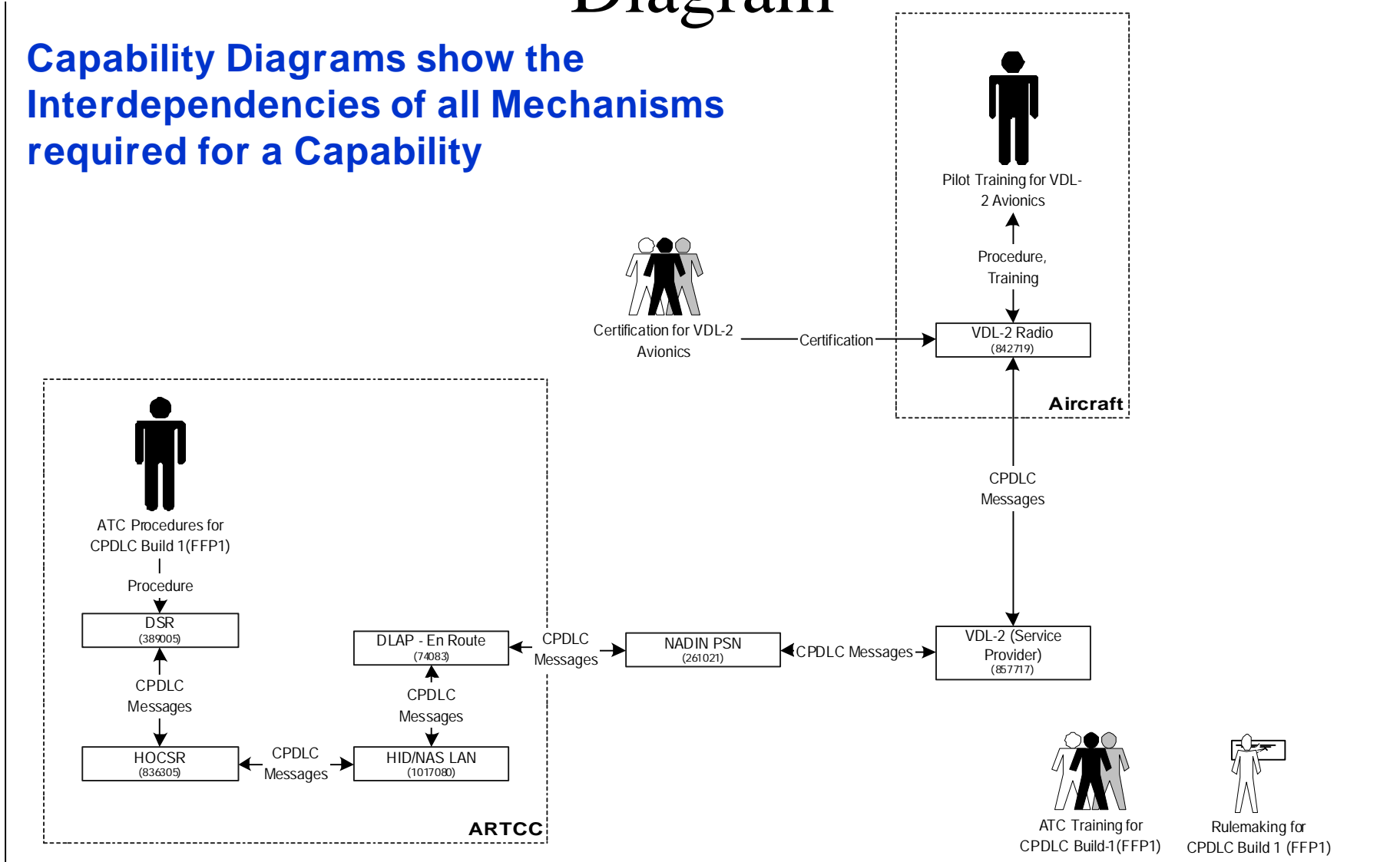
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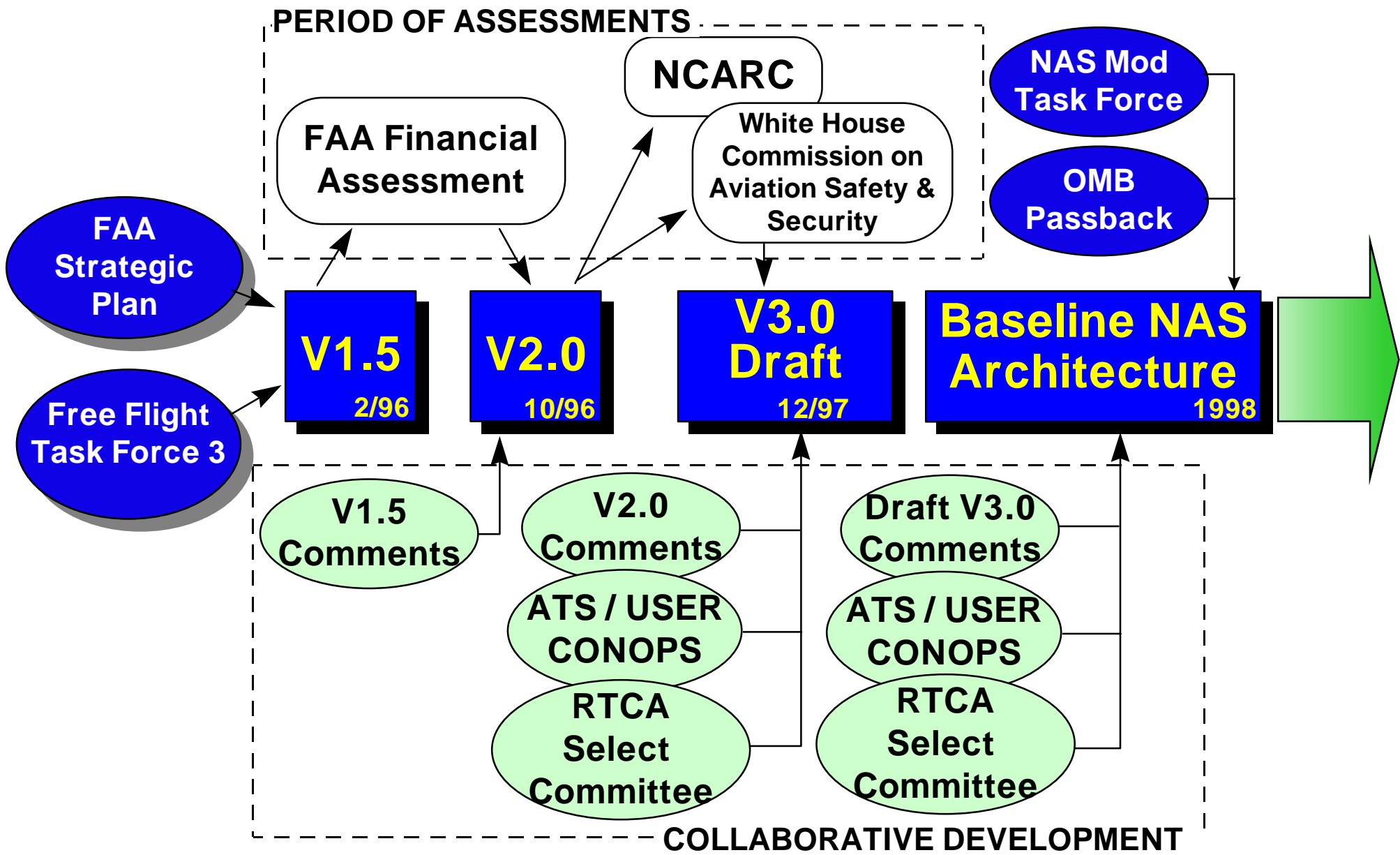
The NAS Architecture is not an end-state, but a “living” representation of an integrated and evolutionary approach to NAS modernization.

- **Concept-of-Operations Driven**
- **Structured Around Capabilities and Services - Not Just Line Items In A Budget**
- **Best Fit and Balance Between Sustainment and Modernization For The Expected Funding**
- **“Wedges” In Planning For Technology Refresh and New Capabilities**
- **Data Driven With Models and “What If” Capabilities**
- **System-of-systems View is Critical to Decision Making**

CPDLC - Build 1 Capability Diagram

Capability Diagrams show the Interdependencies of all Mechanisms required for a Capability





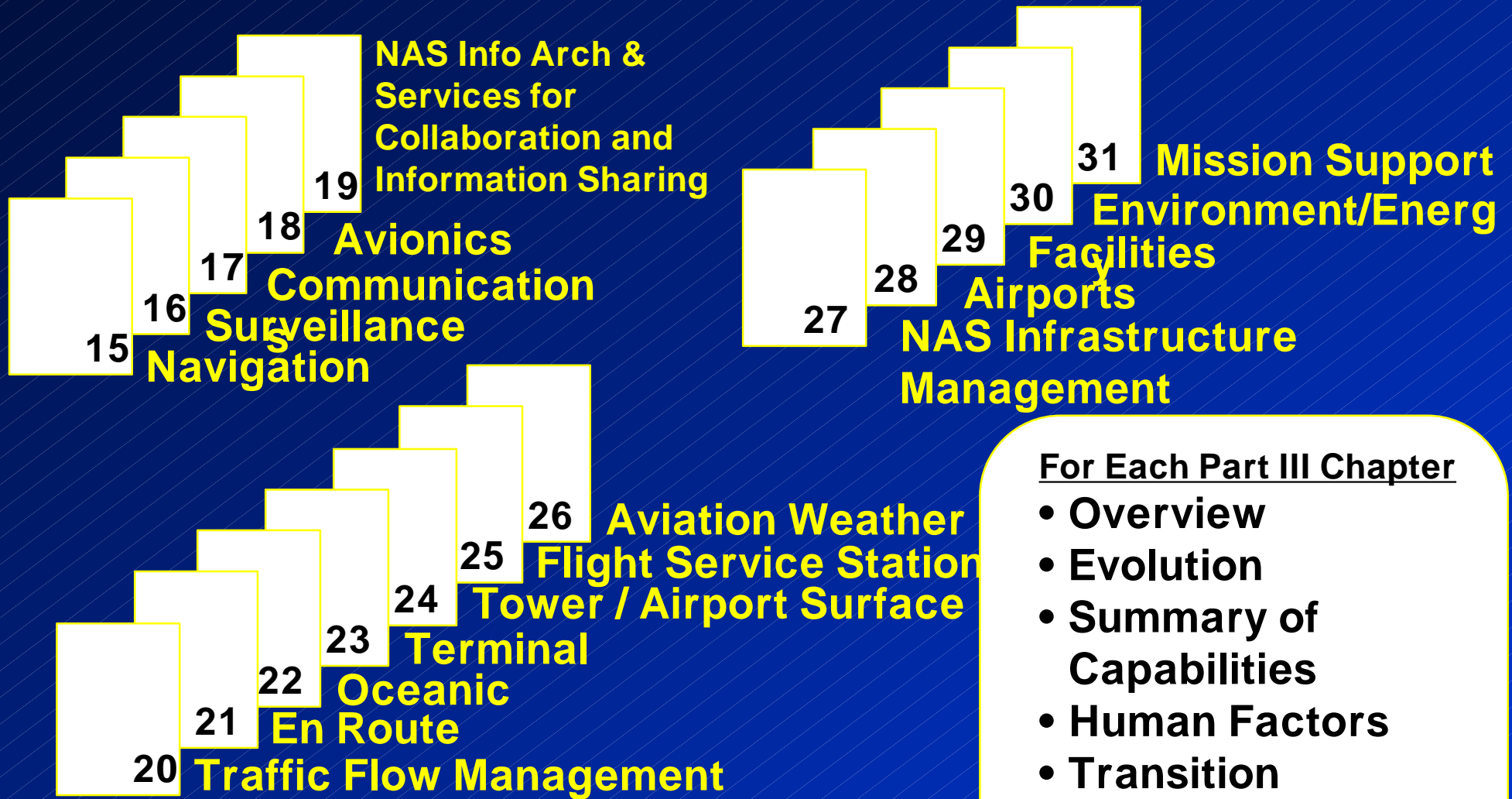
Part I - Introduction to the NAS Architecture

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- 1 Executive Summary
 - 2 Introduction Overview

Part II - NAS Architecture Summary

- 3 NAS Architecture Overview
- 4 NAS Capabilities
- 5 Evolution of NAS
- 6 Risk Management
- 7 Safety Factors
- 8 Human Factors
- 9 Information Security
- 10 Research, Engineering & Development
- 11 Regulation & Certification
- 12 Personnel
- 13 Cost

Part III - NAS Architecture Functional Descriptions



For Each Part III Chapter

- Overview
- Evolution
- Summary of Capabilities
- Human Factors
- Transition
- Cost
- Watch Items

Key Architecture Products

- **Architecture**
 - Hard copy
 - Internet
- **Blueprint for NAS Modernization**
 - Hardcopy
 - Internet
- **Functional Information Packets**
 - Database information, capability/system diagrams
 - Hard Copy
 - Intranet

NAVIGATION HIGHLIGHTS

WAAS Stage 1



WAAS Stage 2

WAAS Stage 3

Added GEOs

Increased Safety
4,200 Procedures
En Route Navigation
Terrain Avoidance CFIT

Near Cat I



Full Cat I

LAAS Cat 1



LAAS Cat II/III

Replacement GPS Satellites



Ground-Based Nav aids

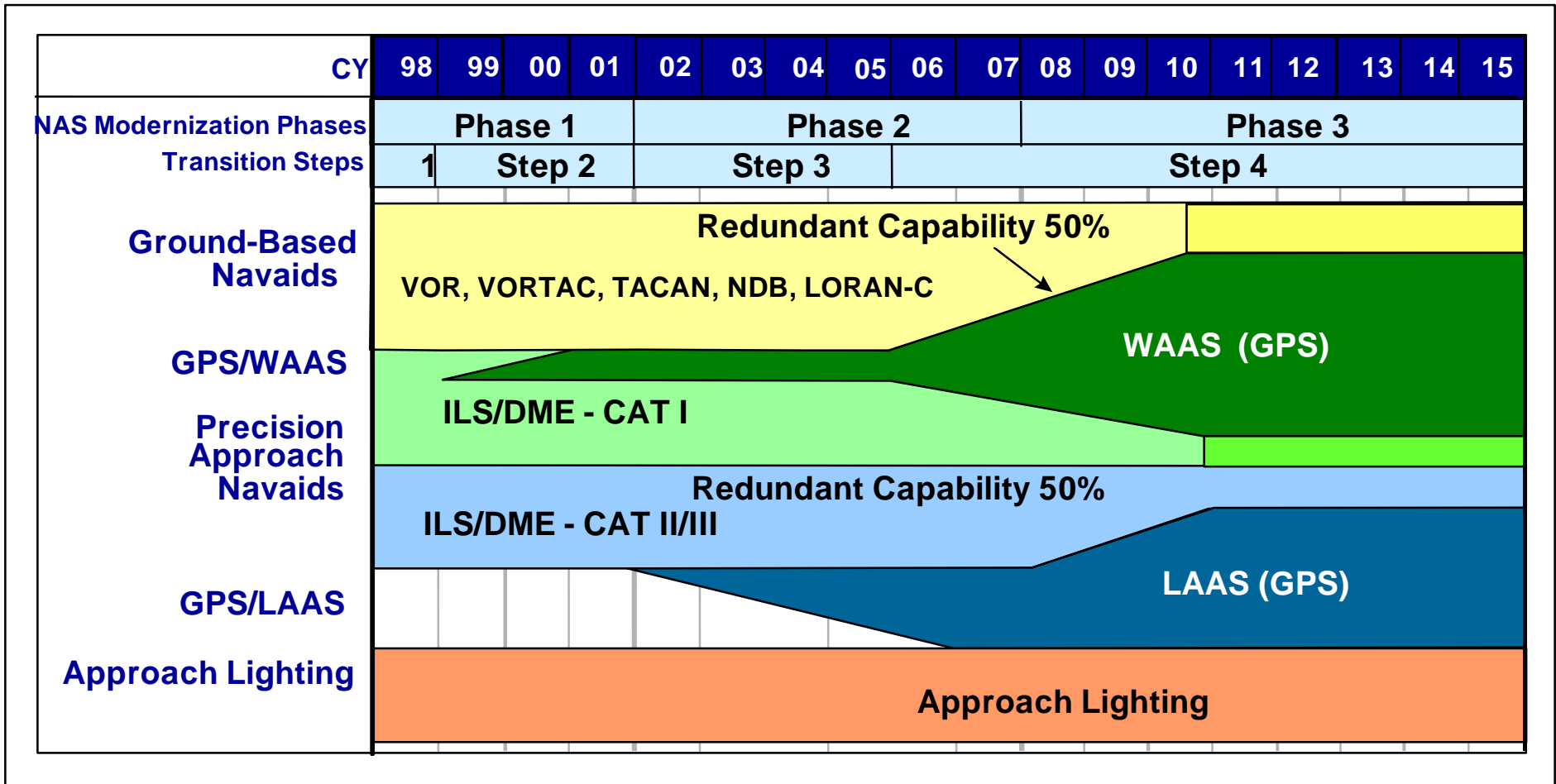


Reduce by 1/2 to 2/3rds

Navigation and Landing Watch Items

- **Availability of Geostationary WAAS satellites**
- **Studies on redundant Nav aids**
- **Certified, affordable avionics**
- **International agreements and standards**
- **Policies on transition**
- **WAAS performance**
- **WAAS/LAAS schedule**
- **Second civil frequency**
- **User equipage rates**

Navigation and Landing Transition



Legend

CAT - Category

GPS - Global Positioning System

ILS/DME - Instrument Landing System/
Distance Measuring Equipment

LAAS- Local Area Augmentation System

LORAN C - Long Range Navigation

NDB - Non-Directional Beacon

TACAN - Tactical Air Navigation

VOR- Very High Frequency Omnidirectional Range

VORTAC - Very High Frequency Omnidirectional

Range collocated with Tactical Air Navigation

WAAS - Wide Area Augmentation System

Surveillance Highlights

TCAS
Change 7
Basic
Safety Net

Oceanic/Offshore

ADS-A
ADS-B air-to-air

En Route

Primary
Secondary



Secondary
ADS-B
Primary -Defense Systems

Terminal

Primary
Secondary
ADS-B air-to-air



Primary
Secondary
ADS-B air-to-air/ground

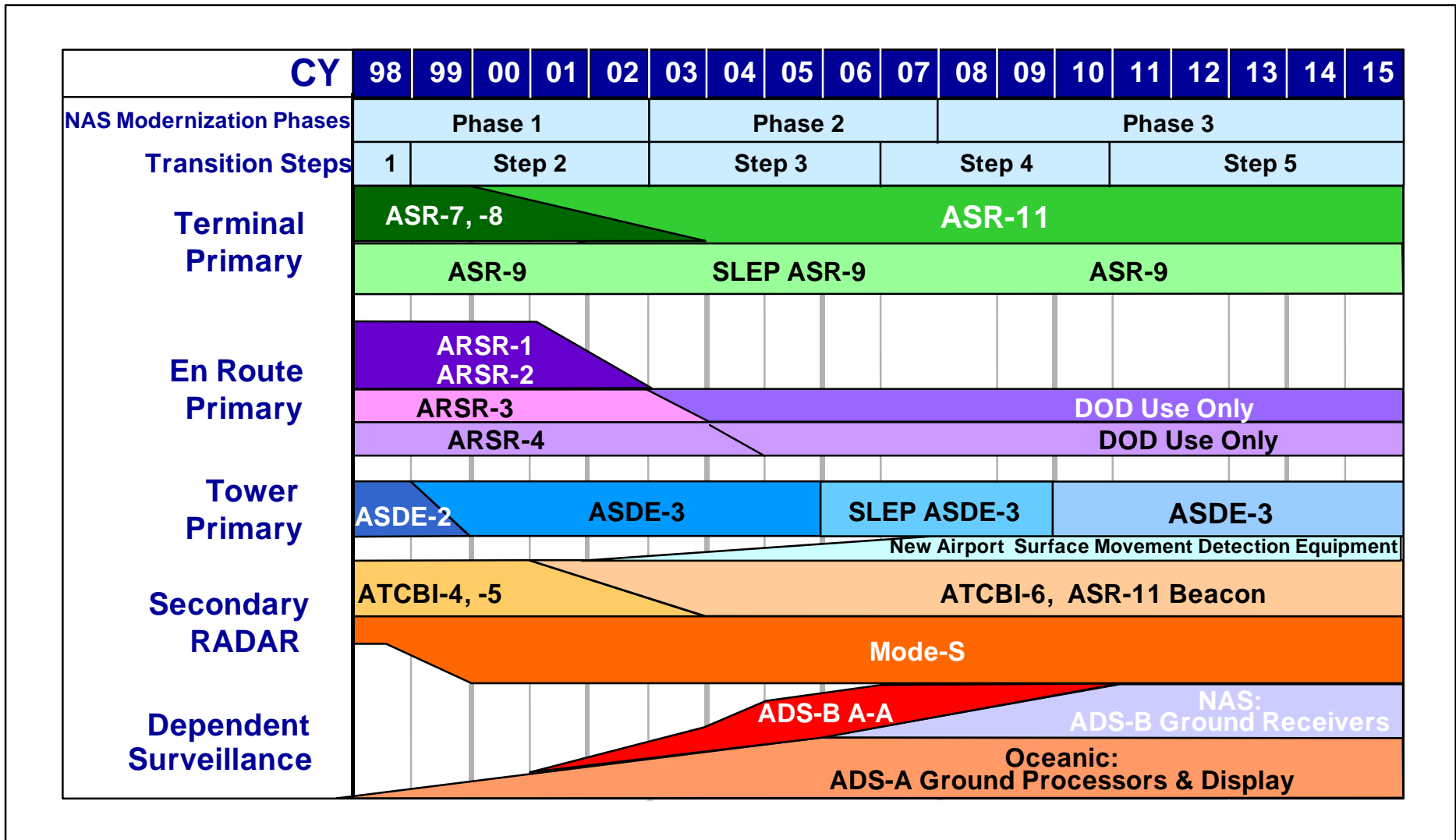
Surface

Primary
ADS-B
Moving Maps

Surveillance Watch Items

- **Decommissioning of long-range radars based on Weather to the Controller**
- **Development of ADS-A/B**
- **ATC processing of aircraft-derived position data**
- **User equipage rates for ADS avionics**

Surveillance Transition



Legend

ADS-B - Automatic Dependent Surveillance - Broadcast
 ADS-A - Automatic Dependent Surveillance - Addressable
 ASDE - Airport Surface Detection Equipment
 ATCBI - Air Traffic Control Beacon Interrogator

ASR - Airport Surveillance Radar
 ARSR - Air Route Surveillance Radar
 Mode-S - Mode-Select (secondary radar discretely addressable mode with data link)
 SLEP - Service Life Extension Program

AIR/GROUND COMMUNICATIONS HIGHLIGHTS

Oceanic Services

ADS-A
Data Link (AOC/ATC)

FANS-1a
HF Data Link
SATCOM

VDL-2

CPDLC

VDL-3

Digital Voice

Spectrum Recovery

Analog VHF

General Aviation Transition

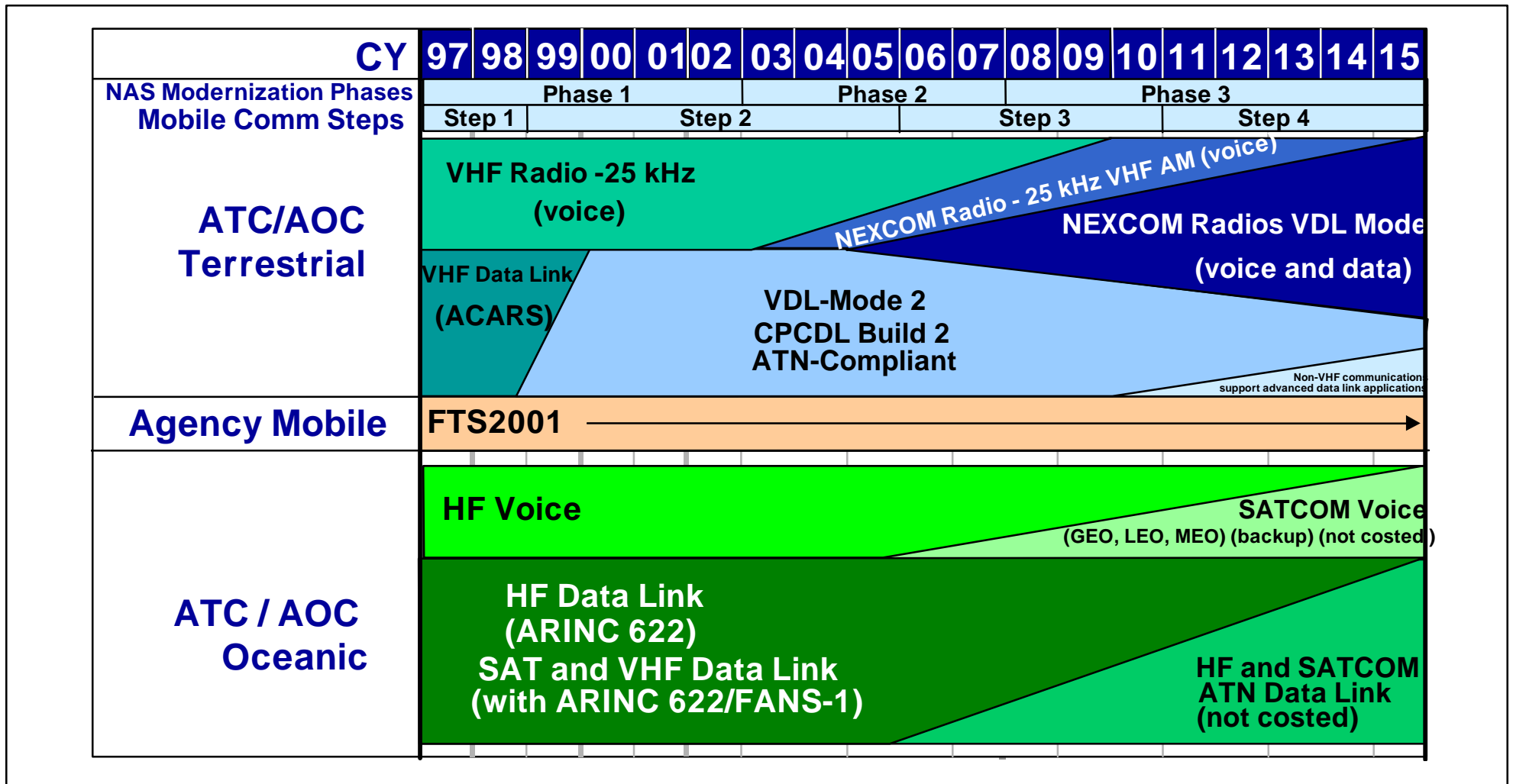
UHF

Defense Reqm'ts

Communications Watch Items

- **User equipage with VDL-Mode 2**
- **User equipage with VDL-Mode 3 radios**

Communications Transition - Mobile



Legend

ACARS - Aircraft Communications Addressing and Reporting System
 AOC - Aeronautical Operational Control
 ATC - Air Traffic Control
 ATN - Aeronautical Telecommunication Network
 CPDLC - Controller Pilot Data Link Communications
 FTS - Future Telecommunication System
 GEO - Geosynchronous Earth Orbiting

HF - High Frequency
 LEO - Low Earth Orbiting
 MEO - Medium Earth Orbiting
 NEXCOM - Next Generation Communications
 SATCOM - Satellite Communications
 VDL - Very High Frequency Data Link

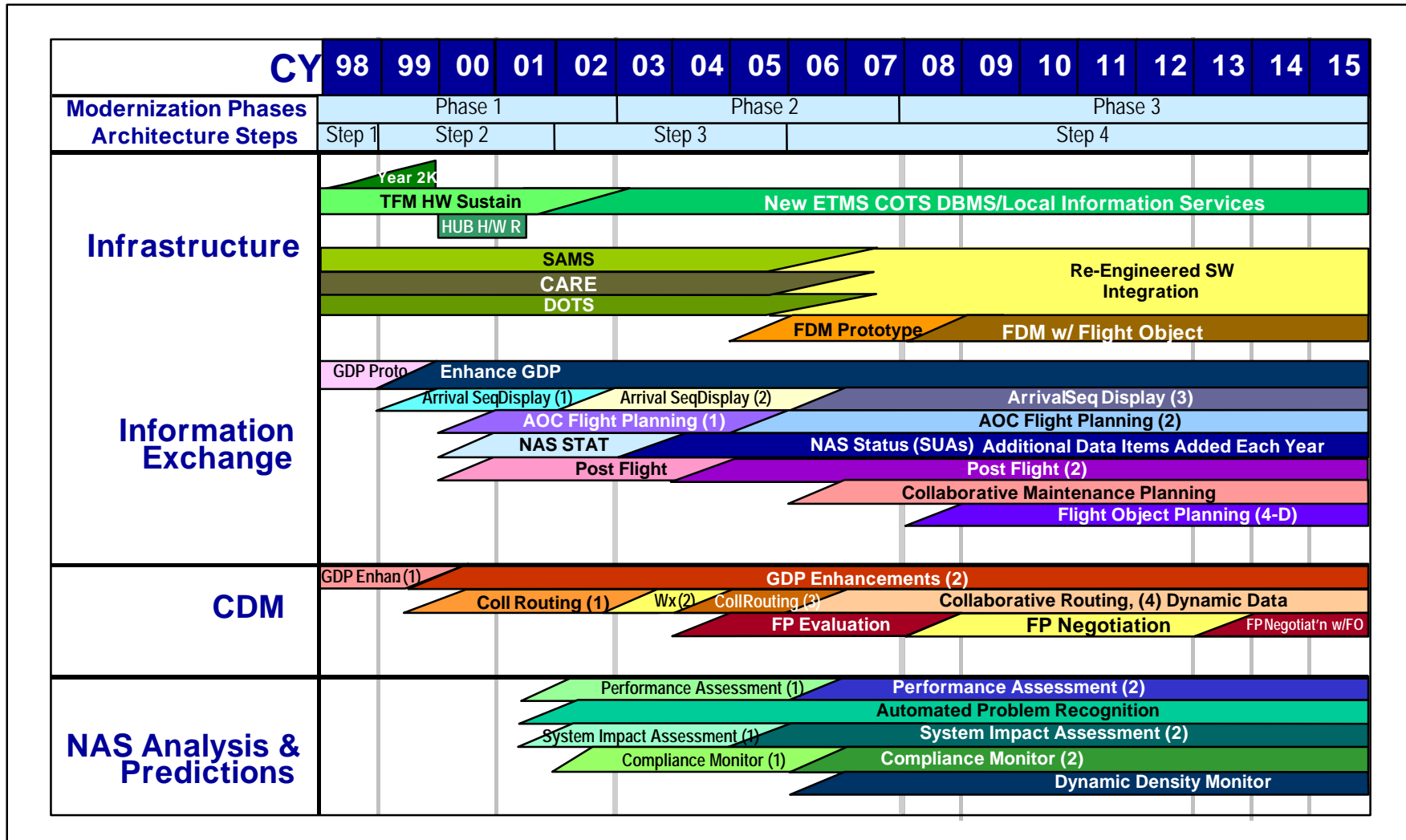
User/FAA Consensus on Free Flight Tools

Free Flight Phase 1 (FFP1) select capability limited deployment

- Controller Pilot Data Link Communications (CPDLC) Build-1
- User Request Evaluation Tool Core Capability Limited Deployment (URET CCLD)
- Traffic Management Advisory - Single Center (TMA-SC)
- Passive Final Approach Spacing Tool (pFAST)
- Collaborative Decision Making (CDM)
- Initial Surface Movement Advisor (SMA)
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Tools Delivering Benefits no later than 2002

Traffic Flow Management Transition



Legend

AOC - Aeronautical Operational Control
 COTS - Commercial Off-the-Shelf
 DBMS - database Management System
 DOTS - Dynamic Ocean Tracking System
 ETMS - Enhanced Traffic Management System
 FP - Flight Plan

FDM - Flight Data Management
 GDP - Ground Delay Program
 HW - Hardware
 SAMS - Special Use Airspace Management System
 TFM - Traffic Flow Management