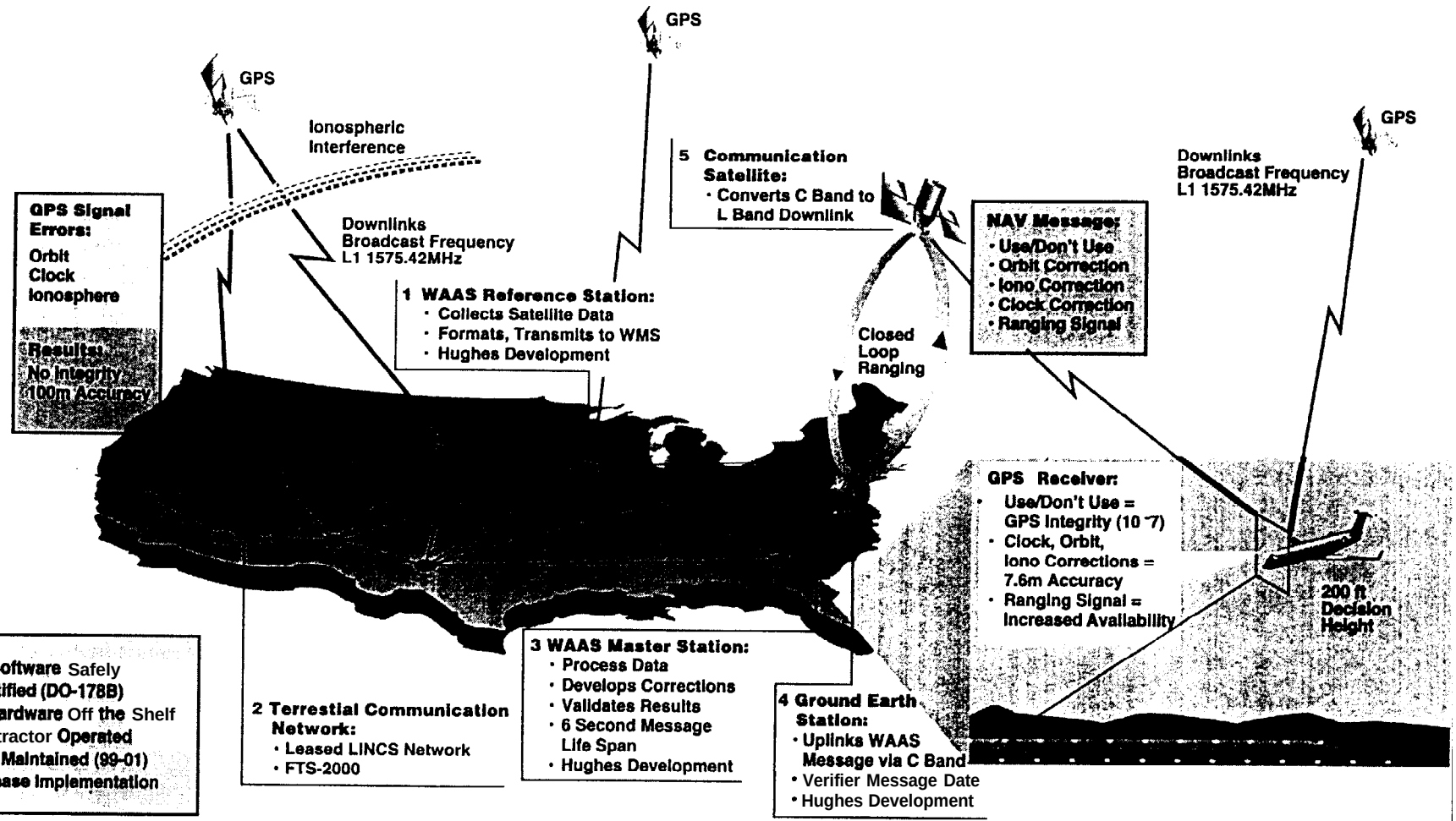
SATNAV
SATELLITE NAVIGATION

WAAS
Overview Briefing

CGSIC FAA 445-01

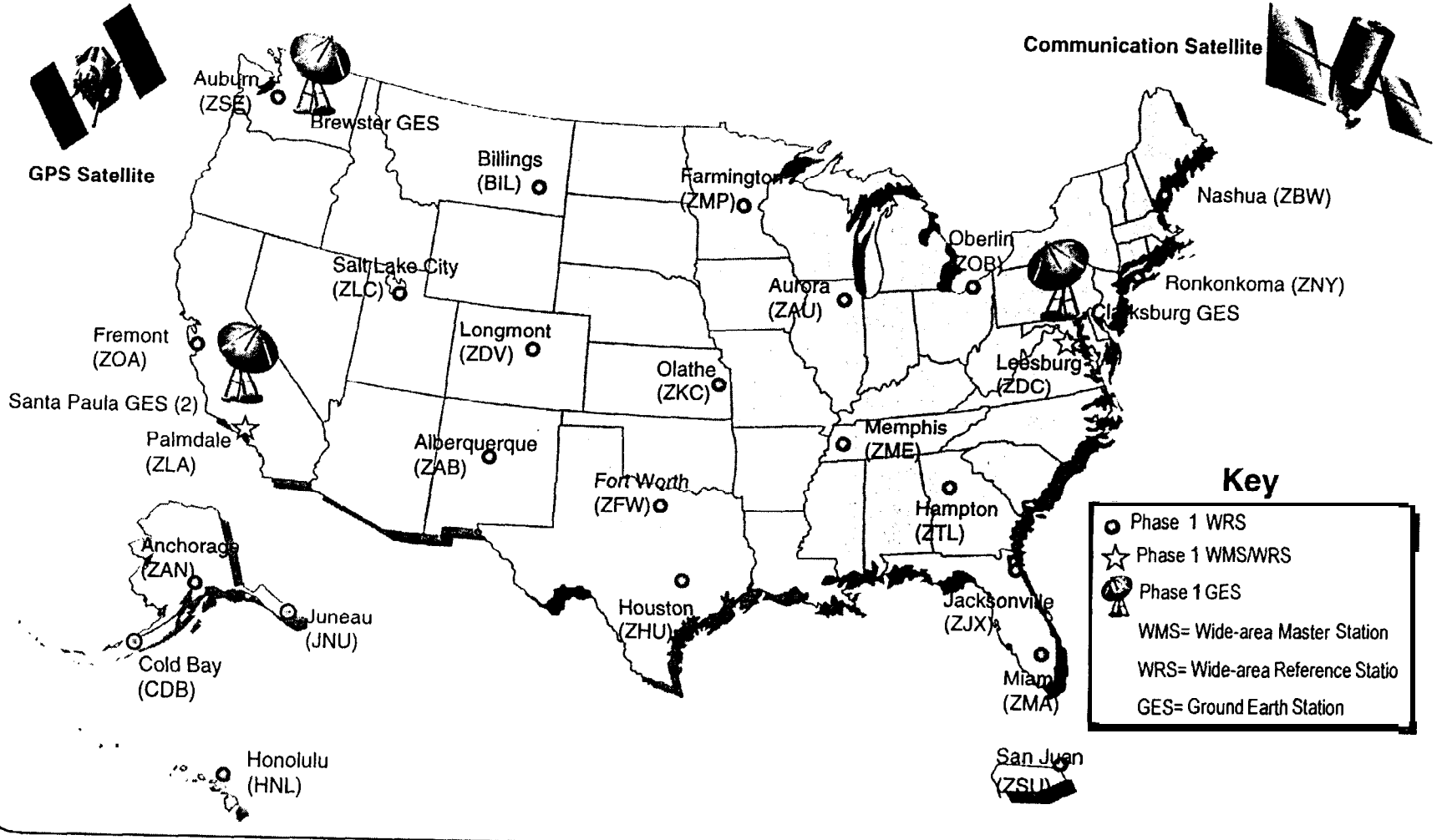
FAA 438-01

Wide Area Augmentation System

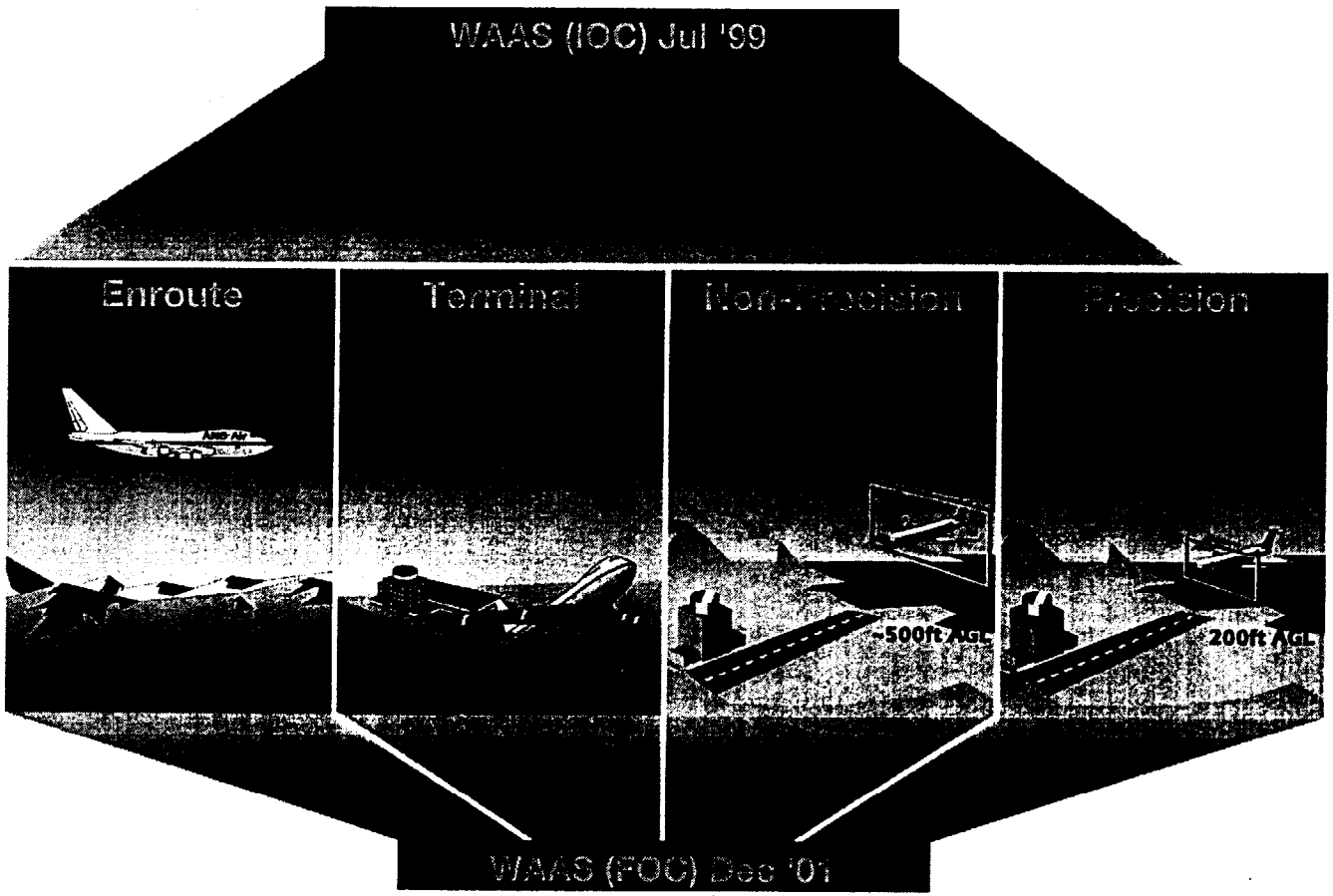


- All Software Safely Certified (DO-178B)
- All Hardware Off the Shelf
- Contractor Operated and Maintained (99-01)
- 3 Phase Implementation

Wide Area Augmentation System
Phase 1 Locations



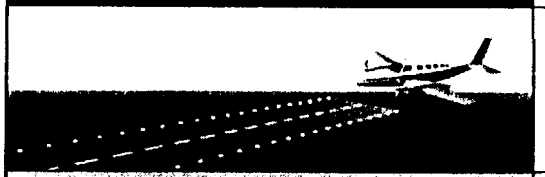
WAAS Capabilities



Benefits of WAAS

Primary Means of Navigation - Take-Off, En Route, Approach and Landing

More Direct Routes - Not Restricted By Location of Ground-Based Navigation Equipment



Precision Approach Capability - At Any Qualified Airport in U.S.

Decommissioning of Older, Expensive Ground-Based Navigation Equipment

Reduced/Simplified Equipment On Board Aircraft

Increased Capacity - More Aircraft Allowed in Given Airspace Without Increased Risk

WAAS Phases

Phase 1	1 May 1996 - 31 March 1999
Phase 2	1 May 1998 - 30 April 2000
Phase 3	1 November 1999 - 31 October 2001
ICMLS Option 1 Year	1 November 2001 - 31 October 2002

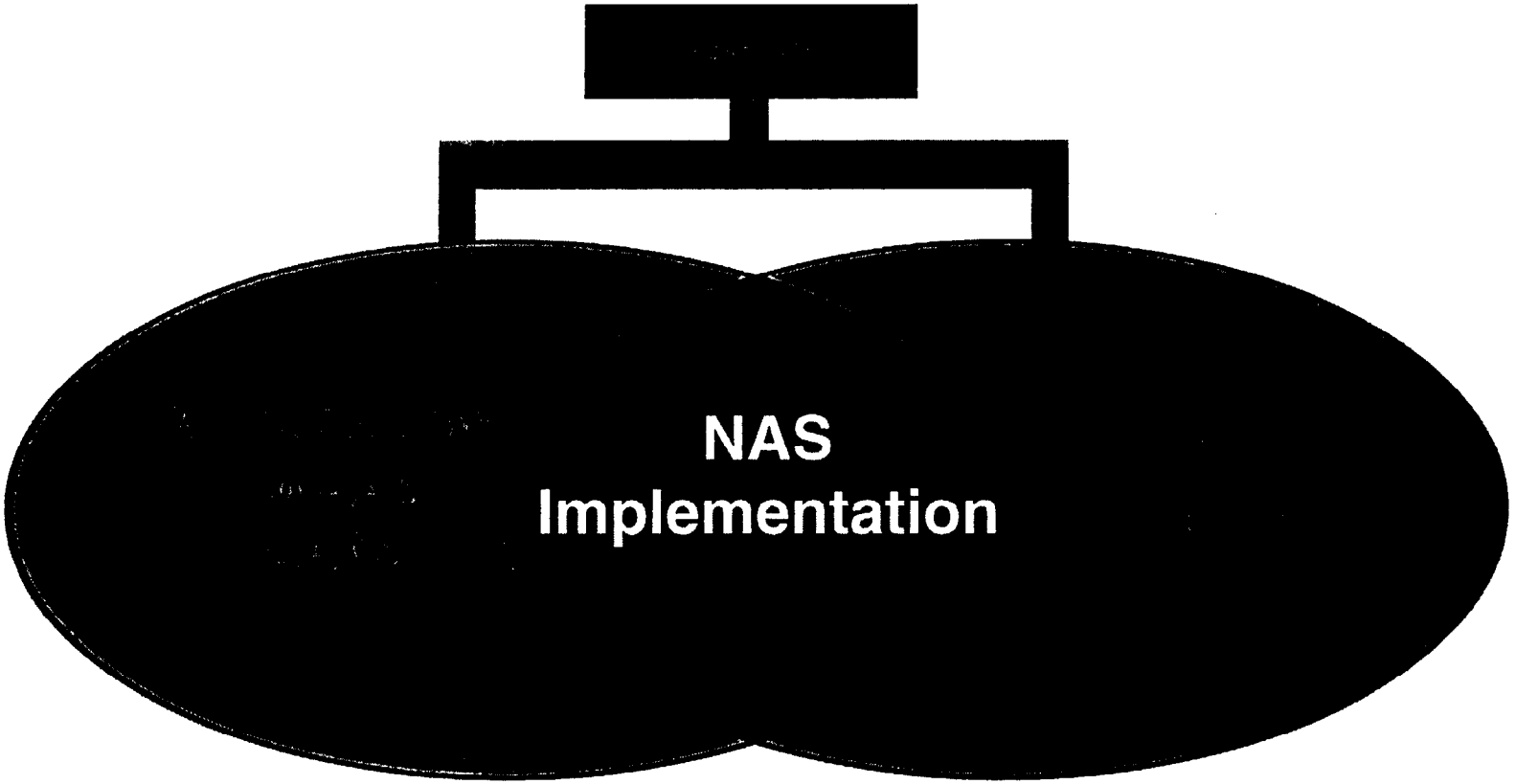
Site Installation Schedule
1/98 to 6/98

SATNAV
SATELLITE NAVIGATION

Site	Start Date	End Date
Oakland	13 Jan 98	21 Jan 98
Jacksonville	27 Jan 98	4 Feb 98
Houston	3 Feb 98	11 Feb98
Miami	3 Feb 98	11 Feb 98
Fort Worth	10 Feb 98	18 Feb 98
Albuquerque	24 Feb 98	4 Mar 98
Puerto Rico	24 Feb 98	4 Mar 98
Los Angeles	3 Mar 98	11 Mar98
Chicago	10 Mar 98	18 Mar 98
Denver	17 Mar 98	25 Mar 98
Washington	17 Mar 98	25 Mar 98
Salt Lake City	24 Mar 98	1 Apr 98
Atlanta	31 Mar 98	8 Apr 98
Seattle	7 Apr 98	15 Apr 98
Memphis	7 Apr 98	15 Apr 98
Honolulu	14 Apr 98	22 Apr 98
New York	21 Apr 98	29 Apr 98
Billings	28 Apr 98	6 May 98
Boston	28 Apr 98	6 May 98
Anchorage	12 May 98	20 May 98
Cleveland	12 May 98	20 May 98
Cold Bay	19 May 98	27 May 98
Minneapolis	19 May 98	27 May 98
Juneau	26 May 98	3 Jun 98
Kansas City	26 May 98	3 Jun 98

+ - Today

NAS Implementation Mission



To Coordinate the Efficient Implementation of Satellite Navigation Technology with the Operational Organizations and User Groups of the National Airspace System (NAS).

NAS Implementation Major Activities

SATNAV
SATELLITE NAVIGATION

Receiver Development

- MOPS
- TSO
- H/W
- S/W
- Testing

Procedures

- Flight Standards
- TERPS Criteria
- Surveys
- Instrument Approach Procedures (IAPS)
- Flight Inspection
- GPS Database
- Automation

Air Traffic Airway Facilities

- Requirements
- OPS Concept
- Implementation Plan
- Regional Initiatives
- System Enhancements
- NOTAMS

Operational Integration

- Interference
- Future Architecture
- PDD
- IGEB
- DoD/DOT Pos Nav

WAAS Procedures Development Schedule (AVN)

	99**	00	01	02	03	04	05	06	07	08	Total
TSO-C129*	45	490	490	490	490	490	485	485	485	150	4100
WAAS	45	490	490	490	490	490	485	485	485	1'50	4100
Helicopter* TSO-Cl29	5	10	IO	IO	IO	IO	15	15	15	0	100
Helicopter WAAS	5	IO	IO	IO	IO	IO	15	15	15	0	100
											[redacted]

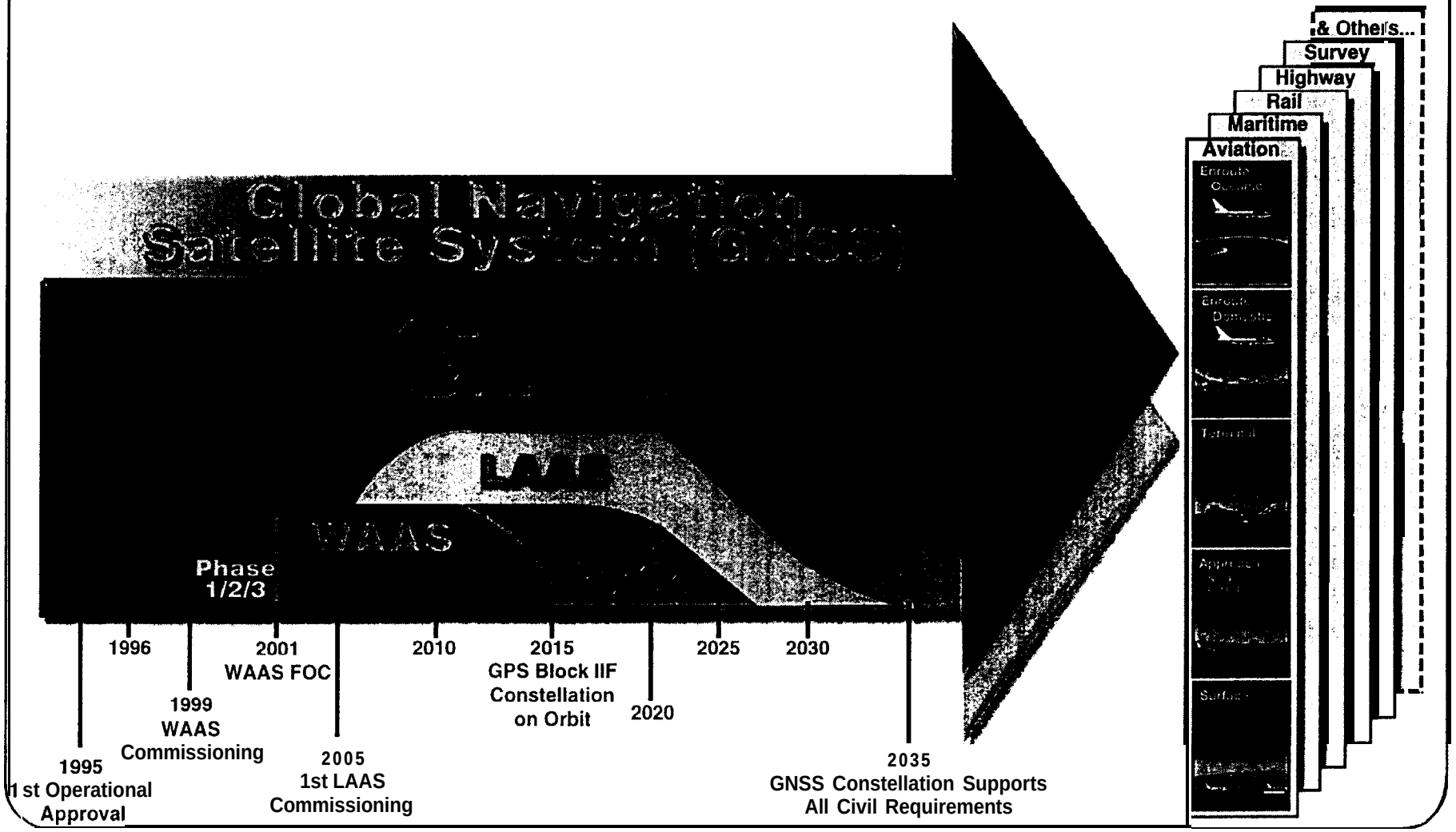
* A TSO-Cl29 nonprecision approach will be developed in conjunction with each WAAS approach.

**TSO-C129 standalone approaches will continue to be developed at a rate of 500 per year until WAAS Procedure development is initiated.

Risk Mitigation

- Mitigate Risk Associated with GPS Implementation GPS System Performance
  - Future Satellite Improvements
  - Other Satellite System use (GLONASS, MSAS, EGNOS, etc.)
  - Performance Monitoring/Joint Studies

Risk Mitigation

- Mitigate Risk Associated with GPS Implementation
  - Signal Interference
    - -- Spoofing/Jamming
    - -- Spectrum Analysis
  - Anomalies
  - Ionospheric Effects
    - -- Tropospheric Studies
    - -- Solar Maximums
  - Ensuring Protection of Aviation Frequencies

Satellite Navigation Implementation