Space & Missile Systems Center
Global Positioning Systems Directorate

Public Interface Control Working Group (ICWG) & Public Forum

Global Positioning Systems (GPS)

Public Interface Control Working Group & Public Forum

12 September 2018
0830 – 1630 hrs PT

United States Air Force GPS Directorate
Phone Number: 1-310-653-2663 Meeting ID: 8337375 Passcode: 123456
DCS Website: https://conference.apps.mil/webconf/gpspublicmeeting

Opening Remarks

Global Positioning Systems (GPS) Directorate Space and Missile Systems Center

GPS Requirements Team

Air Force

Mr. James Horejsi, GPS Chief Engineer

Daniel Godwin, GPS Requirements Section Chief

Lt Michael Telcide, GPS Enterprise/Space Requirements Lead

Lt Benjamin Ratner, GPS Ground/User Requirements Lead

Capt Kyle Woodard, GPS Requirements IMA

Aerospace Corporation

Dr. Rhonda Slattery

Karl Kovach

Systems Engineering and Integration (SE&I)

Philip Kwan

Jennifer Lemus

Huey Nguyenhuu

Albert Sicam

Roll Call

Meeting Purpose

- The purpose of the meeting is to:

1) Obtain ICWG approval on the proposed language generated for the enterprise RFCs that may impact the public documents

2) Discuss any new open forum items against the Public Signals in Space documents

Agenda – Part 1 (Public ICWG)

Opening Remarks

Roll Call

Meeting Logistics

Rules of Engagement & Meeting Purpose

GPS Technical Baseline Configuration Management Process

RFC-374 (2018 Public Document Proposed Changes)

- Operational Advisory
- Leap Second and Earth Orientation Parameters
- Clean-Up and Health Bit Clarification

Open RFC Discussion Session

Action Item Review

Adjourn

Meeting Logistics

- Restrooms
- Emergency Exits
- Refreshments
- Lunch
- Wi-Fi
- Additional Meeting Space
- Meeting Minutes

Rules of Engagement

UNCLASSIFIED

ABSOLUTELY NO PROPRIETARY, CLASSIFIED, OR COMPETITION SENSITIVE INFORMATION IS TO BE DISCUSSED DURING THIS MEETING.

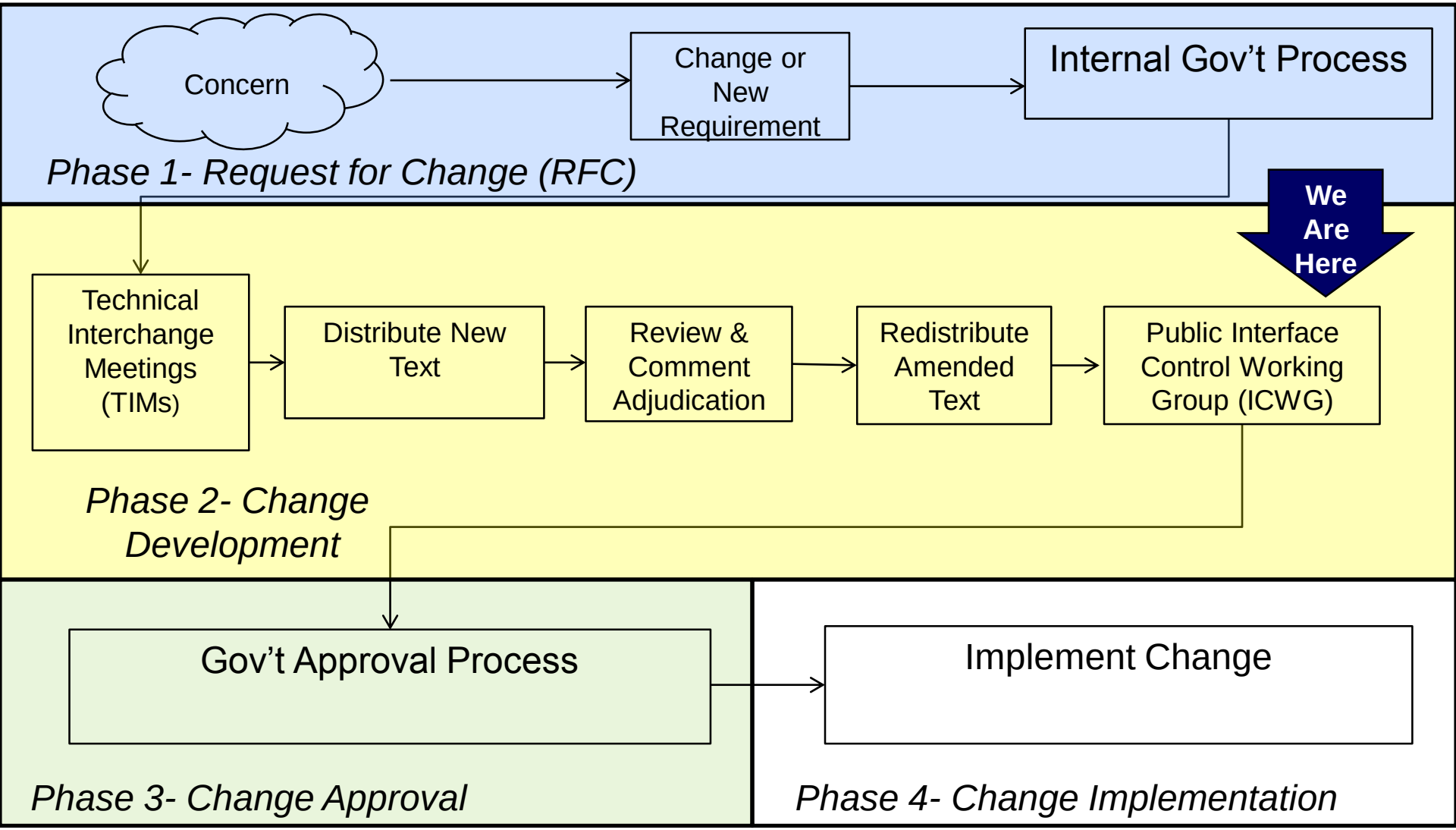
Rules of Engagement (Cont'd)

- Please place your phones on mute when not speaking to minimize background noise
- Comments against the topics listed on the official agenda will get priority during discussion
- Topics that warrant additional discussion may be side-barred
- Ad-hoc topics may be discussed during the open discussion
- Meeting minutes and final IRNs will be generated and distributed as a product of this meeting
- For in-person attendees, please raise your hand before speaking and someone will bring you a microphone
- Please announce your name and organization before addressing the group

Rules of Engagement (Cont'd)

- Types of comments to be discussed:
  - Critical (C)
  - Substantive (S)
  - Rejected Administrative (A)
  - Deferred Administrative (A)
- Comments are grouped by sub-topic rather than by comment type

Change Management High Level Process Flow



Tech Baseline Configuration Management Process

- The government is currently updating its guidance on GPS CM practices
- Intend to publicly release the Change Control Board Operating Instruction (via GPS.gov) once approved
- Public inputs may be provided for next year's revision to: smcgper@us.af.mil

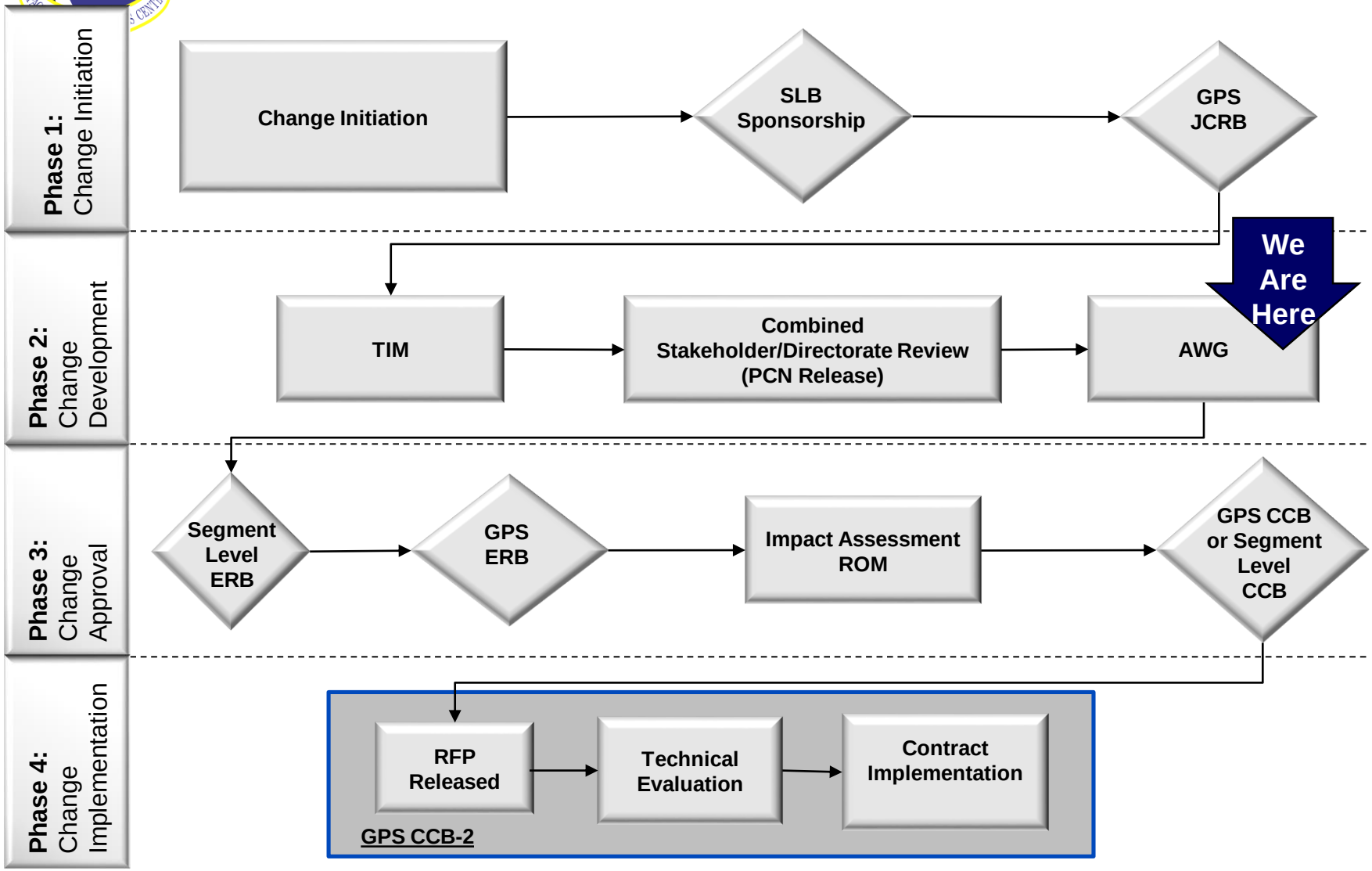
- Couple terminology changes:
  - Public Interface Control Working Group → Public Adjudication Working Group
  - Lower Level Board → Segment Level Board
  - Proposed Interface Revision Notice (PIRN) / Proposed Specification Change Notice (PSCN) → Proposed Change Notice (PCN)
    - Once ERB approved, a PCN will become an IRN or SCN

Concern Template

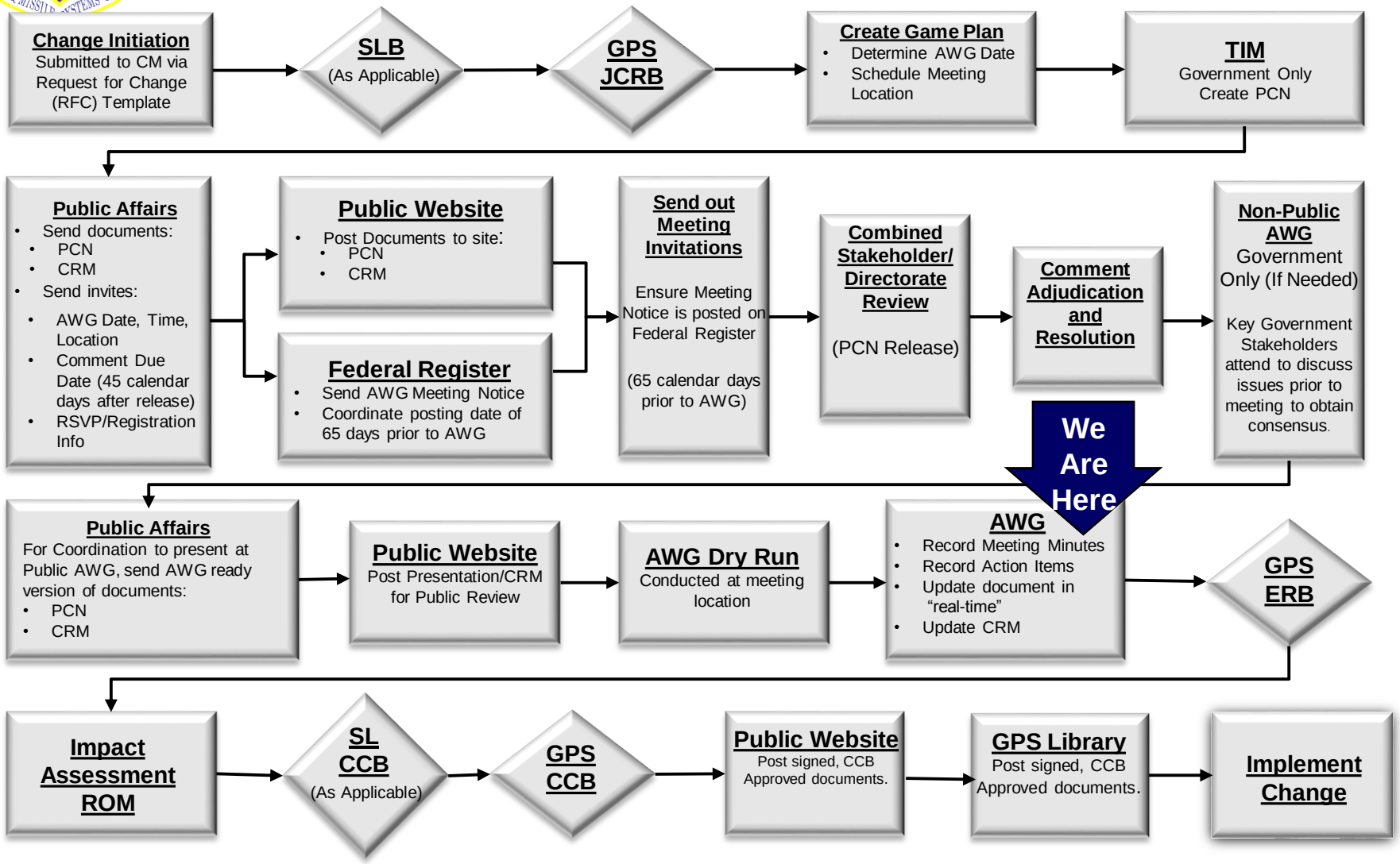
Submit any GPS public document concern to smcgper@us.af.mil

Concern			
Originator	**Organization**	**Phone No.**	**Email**
Description			
Proposed Resolution			
Document(s) Impacted			
Date			
Remark			

TBCMP Flow Chart (To-Be)



TBCMP Process – GPS Public Changes (To-Be)



RFC-374 Comments Resolution Matrix (CRM) Status

CRM – COMBINED REVIEW STATUS

Disposition/Type	Critical	Substantive	Administrative	Totals	Concurrence
Accept	0	26	29	55	55
Accept with Comment	4	11	13	26	26
Reject	5	19	11	35	35
Defer	11	19	4	34	34
Grand Totals:	20	75	57	152	152

DOORS ID	{DOORS ID(s)}		
Paragraph	{Insert text here}	**Comment Number**	{from CRM}
Comment Type	{Critical/Substantive}	**Disposition**	{Accept/Accept w/ Comment/Reject/Defer}
Comment Originator(s)	Commenter Name (Commenter Organization)		
Comment	{What was submitted by the commenter in the CRM}		
Directorate Response	{Text describing the rationale of the disposition}		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
{Text shown in current version of CCB-approved interface revision notice}	{Text from PIRN}	{Proposed text received by the commenter during the PIRN review, and/or proposed text by the government to adjudicate the subject comment}

{TEMPLATE for Comment Adjudication}

Operational Advisory Topics

Lt Benjamin Ratner
Lt Michael Telcide
Jennifer Lemus
Philip Kwan

Operational Advisory Topics

Problem Statement:
Currently the Operational Advisories (OAs) that are published and archived contain plane/slot descriptions that are not in the constellation definition provided to the public in the GPS Standard Positioning Service (SPS) Performance Standard (PS). The OA does not have the capability to correctly publish information regarding fore/aft position since moving to the 24+3 constellation with three expanded slots. In addition, the Points of Contact of the OA are not represented in a way that allows for efficient updates. This is a follow-up to RFC-351, which was CCB-approved on 8-Jan-2018.
Proposed Solution:
Modify the OA as agreed to in ICD-GPS-240 and ICD-GPS-870.
Impacted Documents:
ICD-GPS-240 and ICD-GPS-870

Operational Advisory Topics

CRM – COMBINED REVIEW STATUS

Disposition/Type	Critical	Substantive	Administrative	Totals	Concurrence
Accept	00	00	9	9	9
Accept with Change	1	3	1	5	5
Reject	00	00	4	4	4
Defer	00	00	00	00	0
Grand Totals:	1	3	14	18	18

DOORS ID	ICD240-160, ICD240-167, ICD240-168, ICD870-189, ICD870-190, ICD870-196, ICD870-197, ICD870-198, ICD870-199, ICD870-200, ICD870-201, ICD870-202, ICD870-203, ICD870-204, ICD870-205, ICD870-206, ICD870-207		
Paragraph	ICD-GPS-240: 20.1, 20.3 ICD-GPS-870: 20.1, 20.3	**Comment Number**	1, 24
Comment Type	S – Substantive, C – Critical	**Disposition**	***Accept, Accept with Comments***
Comment Originator(s)	1. Rhonda Slattery (Aerospace) 2. Kanwaljit Sandhoo (MITRE)		
Comment	1. By removing Section 1 and renumbering, you are forcing everyone who reads in sections 2 and 3 to rewrite their software to account for the number change. Since most of these people probably don't participate in the ICWG, this is going to cause a huge failure when OCX goes operational. Leave in section 1, and replace the content with something like "N/A". Update ICD 240, Section 20.3 to add N/A as a possible choice for people who parse Section 1. Leave the sections numbered the same. Leave in Section 20.3 with a single sentence to explain that Section 1 will always be N/A from OCX. Back out all the other numbering changes 2. USCG Comment: It will be helpful Updates to ICD 240 that highlight backward compatibility with existing operations.		
Directorate Response	Specify in ICD-GPS-870 that section 1 of the OA has no data (“RESERVED”) and update ICD-GPS-240 to accommodate that (due to backward compatibility). However, in ICD-GPS-240, specify that there currently contains data, and if there is no data, it will be denoted with “RESERVED.” Reverse all changes associated with removal of section 1 of the OA in ICD-GPS-870, e.g. section renumbering.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
See following slides	See following slides	See following slides

ICD240-160 [added to RFC]: *Baseline Text (WAS):*

```
UNCLASSIFIED
GPS OPERATIONAL ADVISORY         086.0A1
SUBJ: GPS STATUS       27 MAR 2XXX

1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM)
A. BLOCK I  : NONE
B. BLOCK II : PRNS  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14
   PLANE    : SLOT B2, D1, C2, D4, B6, C5, A6, A3, A1, E3, D2, B4, F3, F1
   CLOCK    :      RB, RB, CS, RB, RB, RB, RB, CS, CS, CS, RB, RB, RB, RB
   BLOCK II : PRNS 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
   PLANE    : SLOT F2, B1, C4, E4, C3, E1, D3, E2, F4, D5, A5, F5, A4, B3
   CLOCK    :      RB, RB, RB, RB, RB, RB, RB, RB, RB, CS, RB, RB, CS, RB
C. BLOCK III: PRNS 29, 30, 31, 32
   PLANE    : SLOT C1, B5, A2, E5
   CLOCK    :      RB, RB, RB, RB
2. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS:           FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2XXX022       261836Z MAR 2XXX    18   FCSTDV       092/1600-093/0630
B. ADVISORIES:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2XXX020       202158Z MAR 2XXX         GENERAL      /-/
2XXX021       241836Z MAR 2XXX    32   LAUNCH       /-/
2XXX023       262212Z MAR 2XXX         GENERAL      /-/
3. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS
OPERATIONS CENTER AT (XXX)XXX-XXXX OR DSN XXX-XXXX
B. CIVIL NON-AVIATION:  FOR INFORMATION, CONTACT US COAST GUARD NAVCEN AT COMMERCIAL 703-
313-5900 24 HOURS DAILY AND INTERNET HTTPS://WWW.NAVCEN.USCG.GOV.
C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178,
HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/
D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING
HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC
```

Figure 20-1 Sample Operational Advisory

ICD240-160 [added to RFC]: *Proposed Text:*

```
UNCLASSIFIED
GPS OPERATIONAL ADVISORY          086.0A1
SUBJ: GPS STATUS        27 MAR 2XXX

1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM)
A. BLOCK I   : NONE
B. BLOCK II  : PRNS  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14
   PLANE     : SLOT B2, D1, C2, D4, B6, C5, A6, A3, A1, E3, D2, B4, F3, F1
   CLOCK     :      RB, RB, CS, RB, RB, RB, RB, CS, CS, CS, RB, RB, RB, RB
   BLOCK II  : PRNS 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
   PLANE     : SLOT F2, B1, C4, E4, C3, E1, D3, E2, F4, D5, A5, F5, A4, B3
   CLOCK     :      RB, RB, RB, RB, RB, RB, RB, RB, RB, CS, RB, RB, CS, RB
C. BLOCK III: PRNS 29, 30, 31, 32
   PLANE     : SLOT C1, B5, A2, E5
   CLOCK     :      RB, RB, RB, RB
2. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS:            FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2XXX022       261836Z MAR 2XXX    18   FCSTDV       092/1600-093/0630
B. ADVISORIES:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2XXX020       202158Z MAR 2XXX         GENERAL      /-/
2XXX021       241836Z MAR 2XXX    32   LAUNCH       /-/
2XXX023       262212Z MAR 2XXX         GENERAL      /-/
~~3. REMARKS:~~
~~A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS~~
~~OPERATIONS CENTER AT (XXX)XXX-XXXX OR DSN XXX-XXXX.~~
~~B. CIVIL NON-AVIATION: FOR INFORMATION, CONTACT US COAST GUARD NAVCEN AT~~
~~COMMERCIAL 703-313-5900 24 HOURS DAILY AND INTERNET~~
~~HTTPS://WWW.NAVCEN.USCG.GOV~~
~~C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178,~~
~~HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/~~
~~D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING~~
~~HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC~~
3. REMARKS:
A.    THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS
OPERATIONS CENTER AT HTTPS://GPS.AFSPC.AF.MIL/GPSOC/, DSN 560-2541, COMM 719-567-2493,
GPSOPERATIONSCENTER@US.AF.MIL,
B. CIVIL NON-AVIATION - NAVCEN AT 703-313-5900, HTTPS://WWW.NAVCEN.USCG.GOV,
C. CIVIL AVIATION - FAA NASEO AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/,
D. MILITARY ALTERNATE - JOINT SPACE OPERATIONS CENTER, DSN 276-3514, COMM 805-606-3514,
JSPOCCOMBATOPS@VANDENBERG.AF.MIL
```

Keep Section 1 as-is in ICD-GPS-240, but…

Administrative comment to update POC information

Figure 20-1 Sample Operational Advisory

ICD240-333, ICD240-334, ICD240-335 [New objects after ICD240-318]:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
[ICD240-318] Figure 20-3 OA Section One	<Not in RFC>	[ICD240-318] Figure 20-3 OA Section One [ICD240-333] If no data are available, section one is denoted with "RESERVED." An example is illustrated in Figure 20-3a. [ICD240-334] 1. RESERVED [ICD240-335] Figure 20-3a OA Section One (No Data)

ICD870-189:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in three sections. The following paragraphs describe each section and subsection of the OA.	The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in ~~three~~two sections. The following paragraphs describe each section and subsection of the OA.	The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in three~~two~~ sections. The following paragraphs describe each section and subsection of the OA. Users should be advised that the Point of Contact (POC) information contained in Section 3 of the OA samples are subject to change. The information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent OAs for up-to-date information.

This addition to be discussed in a following slide (#44)

ICD870-190: Baseline Text (WAS):

```
UNCLASSIFIED
GPS OPERATIONAL ADVISORY        086.OA1
SUBJ: GPS STATUS      27 MAR 2009

1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM):
A. BLOCK I   : NONE
B. BLOCK II : PRNS 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14
   PLANE     : SLOT B2, D1, C2, D4, B6, C5, A6, A3, A1, E3, D2, B4, F3, F1
   CLOCK     :      RB, RB, CS, RB, RB, RB, RB, CS, CS, CS, RB, RB, RB, RB
   BLOCK II : PRNS 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
   PLANE     : SLOT F2, B1, C4, E4, C3, E1, D3, E2, F4, D5, A5, F5, A4, B3
   CLOCK     :      RB, RB, RB, RB, RB, RB, RB, RB, RB, CS, RB, RB, CS, RB
   BLOCK II : PRNS 29, 30, 31, 32
   PLANE     : SLOT C1, B5, A2, E5
   CLOCK     :      RB, CS, RB, RB
C*.BLOCK III: PRNS 33, 34, 35
   PLANE     : SLOT A2, C3, F4
   CLOCK     :      RB, RB, RB
2. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS:              FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2009022       261836Z MAR 2009    18   FCSTDV       092/1600-093/0630
B. ADVISORIES:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2009020       202158Z MAR 2009         GENERAL      /-/
2009021       241836Z MAR 2009    01   LAUNCH       /-/
2009023       262212Z MAR 2009         GENERAL      /-/
3. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER
AT 719-567-2541 OR DSN 560-2541.
B. CIVIL NON-AVIATION: US COAST GUARD NAVCEN AT 703-313-5900 24 HOURS DAILY AND INTERNET
HTTPS://WWW.NAVCEN.USCG.GOV.
C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178,
HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/.
D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR
HTTPS://GPS.AFSPC.AF.MIL/GPSOC.
```

*Note: Section 1.C of the example OA message shown above contains example data for the GPS III SVs to show the type of data that will go in this section in the OCX era. This example is not meant to represent the actual GPS constellation configuration.

Figure 20-1 Sample Operational Advisory

ICD870-190: PIRN Text (IS):

```
UNCLASSIFIED
GPS OPERATIONAL ADVISORY        086.OA1
SUBJ: GPS STATUS      27 MAR 2009

1. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS:           FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2009022       261836Z MAR 2009    18   FCSTDV       092/1600-093/0630
B. ADVISORIES:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:
NANU          MSG DATE/TIME       PRN  TYPE         SUMMARY (JDAY/ZULU TIME START - STOP)

2009020       202158Z MAR 2009         GENERAL      /-/
2009021       241836Z MAR 2009    01   LAUNCH       /-/
2009023       262212Z MAR 2009         GENERAL      /-/
2. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER
AT 719-567-2541 OR DSN 560-2541.
B. CIVIL NON-AVIATION: US COAST GUARD NAVCEN AT 703-313-5900 24 HOURS DAILY AND INTERNET
HTTPS://WWW.NAVCEN.USCG.GOV.
C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178,
HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/.
D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR
HTTPS://GPS.AFSPC.AF.MIL/GPSOC.
```

Figure 20-1. Sample Operational Advisory

ICD870-190:

Proposed Text:

UNCLASSIFIED
GPS OPERATIONAL ADVISORY 086.OA1
SUBJ: GPS STATUS 27 MAR 2009

1. ~~SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM):~~
~~A. BLOCK I : NONE~~
~~B. BLOCK II : PRNS 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14~~
~~PLANE : SLOT B2, D1, C2, D4, B6, C5, A6, A3, A1, E3, D2, B4, F3, F1~~
~~CLOCK : RB, RB, CS, RB, RB, RB, RB, CS, CS, CS, RB, RB, RB, RB~~
~~BLOCK II : PRNS 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28~~
~~PLANE : SLOT F2, B1, C4, E4, C3, E1, D3, E2, F4, D5, A5, F5, A4, B3~~
~~CLOCK : RB, RB, RB, RB, RB, RB, RB, RB, CS, RB, RB, CS, RB~~
~~BLOCK II : PRNS 29, 30, 31, 32~~
~~PLANE : SLOT C1, B5, A2, E5~~
~~CLOCK : RB, CS, RB, RB~~
~~C*.BLOCK III: PRNS 33, 34, 35~~
~~PLANE : SLOT A2, C3, F4~~
~~CLOCK : RB, RB, RB~~
RESERVED
~~1~~2. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS: FOR SEVEN DAYS AFTER EVENT CONCLUDES.

NANU	MSG DATE/TIME	PRN	TYPE	SUMMARY (JDAY/ZULU TIME START - STOP)
2009022	261836Z MAR 2009	18	FCSTDV	092/1600-093/0630

B. ADVISORIES:

NANU	MSG DATE/TIME	PRN	TYPE	SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:

NANU	MSG DATE/TIME	PRN	TYPE	SUMMARY (JDAY/ZULU TIME START - STOP)
2009020	202158Z MAR 2009		GENERAL	/-/
2009021	241836Z MAR 2009	01	LAUNCH	/-/
2009023	262212Z MAR 2009		GENERAL	/-/

~~2~~3. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER AT ~~(XXX)XXX-XXXX OR DSN XXX-XXXX~~ HTTPS://GPS.AFSPC.AF.MIL/GPSOC/, DSN 560-2541, COMM 719-567-2493, GPSOPERATIONSCENTER@US.AF.MIL,
B. CIVIL NON-AVIATION - ~~FOR INFORMATION, CONTACT US COAST GUARD NAVCEN AT COMMERCIAL 703-313-5900 24 HOURS DAILY AND INTERNET HTTPS://WWW.NAVCEN.USCG.GOV~~ NAVCEN AT 703-313-5900, HTTPS://WWW.NAVCEN.USCG.GOV,
~~C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/~~
C. CIVIL AVIATION - FAA NASEO AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/,
~~D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC~~
D. MILITARY ALTERNATE - JOINT SPACE OPERATIONS CENTER, DSN 276-3514, COMM 805-606-3514, JSPOCCOMBATOPS@VANDENBERG.AF.MIL

Section 1 put back in as “RESERVED”

Sections 1 & 2 are reverted back to 2 & 3

Administrative comment to update POC

Figure 20-1 Sample Operational Advisory

ICD870-196:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
20.3 OA Section 1	<DELETED>	[Reverted to Baseline Text]

ICD870-197:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Section 1 lists operational satellites by PRN number, assigned plane, and clock in current use. The PRN number is a two digit number that is zero padded. Subsection 1.A previously identified operational satellites in Block I. However, these satellites are no longer operational, so this subsection includes the word “NONE”. Subsection 1.B identifies satellites within Block II that are currently in use. Subsection 1.C identifies satellites within Block III that are currently in use. The example data shown for Section 1 is not meant to represent the actual GPS constellation configuration. The abbreviations CS and RB are used to indicate Cesium and Rubidium clocks, respectively. An example of section 1 of the OA is illustrated in Figure 20-3.	<DELETED>	~~Section 1 lists operational satellites by PRN number, assigned plane, and clock in current use. The PRN number is a two digit number that is zero padded. Subsection 1.A previously identified operational satellites in Block I. However, these satellites are no longer operational, so this subsection includes the word “NONE”. Subsection 1.B identifies satellites within Block II that are currently in use. Subsection 1.C identifies satellites within Block III that are currently in use. The example data shown for Section 1 is not meant to represent the actual GPS constellation configuration. The abbreviations CS and RB are used to indicate Cesium and Rubidium clocks, respectively~~ Section 1 is denoted with "RESERVED." An example of section 1 of the OA is illustrated in Figure 20-3.

ICD870-198, ICD870-199:

BASELINE TEXT (WAS)

```
1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM):
A. BLOCK I   : NONE
B. BLOCK II  : PRNS 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14
   PLANE     : SLOT B2, D1, C2, D4, B6, C5, A6, A3, A1, E3, D2, B4, F3, F1
   CLOCK     :      RB, RB, CS, RB, RB, RB, RB, CS, CS, CS, RB, RB, RB, RB
   BLOCK II  : PRNS 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
   PLANE     : SLOT F2, B1, C4, E4, C3, E1, D3, E2, F4, D5, A5, F5, A4, B3
   CLOCK     :      RB, RB, RB, RB, RB, RB, RB, RB, RB, CS, RB, RB, CS, RB
   BLOCK II  : PRNS 29, 30, 31, 32
   PLANE     : SLOT C1, B5, A2, E5
   CLOCK     :      RB, CS, RB, RB
C. BLOCK III: PRNS 33, 34, 35
   PLANE     : SLOT A2, C3, F4
   CLOCK     :      RB, RB, RB
```

Figure 20-3 OA Section 1

PIRN TEXT (IS)

<DELETED>

PROPOSED TEXT

~~1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM):~~
~~A. BLOCK I : NONE~~
~~B. BLOCK II : PRNS 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14~~
~~PLANE : SLOT B2, D1, C2, D4, B6, C5, A6, A3, A1, E3, D2, B4, F3, F1~~
~~CLOCK : RB, RB, CS, RB, RB, RB, RB, CS, CS, CS, RB, RB, RB, RB~~
~~BLOCK II : PRNS 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28~~
~~PLANE : SLOT F2, B1, C4, E4, C3, E1, D3, E2, F4, D5, A5, F5, A4, B3~~
~~CLOCK : RB, RB, RB, RB, RB, RB, RB, RB, RB, CS, RB, RB, CS, RB~~
~~BLOCK II : PRNS 29, 30, 31, 32~~
~~PLANE : SLOT C1, B5, A2, E5~~
~~CLOCK : RB, CS, RB, RB~~
~~C. BLOCK III: PRNS 33, 34, 35~~
~~PLANE : SLOT A2, C3, F4~~
~~CLOCK : RB, RB, RB~~
RESERVED

Figure 20-3 OA Section 1

ICD870-200, 201:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
OA Section 2 Section 2 contains a summary of current and recent advisories, forecasts, and general text messages. It is organized into three subsections. Subsection 2A summarizes scheduled NANU messages. Subsection 2B summarizes advisory messages (messages with prefix UNU). Section 2C summarizes general text messages. The PRN number is zero-padded. An example of section 2 of the OA is illustrated in Figure 20-4.	OA Section 1 Section 1 contains a summary of current and recent advisories, forecasts, and general text messages. It is organized into three subsections. Subsection 1A summarizes scheduled NANU messages. Subsection 1B summarizes advisory messages (messages with prefix UNU). Section 1C summarizes general text messages. The PRN number is zero-padded. An example of section 1 of the OA is illustrated in Figure 20-3.	[Reverted to Baseline Text]

ICD870-202, ICD870-203:

BASELINE TEXT (WAS)

```
2. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS:              FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU          MSG DATE/TIME        PRN  TYPE          SUMMARY (JDAY/ZULU TIME START - STOP)

2009022       261836Z MAR 2009     18   FCSTDV        092/1600-093/0630
B. ADVISORIES:
NANU          MSG DATE/TIME        PRN  TYPE          SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:
NANU          MSG DATE/TIME        PRN  TYPE          SUMMARY (JDAY/ZULU TIME START - STOP)

2009020       202158Z MAR 2009          GENERAL       /-/
2009021       241836Z MAR 2009     01   LAUNCH        /-/
2009023       262212Z MAR 2009          GENERAL       /-/
```

Figure 20-4 OA Section 2

PIRN TEXT (IS)

```
1. CURRENT ADVISORIES AND FORECASTS:
A. FORECASTS:              FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU          MSG DATE/TIME        PRN  TYPE          SUMMARY (JDAY/ZULU TIME START - STOP)

2009022       261836Z MAR 2009     18   FCSTDV        092/1600-093/0630
B. ADVISORIES:
NANU          MSG DATE/TIME        PRN  TYPE          SUMMARY (JDAY/ZULU TIME START - STOP)

C. GENERAL:
NANU          MSG DATE/TIME        PRN  TYPE          SUMMARY (JDAY/ZULU TIME START - STOP)

2009020       202158Z MAR 2009          GENERAL       /-/
2009021       241836Z MAR 2009     01   LAUNCH        /-/
2009023       262212Z MAR 2009          GENERAL       /-/
```

Figure 20-4 OA Section 1

PROPOSED TEXT

[Reverted to Baseline Text]

ICD870-204, 205:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
OA Section 3 Section 3 identifies points of contact for additional technical and support information. It is organized into three subsections, each in text format. An example of section 3 of the OA is illustrated in Figure 20-5.	OA Section 2 Section 2 identifies points of contact for additional technical and support information. It is organized into three subsections, each in text format. An example of section 2 of the OA is illustrated in Figure 20-4.	[Reverted to Baseline Text]

ICD870-206, ICD870-207:

BASELINE TEXT (WAS)

3. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER AT 719-567-2541 OR DSN 560-2541.
B. CIVIL NON-AVIATION: US COAST GUARD NAVCEN AT 703-313-5900 24 HOURS DAILY AND INTERNET HTTPS://WWW.NAVCEN.USCG.GOV.
C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/.
D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC.

Figure 20-5 OA Section 3

PIRN TEXT (IS)

2. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER AT 719-567-2541 OR DSN 560-2541.
B. CIVIL NON-AVIATION: US COAST GUARD NAVCEN AT 703-313-5900 24 HOURS DAILY AND INTERNET HTTPS://WWW.NAVCEN.USCG.GOV.
C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/.
D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC.

Figure 20-5 OA Section 2

PROPOSED TEXT

3. REMARKS:
A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER AT ~~(XXX)XXX-XXXX OR DSN XXX-XXXX~~ HTTPS://GPS.AFSPC.AF.MIL/GPSOC/, DSN 560-2541, COMM 719-567-2493, GPSOPERATIONSCENTER@US.AF.MIL.
B. CIVIL NON-AVIATION - ~~FOR INFORMATION, CONTACT US COAST GUARD NAVCEN AT COMMERCIAL 703-313-5900 24 HOURS DAILY AND INTERNET HTTPS://WWW.NAVCEN.USCG.GOV~~ NAVCEN AT 703-313-5900, HTTPS://WWW.NAVCEN.USCG.GOV.
~~C. CIVIL AVIATION: FAA SATELLITE OPERATIONS GROUP AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/~~
C. CIVIL AVIATION - FAA NASEO AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/.
~~D. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC~~
D. MILITARY ALTERNATE - JOINT SPACE OPERATIONS CENTER, DSN 276-3514, COMM 805-606-3514, JSPOCCOMBATOPS@VANDENBERG.AF.MIL

Figure 20-5 OA Section ~~2~~3

DOORS ID	PIRN/PCN Cover Sheets for ICD870, IS200, IS705, IS800		
Paragraph	Description of Change Section	**Comment Number**	26, 28, 29, 31
Comment Type	A – Administrative	**Disposition**	***Reject***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	Description of Change: 1. Modify the OA as agreed to in ICD-GPS-240 and ICD-GPS-870. I was told the move to remove the OA from ICD-GPS-240 was rejected. Suggested rewrite: 1. Modify the OA as agreed to in ICD-GPS-870.		
Directorate Response	Due to a different CRM comment, to ensure backward compatibility, ICD-GPS-240 will be updated as well.		

Original PIRN/PCN Cover Sheet Text	**PROPOSED TEXT**
1. Modify the OA as agreed to in ICD-GPS-240 and ICD-GPS-870.	<No change>

DOORS ID	ICD-GPS-870		
Paragraph	Pages 30-33	**Comment Number**	58
Comment Type	S - Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	Recommend formatting this section like ICD-240. There is no need to include an example of every type of NANU defined in this section since the sections NANU type in each are identical. Those sections are defined on pages 39-43.		
Directorate Response	Extra examples provide additional value. Removing them would make it consistent with ICD-GPS-240, but otherwise decreases information provided. To simplify the update process, update the POC information in the first NANU example and then point the POC section in the rest of the examples to the first.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
POC information as-written in NANU examples	N/A	See following slides

ICD870-94 (Added to RFC): *Proposed Text:*

NOTICE ADVISORY TO NAVSTAR USERS (NANU) YYYYSSS
SUBJ: SVNXXX (PRNXX) FORECAST OUTAGE JDAY JJJ/HHMM - JDAY JJJ/HHMM
1. NANU TYPE: FCSTDV
NANU NUMBER: YYYYSSS
NANU DTG: DDHHMMZ MMM YYYY
REFERENCE NANU: N/A
REF NANU DTG: N/A
SVN: XXX
PRN: XX
START JDAY: JJJ
START TIME ZULU: HHMM
START CALENDAR DATE: DD MMM YYYY
STOP JDAY: JJJ
STOP TIME ZULU: HHMM
STOP CALENDAR DATE: DD MMM YYYY

2. CONDITION: GPS SATELLITE SVNXXX (PRNXX) WILL BE UNUSABLE ON JDAY JJJ (DD MMM YYYY) BEGINNING HHMM ZULU UNTIL JDAY JJJ (DD MMM YYYY) ENDING HHMM ZULU.

3. POC: ~~CIVIL NON-AVIATION - NAVCEN at 703-313-5900, HTTPS://WWW.NAVCEN.USCG.GOV, CIVIL AVIATION - FAA Satellite Operations Group at 540-422-4178, https://www.faa.gov/air_traffic/nas/gps_reports/, MILITARY - GPS Operations Center at HTTPS://GPS.AFSPC.AF.MIL/GPSOC, DSN 560-2541, COMM 719-567-2493, GPS_SUPPORT@SCHRIEVER.AF.MIL, HTTP://WWW.SCHRIEVER.AF.MIL/GPS, MILITARY ALTERNATE - JOINT SPACE OPERATIONS CENTER, DSN 276-9994, COMM 805-606-9994, JSPOCCOMBATOPS@VANDENBERG.AF.MIL~~
CIVIL NON-AVIATION – NAVCEN AT 703-313-5900, HTTPS://WWW.NAVCEN.USCG.GOV,
CIVIL AVIATION – FAA NASEO AT 540-422-4178, HTTPS://WWW.FAA.GOV/AIR_TRAFFIC/NAS/GPS_REPORTS/,
MILITARY – GPS OPERATIONS CENTER AT HTTPS://GPS.AFSPC.AF.MIL/GPSOC/, DSN 560-2541, COMM 719-567-2493, GPSOPERATIONSCENTER@US.AF.MIL, HTTP://WWW.SCHRIEVER.AF.MIL/GPS/,
MILITARY ALTERNATE – JOINT SPACE OPERATIONS CENTER, DSN 276-3514, COMM 805-606-3514, JSPOCCOMBATOPS@VANDENBERG.AF.MIL

POC info in Figure 10-1 reflects the time of ICD release

Figure 10-1 FCSTDV NANU Message Template

All NANU Templates: ICD-GPS-870 Figures 10-2 through 10-10, 10-12 through 10-16 are updated in a similar fashion

PROPOSED TEXT

```
NOTICE ADVISORY TO NAVSTAR USERS (NANU) YYYYSSS
SUBJ: SVNXXX (PRNXX) FORECAST OUTAGE JDAY JJJ/HHMM - JDAY JJJ/HHMM
1.      NANU TYPE: FCSTMX
        NANU NUMBER: YYYYSSS
        NANU DTG: DDHHMMZ MMM YYYY
        REFERENCE NANU: N/A
        REF NANU DTG: N/A
        SVN: XXX
        PRN: XX
        START JDAY: JJJ
        START TIME ZULU: HHMM
        START CALENDAR DATE: DD MMM YYYY
        STOP JDAY: JJJ
        STOP TIME ZULU: HHMM
        STOP CALENDAR DATE: DD MMM YYYY

2.  CONDITION: GPS SATELLITE SVNXXX (PRNXX) WILL BE UNUSABLE ON JDAY JJJ
(DD MMM YYYY) BEGINNING HHMM ZULU UNTIL JDAY JJJ (DD MMM YYYY)
ENDING HHMM ZULU.

3.  POC: CIVIL NON-AVIATION - NAVCEN at 703-313-5900, HTTPS://WWW.NAVCEN.USCG.GOV,
CIVIL AVIATION - FAA Satellite Operations Group at 540-422-4178,
https://www.faa.gov/air_traffic/nas/gps_reports/,
MILITARY - GPS Operations Center at HTTPS://GPS.AFSPC.AF.MIL/GPSOC, DSN 560-2541, COMM 719-567-
2493, GPS_SUPPORT@SCHRIEVER.AF.MIL, HTTP://WWW.SCHRIEVER.AF.MIL/GPS,
MILITARY ALTERNATE - JOINT SPACE OPERATIONS CENTER, DSN 276-9994, COMM 805-606-9994,
JSPOCCOMBATOPS@VANDENBERG.AF.MIL
See Figure 10-1 for POC format
```

POC info points to Figure 10-1 (previous slide)

Figure 10-2 FCSTMX NANU Message Template

ICD870-88 (Added to RFC):

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
NANUs are used to notify Users of scheduled and unscheduled satellite outages and general GPS information. An outage is defined to be a period of time that the satellite is removed from service and not available for use. Operators determine the satellite meets the conditions for "unhealthy" provided in Section 2.3.2 of the Standard Positioning Service Performance guide. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows: · Scheduled outages · Unscheduled outages · General text message · Others	N/A	NANUs are used to notify Users of scheduled and unscheduled satellite outages and general GPS information. An outage is defined to be a period of time that the satellite is removed from service and not available for use. Operators determine the satellite meets the conditions for "unhealthy" provided in Section 2.3.2 of the Standard Positioning Service Performance guide. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows: · Scheduled outages · Unscheduled outages · General text message · Others Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change. The first NANU example includes POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information.

Follows changes in previous 2 slides

DOORS ID	ICD870-737		
Paragraph	3.1.1	**Comment Number**	105
Comment Type	S – Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Kevin Pi (Raytheon)		
Comment	Objects (ICD870-309, ICD870-310, ICD870-311, ICD870-312, ICD870-313, ICD870-314, ICD870-315, ICD870-524, ICD870-523, ICD870-522, ICD870-521) related to VCRM description were removed - the rationale indicated there are no requirements in this document but there is a shall statement added in ICD870-737 - Recommend synchronizing the two areas. Either add back the verification attributes or remove the shall statement.		
Directorate Response	This is the CS POC requirement, which will be relocated to the proper document. It does not belong in the public documents. However, address the concern that the POC information contained in the GPS products is updated more frequently than the ICDs – advise the user to refer to the POC information in the released GPS products for the latest POC information.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
[ICD870-737] N/A See following slides for new changes	[ICD870-737] The GPS CS shall update Point of Contact (POC) information when it changes within the GPS products provided by the GPS CS.	[ICD870-737] Reverted to baseline text See following slides for new changes

ICD870-88 (Added to RFC):

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
NANUs are used to notify Users of scheduled and unscheduled satellite outages and general GPS information. An outage is defined to be a period of time that the satellite is removed from service and not available for use. Operators determine the satellite meets the conditions for "unhealthy" provided in Section 2.3.2 of the Standard Positioning Service Performance guide. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows: · Scheduled outages · Unscheduled outages · General text message · Others	N/A	NANUs are used to notify Users of scheduled and unscheduled satellite outages and general GPS information. An outage is defined to be a period of time that the satellite is removed from service and not available for use. Operators determine the satellite meets the conditions for "unhealthy" provided in Section 2.3.2 of the Standard Positioning Service Performance guide. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows: · Scheduled outages · Unscheduled outages · General text message · Others Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change. The first NANU example, Figure 10-1, includes POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information.

ICD870-189 (Added to RFC):

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in three sections. The following paragraphs describe each section and subsection of the OA.	N/A	The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in three sections. The following paragraphs describe each section and subsection of the OA. Users should be advised that the Point of Contact (POC) information contained in Section 3 of the OA samples are subject to change. The OA examples include POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent OAs for up-to-date information.

ICD240-336 [Inserted after ICD240-91 through ICD240-95]:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
[ICD240-91] NANUs are used to notify users of scheduled and unscheduled satellite outages and general GPS information. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows: • [ICD240-92]Scheduled outages • [ICD240-93]Unscheduled outages • [ICD240-94]General text message • [ICD240-95]Others	N/A	[ICD240-91] NANUs are used to notify users of scheduled and unscheduled satellite outages and general GPS information. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows: • [ICD240-92]Scheduled outages • [ICD240-93]Unscheduled outages • [ICD240-94]General text message • [ICD240-95]Others [ICD240-336] Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change. The NANU examples include POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information.

ICD240-159 (added to RFC):

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in three sections. The following paragraphs describe each section and subsection of the OA.	N/A	The Operational Advisory (OA) message provides a summary of the satellite constellation status. An example is shown in Figure 20-1. The OA is arranged in three sections. The following paragraphs describe each section and subsection of the OA. Users should be advised that the Point of Contact (POC) information contained in Section 3 of the OA samples are subject to change. The OA examples include POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent OAs for up-to-date information.

Leap Second and Earth Orientation Parameters

Lt Benjamin Ratner
Lt Michael Telcide
Jennifer Lemus
Philip Kwan

Leap Second and Earth Orientation Parameters

Problem Statement:
The linkage between different timing systems is not properly captured in the current technical baseline. With the current documentation, CNAV users will calculate the wrong UT1 time immediately following a leap second change. This affects user applications that require high precision pointing, which may include optical telescopes, spacecraft, or any system with this requirement. The topic was part of RFC-354, which will be superseded due to the inclusion of this topic in this RFC.
Proposed Solution:
The proposed changes to the impacted technical baseline documents would correctly calculate UT1 during a leap second transition.
Impacted Documents:
IS-GPS-200, IS-GPS-705, IS-GPS-800

Leap Second and Earth Orientation Parameters

CRM – COMBINED REVIEW STATUS

Disposition/Type	Critical	Substantive	Administrative	Totals	Concurrence
Accept	0	8	3	11	11
Accept with Change	2	2	3	7	7
Reject	5	19	7	31	31
Defer	00	00	00	00	0
Grand Totals:	7	29	13	49	49

Critical Update: Leap Second and EOP Solution

- Initial proposed solution in the PIRN/PCN release (July 6, 2018):
  - In an attempt to ensure that the Earth Orientation Parameters (EOP) message can be used with the Coordinate Universal Time (UTC) message, this RFC initially defined criteria utilizing $\{t_{EOP,}\ t_{ot}\}$ as indicators: $t_{EOP} = t_{ot}$
  - t_{EOP} is connected to the predict time of the Earth Orientation Parameters (i.e. upload/build time), whereas t_{ot} is at a fixed value (70 hours) into the UTC curve fit interval
  - Therefore, our original solution that coupled the EOP and UTC message and involved t_{EOP} and the EOP curve fit interval is incorrect

Critical Update: Leap Second and EOP Solution

- Solution:
  - Simplify the Leap Second and EOP solution
  - Remove the initial proposed solution
- The following slides explain the outcome of side discussions in August to discuss the new solution
- Comments pertaining to the old solution are marked with **OBE** (overcome by events) and are rejected, i.e. these changes are not a part of this RFC anymore (slides 60-70)

- New changes will be sent out for a 2-week review after the PICWG

Critical Update: Leap Second and EOP Solution

- Solution as proposed in slide 50 was presented at the Public ICWG on Sept 12, 2018, but now has been deferred as of November 2018
- Leap Second and Earth Orientation Parameters topic proposed changes have been removed from RFC-374
- All slides under this topic are labeled with **OBE**
- This topic will return in a future RFC

DOORS ID	IS200-618, IS200-623, IS705-320, IS705-324, IS800-240		
Paragraph	30.3.3.5.1.1 (IS-GPS-200), 20.3.3.5.1.1 (IS-GPS-705), 3.5.4.2.3 (IS-GPS-800)	**Comment Number**	163, 164
Comment Type	C – Critical	**Disposition**	***Accept with Co***
Comment Originator(s)	Karl Kovach (Aerospace)		
Comment	Propose a new solution to the Leap Second / EOP problem that does not require coupling the UTC/EOP messages. In addition, add information that addresses end-of-week crossovers for EOP data.		
Directorate Response	• Solution provided simplifies the resolution to this topic while leaving the UTC and EOP messages decoupled • Remove the initial solution. The added text as a result of this comment addresses the UT1 discontinuity without modifications to the UT1 equation.		

OBE

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
See following slides	See following slides	See following slides

Accounts for end-of-week crossovers

Leap Second / EOP solution

IS200-618 (Added to RFC): Proposed Text:

OBE

The EOP fields in the Message Type 32 contain the EOP data needed to construct the ECEF-to-ECI co transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 30-II. The full coordinate transformation for translating to the corresponding ECI SV antenna phase center position may be accomplished in accordance with the computations detailed in Chapter 5 of IERS Technical Note 36: IERS Conventions (2010) and equations for UT1, x_p and y_p as documented in Table 30-VIII. Note that the "UTC" as used in Table 30-VIII is the quantity as described in Paragraph 3.5.5 of the 2010 IERS Conventions. Figure 5.1 on page 73 of that document depicts the ce System) to ITRS (International Terrestrial Reference he 2010 IERS Conventions, are expected to bring Earth ventions, the user may as a matter of convenience elestial Intermediate Origin (CIO) based approach" or the "Equinox based approach". The EOP par process, and the parameters for x_p and y_p ar broadcast Message Type 32 EOP parameter 8 of the IERS Conventions (2010)), so these

Non-concurrence; not clear to user whether or not GPS Week Number is accounted for when t_{EOP} is compared w/ the time of a Leap Second transition

Suggested text to add to the beginning of this paragraph (approved at ICWG for now, follow-up action to define new term for reference times that account for GPS weeks):
Users must account for the GPS weeks when making the following comparisons between t_{EOP} and the time of a leap second adjustment.
(also apply to IS-GPS-705 and IS-GPS-800)

The EOP data reference time (t_{EOP}) is the sta the start of the Modified Julian Day (MJD) for exactly the start of the MJD due to accumulated leap seconds and least significant bit (LSB) limitations on the representation of time. For use in the equations in Table 30-VIII, the GPS Week Number for the EOP data (WN_{EOP}) in Message Type 32 may be directly derived from the WN_{OP} value in the corresponding Message Type 30. If the t_{op} falls within the GPS day for application of the EOP data, the user may utilize WN_{OP} from that Message Type 30 as the WN_{EOP}, provided that t_{op} from the Message Type 30 is the same value as that in the Message Type 32.

Users are advised that the broadcast Message Type 32 EOP parameters account for the application of a leap second current at time t_{EOP}; i.e., if t_{EOP} is after the time of a leap second adjustment, ΔUT1 will reflect that leap second adjustment. Users should not apply the leap second adjustment for calculating UT1 in the first equation in Table 30-VIII if the t_{EOP} value contained in Message Type 32 EOP parameters is before the time of a leap second adjustment. Upon receiving new Message Type 32 EOP parameters, users should apply the leap second adjustment when calculating UT1 after a leap second adjustment only when the t_{EOP} value is after the time of the leap second adjustment.

Accounts for end-of-week crossovers

Leap Second / EOP solution

IS705-320 (Added to RFC): Proposed Text:

OBE

The EOP fields in the message type 32 contain the EOP data needed to construct the ECEF-to-ECI coordinate transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 20-II. The full coordinate transformation for translating to the corresponding ECI SV antenna phase center position may be accomplished in accordance with the computations detailed in Chapter 5 of IERS Technical Note 36: IERS Conventions (2010) and equations for UT1, x_p and y_p as documented in Table 20-VIII. Note that the "UTC" as used in Table 20-VIII is the quantity as described in Paragraph 3.5.5 of the 2010 IERS Conventions. Figure 5.1 on page 73 of that document depicts the computational flow starting from GCRS (Geocentric Celestial Reference System) to ITRS (International Terrestrial Reference System). Ongoing WGS 84 re-adjustment at NGA and incorporating the 2010 IERS Conventions, are expected to bring Earth based coordinate agreement to within 2 cm. In the context of the Conventions, the user may as a matter of convenience choose to implement the transformation computations via either the "Celestial Intermediate Origin (CIO) based approach" or the "Equinox based approach". The EOP parameters for ΔUT1 are to be applied within the "Rotation to terrestrial system" process, and the parameters for x_p and y_p are applied in the "Rotation for polar motion" process. Users are advised that the broadcast message type 32 EOP parameters already account for zonal, diurnal and semidiurnal effects (described in Chapter 8 of the IERS Conventions (2010)), so these effects should not be further applied by the user.

The EOP data reference time (t_{EOP}) is the start of the GPS day for application of the EOP data. In general, t_{EOP} will be close to the start of the Modified Julian Day (MJD) for the related EOP data distributed to users by other means -- but it will not be at exactly the start of the MJD due to accumulated leap seconds and least significant bit (LSB) limitations on the representation of time. For use in the equations in Table 20-VIII, the GPS Week Number for the EOP data (WN_{EOP}) in message type 32 may be directly derived from the WN_{OP} value in the corresponding message type 30. If the t_{op} falls within the GPS day for application of the EOP data, the user may utilize WN_{OP} from that message type 30 as the WN_{EOP}, provided that t_{op} from the message type 30 is the same value as that in the message type 32.

Users are advised that the broadcast message type 32 EOP parameters account for the application of a leap second current at time t_{EOP}; i.e., if t_{EOP} is after the time of a leap second adjustment, ΔUT1 will reflect that leap second adjustment. Users should not apply the leap second adjustment for calculating UT1 in the first equation in Table 20-VIII if the t_{EOP} value contained in message type 32 EOP parameters is before the time of a leap second adjustment. Upon receiving new message type 32 EOP parameters, users should apply the leap second adjustment when calculating UT1 after a leap second adjustment only when the t_{EOP} value is after the time of the leap second adjustment.

Accounts for end-of-week crossovers

Leap Second / EOP solution

IS800-240 (Added to RFC):

Proposed Text:

OBE

The EOP fields in subframe 3, page 2 contain the EOP needed to construct the ECEF-to-ECI coordinate transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 3.5-2. The coordinate transformation, for translating to the corresponding ECI SV antenna phase center position, is derived using the equations shown in IERS Technical Note 36 and Table 30-VIII of IS-GPS-200 in accordance with Section 30.3.3.5.1.1 of IS-GPS-200. The coordinate systems are defined in Section 20.3.3.4.3.3 of IS-GPS-200.

The EOP data reference time (t_{EOP}) is the start of the GPS day for application of the EOP data. In general, t_{EOP} will be close to the start of the Modified Julian Day (MJD) for the related EOP data distributed to users by other means -- but it will not be at exactly the start of the MJD due to accumulated leap seconds and least significant bit (LSB) limitations on the representation of time. For use in the equations in Table 30-VIII of IS-GPS-200, the GPS Week Number for the EOP data (WN_{EOP}) in subframe 3 page 2 may be directly derived from the WN_{OP} value in the corresponding subframe 2. If the t_{op} falls within the GPS day for application of the EOP data, the user may utilize WN_{OP} from subframe 2 as the WN_{EOP}, provided that t_{op} from subframe 2 is the same value as that in the subframe 3 page 2.

Users are advised that the broadcast subframe 3 page 2 EOP parameters account for the application of a leap second current at time t_{EOP}; i.e., if t_{EOP} is after the time of a leap second adjustment, ΔUT1 will reflect that leap second adjustment. Users should not apply the leap second adjustment for calculating UT1 in the first equation in Table 30-VIII of IS-GPS-200 if the t_{EOP} value contained in subframe 3 page 2 EOP parameters is before the time of a leap second adjustment. Upon receiving new subframe 3 page 2 EOP parameters, users should apply the leap second adjustment when calculating UT1 after a leap second adjustment only when the t_{EOP} value is after the time of the leap second adjustment.

Acronym List (Added to RFC): *Proposed Text:* OBE

For:

- [IS200-1488, Section 6.1]
- [IS705-1496, Section 6.1]
- [IS800-893, Section 6.1]

Add “MJD – Modified Julian Day” to the acronym list

Baseline Text (WAS):

OBE

IS705-324 Table 20-VIII. Application of EOP Parameters
IS200-623 Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = UTC + \Delta UT1 + \dot{\Delta UT1}\ (t - t_{EOP})$ *	Compute Universal Time at time t
$x_p = PM\_X + \dot{PM\ X}\ (t - t_{EOP})$ *	Polar Motion in the x-axis
$y_p = PM\_Y + \dot{PM\ Y}\ (t - t_{EOP})$ *	Polar Motion in the y-axis

*t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, the quantity ($t-t_{EOP}$) shall be the actual total time difference between the time t and the epoch time t_{EOP}, and must account for beginning or end of week crossovers. That is, if ($t-t_{EOP}$) is greater than 302,400 seconds, subtract 604,800 seconds from ($t-t_{EOP}$). If ($t-t_{EOP}$) is less than -302,400 seconds, add 604,800 seconds to ($t-t_{EOP}$).

PIRN Text (IS):

OBE

IS705-324 Table 20-VIII. Application of EOP Parameters
IS200-623 Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = t_{UTC\_EOP} + \Delta UT1 + \dot{\Delta UT1}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Compute Universal Time at time t
$x_p = PM\_X + \dot{PMX}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the x-axis
$y_p = PM\_Y + \dot{PMY}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the y-axis
GPS system time of transmission (t) shall be in seconds relative to end/start of week	
Note: Users should use caution when performing the calculations in Table 30-VIII for data where $\lvert(WN_{ot} - WN*604800) + (t - t_{EOP})\rvert < 259200$ s (3 days) as this is outside the EOP curve fit interval.	

Proposed Text:

OBE

Equations reverted back to baseline text

IS705-324 Table 20-VIII. Application of EOP Parameters

IS200-623 Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = UTC + \Delta UT1 + \dot{\Delta UT1}\ (t - t_{EOP})$ ~~$(t - t_{ot} + 604800\ (WN - WN_{ot}))$~~	Compute Universal Time at time t
$x_p = PM\_X + \dot{PM\_X}\ (t - t_{EOP})$ ~~$(t - t_{ot} + 604800\ (WN - WN_{ot}))$~~	Polar Motion in the x-axis
$y_p = PM\_Y + \dot{PM\_Y}\ (t - t_{EOP})$ ~~$(t - t_{ot} + 604800\ (WN - WN_{ot}))$~~	Polar Motion in the y-axis
GPS system time of transmission (t) shall be in seconds relative to end/start of week ~~Note: Users should use caution when performing the calculations in Table 30-VIII for data where $\lvert(WN_{ot} - WN*604800) + (t - t_{EOP})\rvert < 259200$ s (3 days) as this is outside the EOP curve fit interval.~~	

GPS time note remains from the initial PIRN/PCN

PICWG comment to add after this sentence: GPS week numbers must be accounted for in these equations.

Remove Initial Solution

OBE

Delete: IS200-1662, IS200-1671, IS200-1672, IS200-1673, IS705-1526, IS705-1529, IS705-1530, IS705-1531, IS800-921, IS800-922.

- These were objects in the original PIRN/PCN release and inserted as a part of this RFC.
- Specifics covered in the following 3 slides

OBE

[IS200-1662] ~~When implementing the first equation in Table 30-VIII, WN_{ot} and t_{UTC_EOP} are derived from data contained in message type 33 (see Section 30.3.3.6). The Control Segment shall ensure the ΔUT1 and $\dot{\Delta}$UT1 values in a message type 32 can be used with the UTC parameters (WN_{ot}, and Δt_{LS}) in message type 33 to calculate the correct UT1 time, provided the t_{EOP} in message type 32 is identical to the t_{ot} in message type 33 and the two message types are transmitted within a continuous 4-hour period.~~

[IS200-1671] ~~When calculating t_{UTC_EOP} for Table 30-VIII the user shall only use data from a message type 33 with the same t_{ot} as the t_{EOP} of the message type 32 containing ΔUT1 and $\dot{\Delta}$UT1 where both messages were received within a continuous 4-hour window.~~

[IS200-1672] ~~The following definition of t_{UTC_EOP} shall be used.~~

~~$t_{UTC\_EOP} = (t - \Delta t_{UTC\_EOP})$ [modulo 86400 seconds]~~

~~where~~

~~$\Delta t_{UTC\_EOP} = \Delta t_{LS} + A_{0-n} + A_{1-n}(t-t_{ot} + 604800(WN-WN_{ot})) + A_{2-n}(t-t_{ot}+604800(WN-WN_{ot}))^2$~~

[IS200-1673] ~~To avoid discontinuities in UT1 across leap seconds, the value of Δt_{LS} must be used in the calculation of t_{UTC_EOP} regardless of whether a leap second has occurred. This accounts for the continuous nature of UT1 until a new upload after the leap second provides an update value for ΔUT1 that is consistent with the new Δt_{LS}.~~

IS-GPS-705 Revisions

OBE

[IS705-1526] When implementing the first equation in Table 20-VIII, WN_{ot} and t_{UTC_EOP} are derived from data contained in message type 33 (see Section 20.3.3.6). The Control Segment shall ensure the ΔUT1 and $\dot{\Delta}$UT1 values in message type 32 can be used with the UTC parameters (WN_{ot}, and Δt_{LS}) in message type 33 to calculate the correct UT1 time, provided the t_{EOP} in message type 32 is identical to the t_{ot} in message type 33 and the two message types are transmitted within a continuous 4-hour period.

[IS705-1529] When calculating t_{UTC_EOP} for Table 20-VIII the user shall only use data from a message type 33 with the same t_{ot} as the t_{EOP} of the message type 32 containing ΔUT1 and $\dot{\Delta}$UT1 where both messages were received within a continuous 4-hour window.

[IS705-1530] The following definition of t_{UTC_EOP} shall be used.

$t_{UTC\_EOP} = (t - \Delta t_{UTC\_EOP})$ [modulo 86400 seconds]

where

$\Delta t_{UTC\_EOP} = \Delta t_{LS} + A_{0\text{-}n} + A_{1\text{-}n}(t - t_{ot} + 604800(WN - WN_{ot})) + A_{2\text{-}n}(t - t_{ot} + 604800(WN - WN_{ot}))^2$

[IS705-1531] To avoid discontinuities in UT1 across leap seconds, the value of Δt_{LS} must be used in the calculation of t_{UTC_EOP} regardless of whether a leap second has occurred. This accounts for the continuous nature of UT1 until a new upload after the leap second provides an update value for ΔUT1 that is consistent with the new Δt_{LS}.

IS-GPS-800 [illegible]ns

OBE

[IS800-921] ~~When implementing the first equation in Table 30-VIII of IS-GPS-200, WN_{ot} and t_{UTC_EOP} are derived from data contained in subframe 3 page 1 (see Section 3.5.4.1). The Control Segment shall ensure the ΔUT1 and ΔU̇T1 values in a subframe 3 page 2 can be used with the UTC parameters (WN_{ot}, and Δt_{LS}) in subframe 3 page 1 to calculate the correct UT1 time, provided the t_{EOP} in subframe 3 page 2 is identical to the t_{ot} in subframe 3 page 1 and the two message types are transmitted within a continuous 4-hour period.~~

[IS800-922] ~~When calculating t_{UTC_EOP} for Table 30-VIII in IS-GPS-200, the user shall only use data from a subframe 3 page 1 with the same t_{ot} as the t_{EOP} of the subframe 3 page 2 containing ΔUT1 and ΔU̇T1 where both messages were received within a continuous 4-hour window.~~

DOORS ID	IS200-623, IS705-324		
Paragraph	30.3.3.5.1.1 (IS-GPS-200), 20.3.3.5.1.1 (IS-GPS-705)	**Comment Number**	13, 14, 65, 76, 93, 97, 106, 141
Comment Type	C – Critical, S – Substantive	**Disposition**	***Reject***
Comment Originator(s)	1. Brent Renfro (University of Texas) 2. Roger Kirpes (Rockwell Collins) 3. Steven Hutsell (2SOPS) 4. Kevin Pi (Raytheon) 5. Philip Kwan (Engility)		
Comment	1. Misplaced parenthesis in new note at bottom of Table 20-VIII (IS-GPS-705), 30-VIII (IS-GPS-200). 2. 'The equation in the Note is incorrect. 1) Parenthesis is misplaced. 2) Inequality should be "greater than" (or reword the note). The time of application is outside the EOP curve fit interval if the time difference is greater than 3 days. 3) For consistency among the equations in this table, use t_{ot} instead of t_{EOP}. 3. Equation appears incorrect -- apparently missing a parenthesis. 4. ")" incorrectly placed - should be right AFTER "WN" instead of "604800". I understand t_{ot} and t_{EOP} will be identical. Recommend replacing t_{EOP} with t_{ot} to make the equation more logical. 5. In Table 20-VIII of IS-GPS-705 and Table 30-VIII of IS-GPS-200, the Application of EOP Parameters, there is a mistake in the inequality that the note provides. If the user is supposed to calculate the difference between the current time (including time of week) and the data reference time (including time of week), then the week numbers need to be switched and the "less than" symbol needs to be changed to a "greater than" symbol.		
Directorate Response	• Parentheses have been updated accordingly • Inequality fixed with “>” • Decide to keep t_{EOP} because this tells users to utilize both message types in addition to using data within the curve fit interval. If the two messages are not consistent, then the inequality will be met and calculations may not be accurate. • Week number terms were switched within the inequality		

OBE

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT

DOORS ID	IS200-623, IS200-1499, IS705-324		
Paragraph	30.3.3.5.1.1 (IS-GPS-200), 30.3.4.5 (IS-GPS-200), 20.3.3.5.1.1 (IS-GPS-705)	**Comment Number**	94, 95, 96, 98, 99, 100 **OBE**
Comment Type	S – Substantive, A – Administrative	**Disposition**	***Reject***
Comment Originator(s)	1. Steven Hutsell (2SOPS)		
Comment	a. The phrase "EOP curve fit interval" does not appear to reside anywhere else in IS-GPS-200, let alone with an accompanying definition. b. The phrase "use caution", without elaboration, is too vague for an interface specification. c. The wording "this is" is ambiguous/confusing because the pronoun "this" is not explicated (administrative).		
Directorate Response	• Rewrote the note to specify that users should be cautious – added caveat stating consequences of using data that satisfies the inequality in the note; “this” was changed to “this data” • Defined the curve fit interval for EOP to be 6 days (144 hours), with a t_{EOP} of 70 hours into first valid transmission (update to IS200-1499)		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT

DOORS ID	IS200-1662, IS705-1526, IS800-921		
Paragraph	30.3.3.5.1.1 (IS-GPS-200), 20.3.3.5.1.1 (IS-GPS-705), 3.5.4.2.3 (IS-GPS-800)	**Comment Number**	18, 19, 20, 116, 125, 141 **OBE**
Comment Type	S – Substantive	**Disposition**	***Reject***
Comment Originator(s)	1. Steven Brown (Lockheed Martin) 2. Anne Kastenholz (Boeing)		
Comment	1. The current version is complicated and hard to understand. It is not clear what the CS must do, and what the UE should look for. Also, as currently written, it will be hard to break out in DOORs and thus hard for CS to verify. See suggested rewrite (note that formatting is a little off due to this being excel and not word.) The use of list is already in use in these documents. 2. The grammar of "The Control Segment…" sentence doesn't seem correct. Breaking the sentence down provides: "The CS shall ensure <something>, provided <condition>" Does this mean that the CS has no obligation if the condition is false? Aren't the <condition> items really the details of how the CS ensures the <something>? If so, the word "provided" should be something else such as "by ensuring"		
Directorate Response	• The rewrite suggested the CS sets the reference times (a conditional statement) to be identical. We cannot rewrite the conditional statements into requirements. We need the conditions. The conditional statement cannot be removed. The CS cannot ensure that the times are identical all the time because one message type gets updated and uploaded prior to another one. Until the other message type gets updated and uploaded, the times are not aligned. This is the warning to the user (in the requirement that follows). • Consider putting in a caveat that specifies what happens when the condition is false.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT

DOORS ID	IS200-1662, IS705-1526, IS800-921		
Paragraph	30.3.3.5.1.1 (IS-GPS-200), 20.3.3.5.1.1 (IS-GPS-705), 3.5.4.2.3 (IS-GPS-800)	**Comment Number**	66, 67, 68, 77, 78, 79, 85, 86, 87 **OBE**
Comment Type	S – Substantive	**Disposition**	***Reject***
Comment Originator(s)	1. Roger Kirpes (Rockwell Collins, MGUE)		
Comment	1. This statement applies to all three equations in Table 20-VIII/30-VIII, not just the first equation. 2. More UTC parameters than just WN_{ot}, and Δt_{LS} from message type 33 are used in the calculation of UT1. Delete this parenthetical. 3. t_{ot} is also derived from data contained in message type 33 / subframe 3 page 1 -- mention it also.		
Directorate Response	1. Specifying that only t_{UTC_EOP} would be the only variable to specify as being derived from MT33 because this RFC creates the definition, and the other two are directly provided by MT33. Therefore, we don't need to specify that the statement applies to all equations (keep text as "first equation"). t_{UTC_EOP} is derived from variables provided in MT33, so it seems like it's more important to specify in this statement. 2. Removed the parenthetical from UTC parameters 3. Do not include t_{ot} for the same reasoning as #1.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT

DOORS ID	IS705-1530		
Paragraph	20.3.3.5.1.1	**Comment Number**	126
Comment Type	S – Substantive	**Disposition**	***Reject***
Comment Originator(s)	Anne Kastenholz (Boeing)		
Comment	2-n should be a subscript of A. [Redlines]		
Directorate Response	This is true to be consistent with the other instances of the variable as well as similar variables.		

OBE

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	**Redlines** : The following definition of t_{UTC_EOP} shall be used. $t_{UTC\_EOP} = (t - \Delta t_{UTC\_EOP})$ [modulo 86400 seconds] where $\Delta t_{UTC\_EOP} = \Delta t_{LS} + A_{0-n} + A_{1-n}(t-t_{ot} + 604800(WN-WN_{ot})) + A2\text{-}n\ (t-t_{ot}+604800\ (WN-WN_{ot}))^2$	**Redlines** : The following definition of t_{UTC_EOP} shall be used. $t_{UTC\_EOP} = (t - \Delta t_{UTC\_EOP})$ [modulo 86400 seconds] where $\Delta t_{UTC\_EOP} = \Delta t_{LS} + A_{0-n} + A_{1-n}(t-t_{ot} + 604800(WN-WN_{ot})) + A_{2-n}\ (t-t_{ot}+604800\ (WN-WN_{ot}))^2$

DOORS ID	IS200-1671, IS200-1673, IS705-1529, IS705-1531, IS800-922		
Paragraph	30.3.3.5.1.1 (IS-GPS-200), 20.3.3.5.1.1 (IS-GPS-705), 3.5.4.2.3 (IS-GPS-800)	**Comment Number**	145, 146, 147 **OBE**
Comment Type	S – Substantive, A – Administrative	**Disposition**	***Reject***
Comment Originator(s)	Philip Kwan (Engility)		
Comment	Update the grammar in the sentence.		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	[IS200-1671, IS705-1529] When calculating t_{UTC_EOP} for Table 30-VIII/20-VIII the user shall only use data from a Message Type 33 with the same t_{ot} as the t_{EOP} of the Message Type 32 containing $\Delta UT1$ and $\dot{\Delta UT1}$ where both messages were received within a continuous 4-hour window. [IS200-1673, IS705-1531] To avoid discontinuities in UT1 across leap seconds, the value of Δt_{LS} must be used in the calculation of t_{UTC_EOP} regardless of whether a leap second has occurred. This accounts for the continuous nature of UT1 until a new upload after the leap second, has an updated value for $\Delta UT1$ that is consistent with the new Δt_{LS}. [IS800-922] When calculating t_{UTC_EOP} for Table 30-VIII in IS-GPS-200 the user shall only use data from a subframe 3 page 1 with the same t_{ot} as the t_{EOP} of the subframe 3 page 2 containing $\Delta UT1$ and $\dot{\Delta UT1}$ where both messages were received within a continuous 4-hour window.	[IS200-1671, IS705-1529] When calculating t_{UTC_EOP} for Table 30-VIII/20-VIII, the user shall only use data from a Message Type 33 with a ~~with the same t_{ot} as the t_{EOP}~~ t_{ot} that is equal to the t_{EOP} of a Message Type 32 containing $\Delta UT1$ and $\dot{\Delta UT1}$, where both messages were received within a continuous 4-hour window. [IS200-1673, IS705-1531] To avoid discontinuities in UT1 across leap seconds, the value of Δt_{LS} must be used in the calculation of t_{UTC_EOP} regardless of whether or not a leap second has occurred. This accounts for the continuous nature of UT1 until a new upload, provided after the leap second, ~~provides~~ has an updated value for $\Delta UT1$ that is consistent with the new Δt_{LS}. [IS800-922] When calculating t_{UTC_EOP} for Table 30-VIII in IS-GPS-200, the user shall only use data from a subframe 3 page 1 with a ~~with the same t_{ot} as the t_{EOP}~~ t_{ot} that is equal to the t_{EOP} of a subframe 3 page 2 containing $\Delta UT1$ and $\dot{\Delta UT1}$, where both messages were received within a continuous 4-hour window.

DOORS ID	IS800-921 (PIRN/PCN)		
Paragraph	3.5.4.2.3 (IS-GPS-800)	**Comment Number**	17
Comment Type	A – Administrative	**Disposition**	***Reject***
Comment Originator(s)	Steven Brown (Lockheed Martin)		
Comment	The rationale is wrong, no message type 32 in CNAV2		
Directorate Response	For CNAV-2, the information should be "Subframe 3 Page 1 and Subframe 3 Page 2" rather than "message type 33 and message type 32"		

OBE

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	…message type 32… …message type 33…	…~~message type 32~~subframe 3 page 2… …~~message type 33~~subframe 3 page 1…

DOORS ID	IS200-621, IS200-623, IS200-520 (NEW), IS705-322, IS705-324, IS705-1530, IS705-202 (NEW), IS800-875 (NEW)		
Paragraph	IS-GPS-200: 30.3.3.5.1.1, 30.3.3 IS-GPS-705: 20.3.3.5.1.1, 20.3.3 IS-GPS-800: 3.5.2	**Comment Number**	16, 109, 114 ... 23, 128 **OBE**
Comment Type	S – Substantive	**Disposition**	***Accept with Comment***
Comment Originator(s)	1. Steven Brown (Lockheed Martin, GPS III) 2. Anne Kastenholz (Boeing, GPS IIF)		
Comment	1. The new dots are too small. They can move, but must be bigger. 2. PM_$\dot{X}$ and PM_$\dot{Y}$ should not be changed to PM$\dot{X}$ and PM$\dot{Y}$. PM_$\dot{X}$ symbolizes the rate of change of the PM_X variable. Thus, the underscore should not be removed (the root (PM_X) must remain intact). Additionally, PM_X is the correct variable representation because it is the X-component of the PM (polar motion) parameter. Not some acronym with a P, M, X in it. 3. PM_$\dot{X}$ and PM_$\dot{Y}$ are depicted in the figure as PM-$\dot{X}$ and PM-$\dot{Y}$. PM_X and PM_Y are depicted as PM-X and PM-Y. Additionally, the dot is over the T in ΔUT1 which is inconsistent with change to IS200-621 in this RFC. These variables must be made consistent throughout the document.		
Directorate Response	• Make dots bigger in the figures/tables • Dot convention: $\Delta\dot{U}T1$, $P\dot{M}\_X$, $P\dot{M}\_Y$		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
See following slides	See following slides	See following slides

IS200-621: Baseline Text (WAAS):

OBE

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\dot{\Delta UT1}$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 30-5 for complete bit allocation in Message Type 32;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.

†† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.

††† With zonal tides restored.

$\dot{PM}$_X

$\dot{PM}$_Y

$\dot{\Delta UT1}$ †††

IS200-621:

PIRN Text (IS):

OBE

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PMX}$	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PMY}$	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\dot{\Delta UT1}$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 30-5 for complete bit allocation in Message type 32;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.

†† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.

††† With zonal tides restored.

IS200-621:

Proposed Text:

OBE

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\dot{\Delta UT1}$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 30-5 for complete bit allocation in Message Type 32;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.

†† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.

††† With zonal tides restored.

[Left alignment]

Baseline Text (WAS):

OBE

IS705-324 Table 20-VIII. Application of EOP Parameters
IS200-623 Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = UTC + \Delta UT1 + \dot{\Delta UT1}\ (t - t_{EOP})$ *	Compute Universal Time at time t
$x_p = PM\_X + \dot{PM\ X}\ (t - t_{EOP})$ *	Polar Motion in the x-axis
$y_p = PM\_Y + \dot{PM\ Y}\ (t - t_{EOP})$ *	Polar Motion in the y-axis

*t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, the quantity ($t-t_{EOP}$) shall be the actual total time difference between the time t and the epoch time t_{EOP}, and must account for beginning or end of week crossovers. That is, if ($t-t_{EOP}$) is greater than 302,400 seconds, subtract 604,800 seconds from ($t-t_{EOP}$). If ($t-t_{EOP}$) is less than -302,400 seconds, add 604,800 seconds to ($t-t_{EOP}$).

PIRN Text (IS):

OBE

IS705-324 Table 20-VIII. Application of EOP Parameters

IS200-623 Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = t_{UTC\_EOP} + \Delta UT1 + \dot{\Delta UT1}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Compute Universal Time at time t
$x_p = PM\_X + \dot{PMX}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the x-axis
$y_p = PM\_Y + \dot{PMY}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the y-axis
GPS system time of transmission (t) shall be in seconds relative to end/start of week	
Note: Users should use caution when performing the calculations in Table 30-VIII for data where $\lvert(WN_{ot} - WN*604800) + (t - t_{EOP})\rvert < 259200$ s (3 days) as this is outside the EOP curve fit interval.	

Proposed Text:

OBE

IS705-324 Table 20-VIII. Application of EOP Parameters

IS200-623 Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = UTC + \Delta UT1 + \dot{\Delta UT1}\,(t - t_{EOP})$ ~~$(t - t_{ot} + 604800\,(WN - WN_{ot}))$~~	Compute Universal Time at time t
$x_p = PM\_X + \dot{PM\_X}\,(t - t_{EOP})$ ~~$(t - t_{ot} + 604800\,(WN - WN_{ot}))$~~	Polar Motion in the x-axis
$y_p = PM\_Y + \dot{PM\_Y}\,(t - t_{EOP})$ ~~$(t - t_{ot} + 604800\,(WN - WN_{ot}))$~~	Polar Motion in the y-axis
GPS system time of transmission (t) shall be in seconds relative to end/start of week ~~Note: Users should use caution when performing the calculations in Table 30-VIII for data where $\lvert(WN_{ot} - WN*604800) + (t - t_{EOP})\rvert < 259200$ s (3 days) as this is outside the EOP curve fit interval.~~	

PICWG comment to add after this sentence: GPS week numbers must be accounted for in these equations.

IS200-520 [new change]: *Baseline Text (WAS):*

OBE

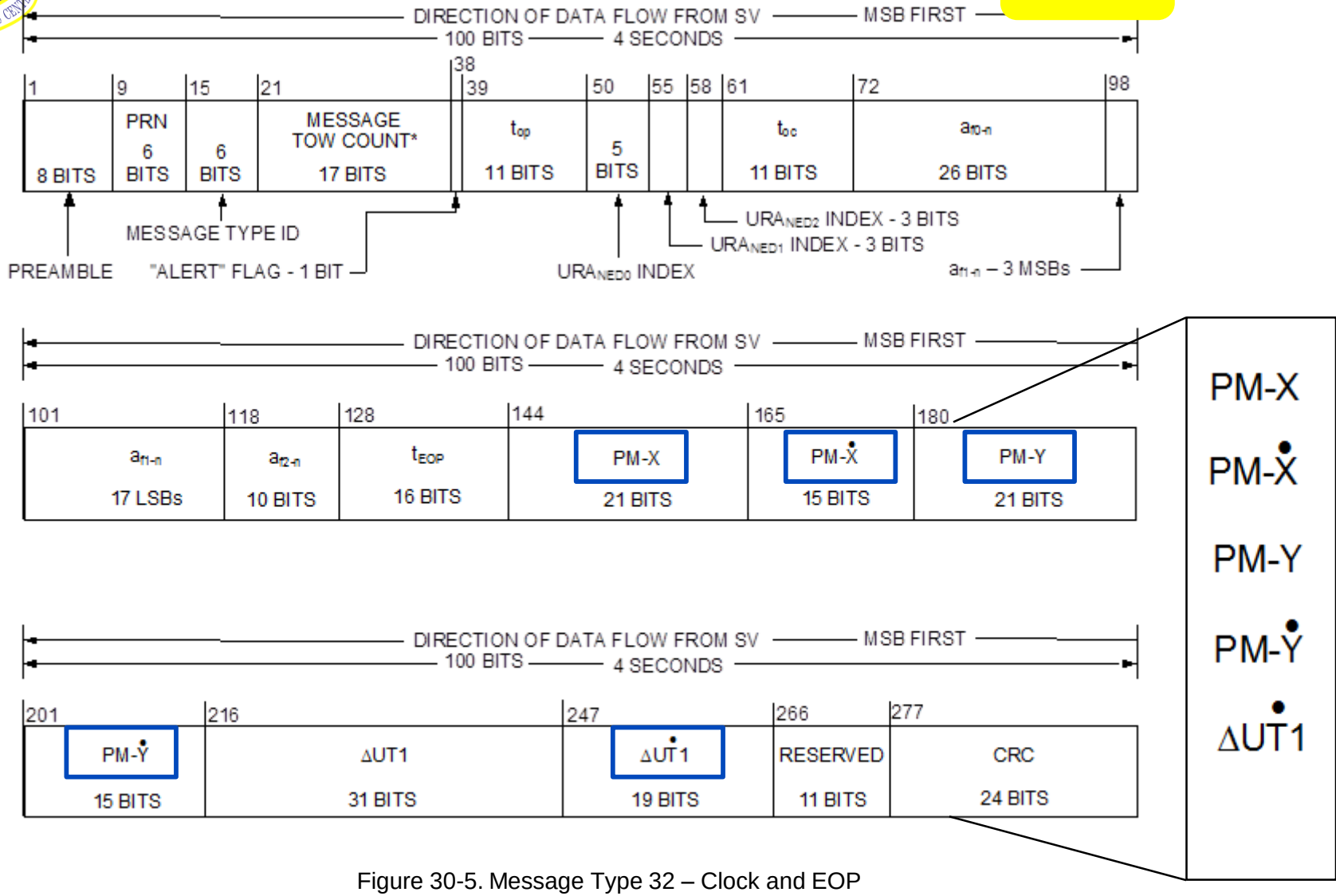


Figure 30-5. Message Type 32 – Clock and EOP

* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 12-SECOND MESSAGE

IS200-520 [new change]:

Proposed Text:

OBE

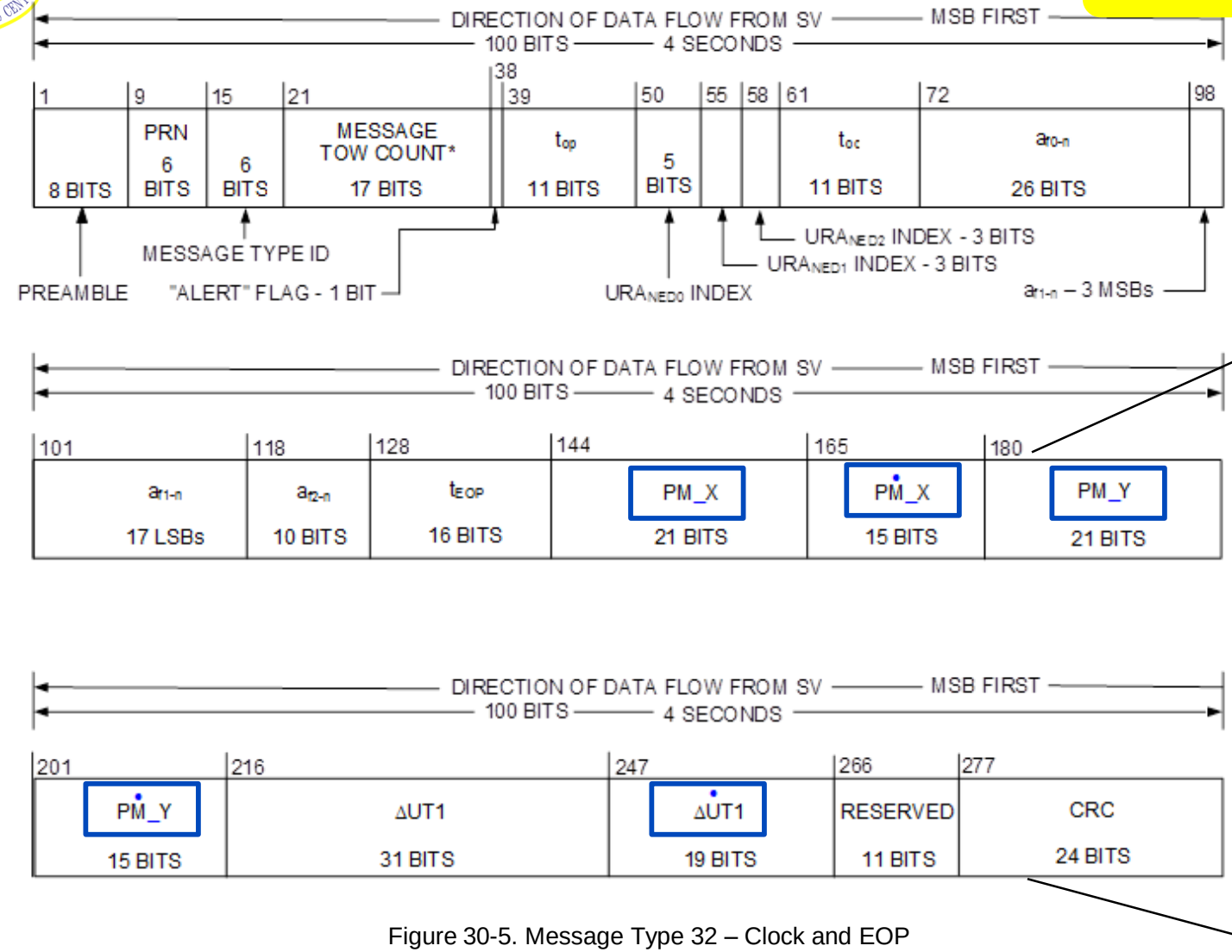


Figure 30-5. Message Type 32 – Clock and EOP

* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 12-SECOND MESSAGE

IS705-322: Baseline Text (WAS): OBE

Table 20-VIII. Earth Orientation Parameters

Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\dot{\Delta UT1}$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 20-5 for complete bit allocation in message type 32;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.

†† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.

††† With zonal tides restored.

$\dot{PM}$_X

$\dot{PM}$_Y

$\dot{\Delta UT1}$ †††

IS705-322:

PIRN Text (IS):

OBE

Table 20-VIII. Earth Orientation Parameters

Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
PMẊ	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
PMẎ	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
ΔU̇T1 †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

PMẊ

PMẎ

ΔU̇T1 †††

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 20-5 for complete bit allocation in message type 32;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.

†† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.

††† With zonal tides restored.

IS705-322:

Proposed Text:

OBE

Table 20-VIII. Earth Orientation Parameters

Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\dot{\Delta UT1}$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 20-5 for complete bit allocation in message type 32;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.

†† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.

††† With zonal tides restored.

[dots were moved]

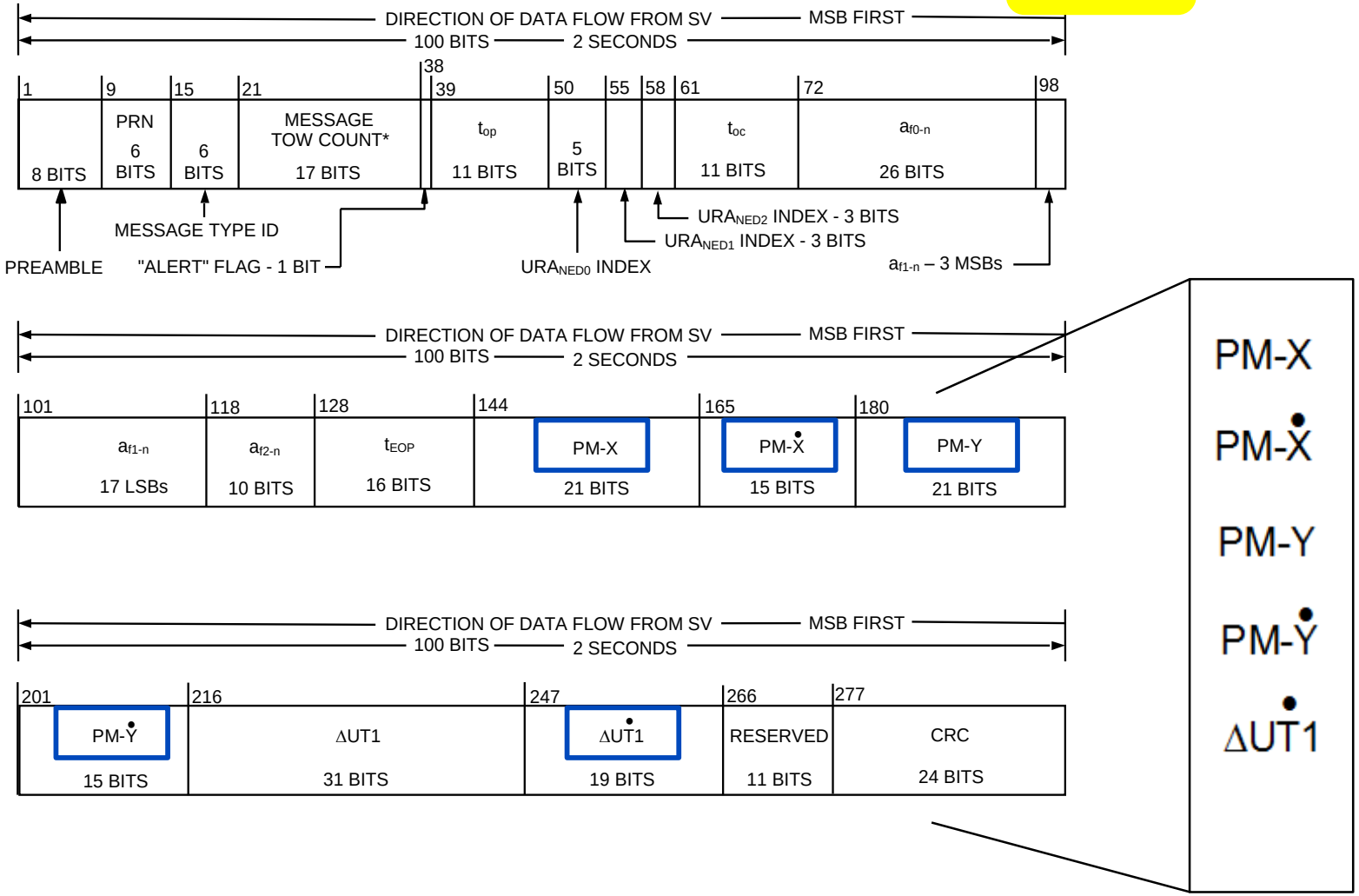
$\dot{PM}$_X

$\dot{PM}$_Y

$\dot{\Delta UT1}$ †††

IS705-202 [new change]: *Baseline Text (WAS):*

OBE



* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

Figure 20-5. Message Type 32 – Clock and EOP

IS705-202 [new change]:

Proposed Text:

OBE

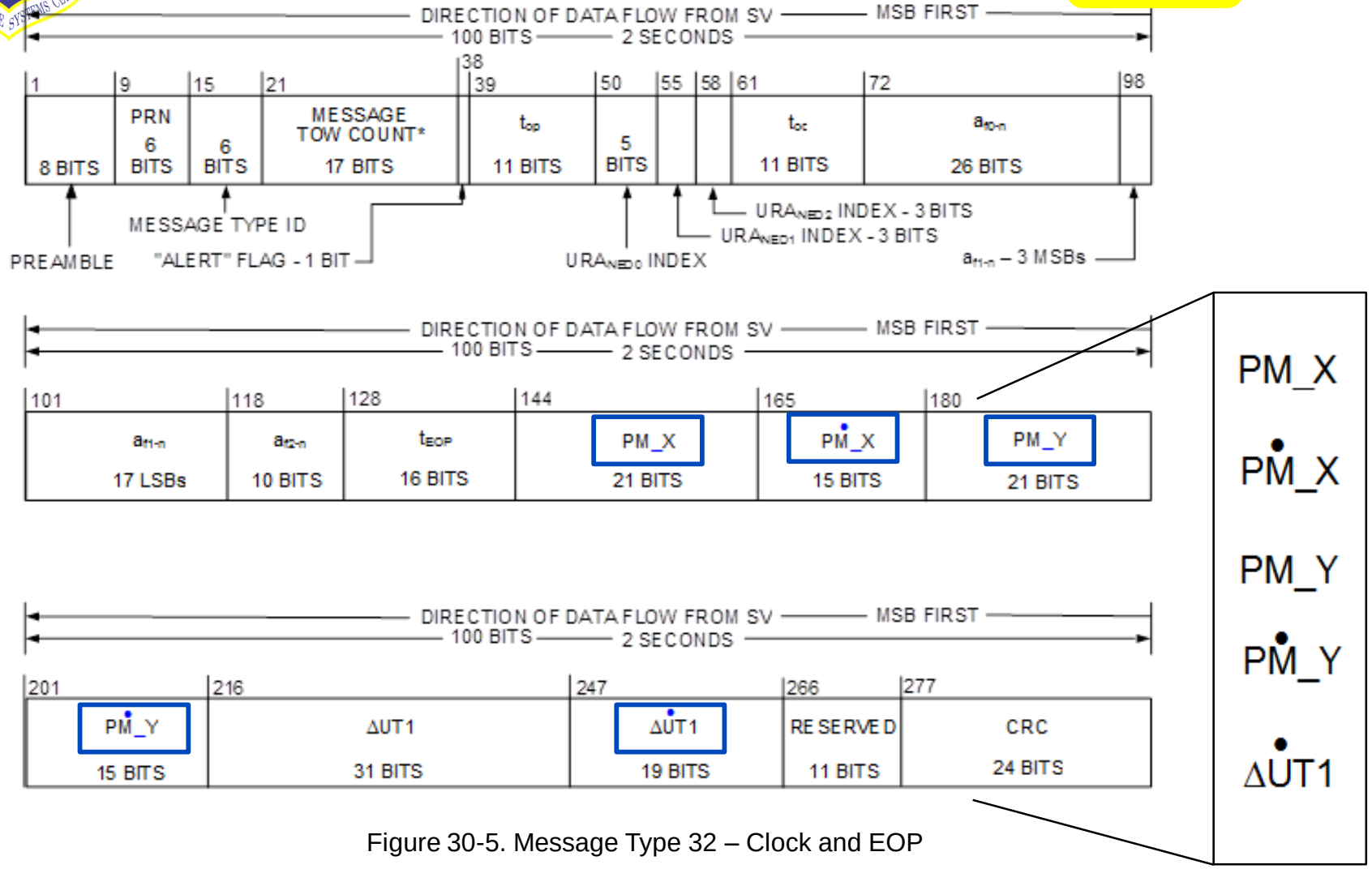


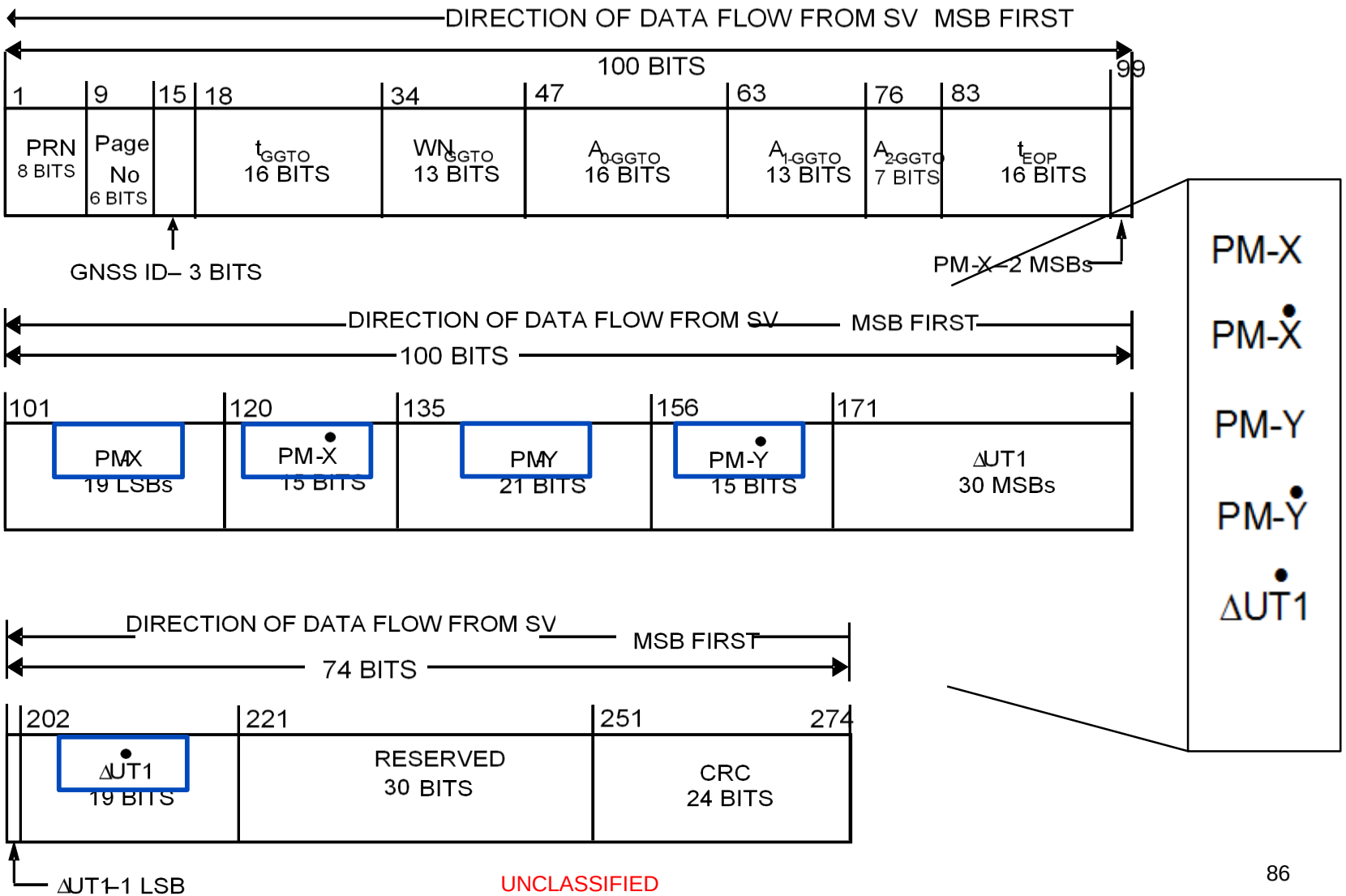
Figure 30-5. Message Type 32 – Clock and EOP

* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

IS800-875 [new change]: Baseline Text (WAS):

OBE

Figure 3.5-3 Subframe 3, Page 2

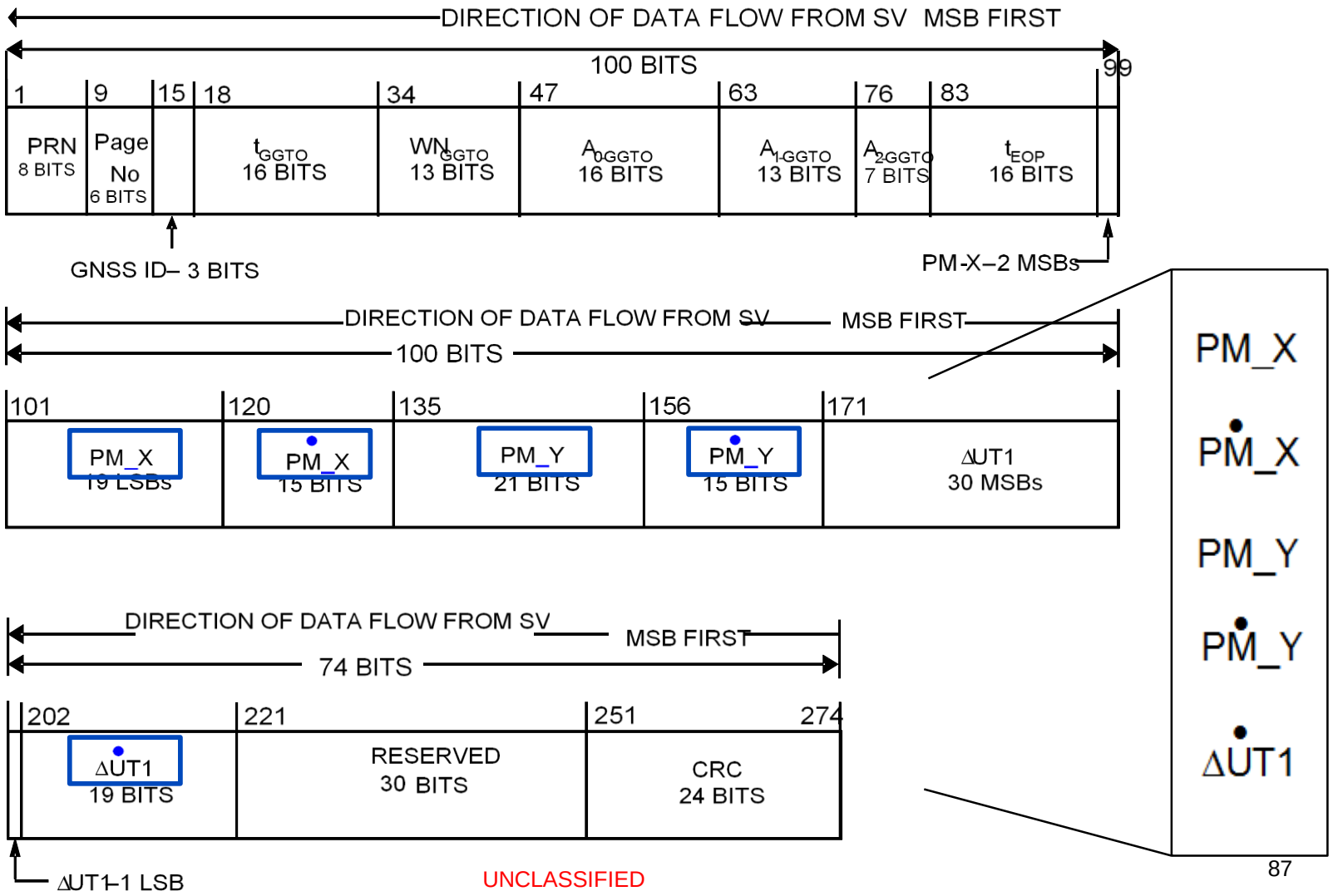


IS800-875 [new change]:

Proposed Text:

OBE

Figure 3.5-3 Subframe 3, Page 2



Clean-Up and Health Bit Clarification Topics

Lt Benjamin Ratner
Lt Michael Telcide
Jennifer Lemus
Philip Kwan

Clean-Up and Health Bit Clarification Topics

Problem Statement:
a) Signal-in-space topics need clarification, as identified by the public in past Public ICWGs. b) There were some administrative errors found during the UpRev process of the public documents. c) Contractor signatories are required for government-controlled documents.
Proposed Solution:
a) Provide clarity for the list of signal-in-space topics b) Clean up identified administrative changes in all public documents. c) Remove required contractor signatories from government-controlled documents.
Impacted Documents:
IS-GPS-200, IS-GPS-705, IS-GPS-800, ICD-GPS-240, ICD-GPS-870

Clean-Up and Health Bit Clarification Topics

CRM – COMBINED REVIEW STATUS

Disposition/Type	Critical	Substantive	Administrative	Totals	Concurrence
Accept	0	18	17	35	35
Accept with Change	1	6	9	16	16
Reject	0	0	1	1	1
Defer	11	19	4	34	34
Grand Totals:	12	43	31	86	86

Update: Health Bit Clarification Topic

- The Health Bit Clarification topic has expanded to include many more changes than what was presented in the initial PIRN/PCN release
- To provide proper public awareness and review time of these changes, the Health Bit Clarification topic is deferred until next year's RFC, i.e. not included as a part of this year's RFC or these PICWG slides
- Changes addressing the Health Bit Clarification topic in the initial PIRN/PCN release are reverted back
- Comments against other clean-up and clarification topics are included in the following slides

Update: Health Bit Clarification Topic

Topics to be covered in 2019:

- Addressing signal health bit ambiguity for L1, L2, and L5 in CNAV and CNAV-2
  - Refer to LNAV SV configuration so users know what codes are included for each carrier; consider adding SV configuration to CNAV and CNAV-2
  - Redefine signal health bits to carrier health bits
- Adding precedence list for signal health indicators in the navigation data to resolve potential conflicts

Update: Health Bit Clarification Topic

Items in the PIRN/PCN release are now reverted to baseline text:

[IS200-540, 30.3.3.1.1.2] The predicted health data will be updated at the time of upload when a new CEI data set has been built by the CS. ~~The health bit indication shall be given relative to the "as designed" capabilities of each SV (see paragraph 20.3.3.3.1.4).~~ The transmitted health data may not correspond to the actual health of the transmitting SV.

[IS200-598, 30.3.3.4.4] … For each health indicator, a "0" signifies that all signals on the associated frequency are okay and "1" signifies that some or all signals on the associated frequency are bad. ~~The health indication shall be given relative to the "as designed" capabilities of each SV (see paragraph 20.3.3.5.1.3).~~ The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. …

[IS705-225, 20.3.3.1.1.2] The predicted health data will be updated at the time of upload when a new CEI data set has been built by the CS. ~~The health indication shall be given relative to the "as designed" capabilities of each SV (see paragraph 20.3.3.3.1.4 of IS-GPS-200).~~ The transmitted health data may not correspond to the actual health of the transmitting SV.

[IS800-251, 3.5.4.3.4] …The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. ~~The health bit indication shall be given relative to the "as designed" capabilities of each SV (see paragraph 20.3.3.3.1.4 of IS-GPS-200).~~ The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

DOORS ID	IS200-598/IS705-299 [NEW], IS800-251		
Paragraph	IS-GPS-200: 30.3.3.4.4 IS-GPS-705: 20.3.3.4.4 IS-GPS-800: 3.5.4.3.4	**Comment Number**	75, 82, 88
Comment Type	S - Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Roger Kirpes (Rockwell Collins)		
Comment	Clarify wording that the predicted health is updated if either new reduced almanac or midi almanac upload is provided by the CS.		
Directorate Response	Since MT 37 (midi almanac) data is discussed in this paragraph, include it in the clarified wording.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS200-598:

BASELINE TEXT (WAS)	PROPOSED TEXT
The three, one-bit, health indication in bits 155, 156, and 157 of Message Type 37 and bits 29,30 and 31 of each packet of reduced almanac refers to the L1, L2, and L5 signals of the SV whose PRN number is specified in the message or in the packet. For each health indicator, a “0” signifies that all signals on the associated frequency are okay and “1” signifies that some or all signals on the associated frequency are bad. The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.	The three, one-bit, health indication in bits 155, 156, and 157 of Message Type 37 and bits 29, 30 and 31 of each packet of reduced almanac refers to the L1, L2, and L5 signals of the SV whose PRN number is specified in the message or in the packet. For each health indicator, a “0” signifies that all signals on the associated frequency are okay and “1” signifies that some or all signals on the associated frequency are bad. The predicted health data will be updated at the time of upload when a new midi almanac or reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

IS705-299 [new change]:

BASELINE TEXT (WAS)	PROPOSED TEXT
… The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.	… The predicted health data will be updated at the time of upload when a new midi almanac or reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

IS800-251:

BASELINE TEXT (WAS)	PROPOSED TEXT
… For each health indicator, a “0” signifies that all signals on the associated frequency are okay and “1” signifies that some or all signals on the associated frequency are bad. The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.	… For each health indicator, a “0” signifies that all signals on the associated frequency are okay and “1” signifies that some or all signals on the associated frequency are bad. The predicted health data will be updated at the time of upload when a new midi almanac or reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

DOORS ID	IS200-343, IS200-584		
Paragraph	20.3.3.3.3.2, 30.3.3.3.1.1.1	**Comment Number**	4, 160
Comment Type	S – Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Rhonda Slattery (Aerospace), Roger Kirpes (Rockwell Collins)		
Comment	1. This change seems to be inconsistent with the changes in [IS200-]320 that the rationale says it is now consistent with. The changes in [IS200-]320 specifically removed L2C as an option for this to apply to. This is specifically adding L2C back in. I think what you want is to leave L2P, and make L1 C/A and P, instead of just P. 2. The document provided with comment #4 suggests that the equations for correcting code phase by T_{GD} for a single frequency L1 P(Y) or L2 P(Y) user should be recast as being applicable to other single frequency users, such as L1 C/A. We disagree. This proposed change is in conflict with the L1 C/A single frequency user correction provided in IS-GPS-200 30.3.3.3.1.1.1, provided the T_{GD} values broadcast in LNAV subframe 1 and CNAV Message Type 30 are the same value.		
Directorate Response	Update single frequency L1 or L2 to be single frequency L1C/A, L1 P(Y), or L2 P(Y) because generalizing it suggests usage of other users like L2C users. This is to be consistent with the single frequency users list corrected in IS200-320 (URA). Update wording to align with the additional IS-GPS-200 30.3.3.3.1.1.1 text that calls for a more accurate code phase correction.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS200-343: PIRN Text (IS):

The L1 and L2 correction term, T_{GD}, is initially calculated by the CS to account for the effect of SV group delay differential between L1 P(Y) and L2 P(Y) based on measurements made by the SV contractor during SV manufacture. The value of T_{GD} for each SV may be subsequently updated to reflect the actual on-orbit group delay differential. This correction term is only for the benefit of "single-frequency" (L1 or L2) users; it is necessitated by the fact that the SV clock offset estimates reflected in the a_{f0} clock correction coefficient (see paragraph 20.3.3.3.3.1) are based on the effective PRN code phase as apparent with two frequency (L1 P(Y) and L2 P(Y)) ionospheric corrections. Thus, the user who utilizes the L1 signal only shall modify the code phase offset in accordance with paragraph 20.3.3.3.3.1 with the equation

$$(\Delta t_{SV})_{L1} = \Delta t_{SV} - T_{GD}$$

where T_{GD} is provided to the user as subframe 1 data. For the user who utilizes L2 only, the code phase modification is given by

$$(\Delta t_{SV})_{L2} = \Delta t_{SV} - \gamma T_{GD}$$

where, denoting the nominal center frequencies of L1 and L2 as f_{L1} and f_{L2} respectively,

$$\gamma = (f_{L1}/f_{L2})^2 = (1575.42/1227.6)^2 = (77/60)^2.$$

IS200-343: Proposed Text:

The L1 and L2 correction term, T_{GD}, is initially calculated by the CS to account for the effect of SV group delay differential between L1 P(Y) and L2 P(Y) based on measurements made by the SV contractor during SV manufacture. The value of T_{GD} for each SV may be subsequently updated to reflect the actual on-orbit group delay differential. This correction term is only for the benefit of "single-frequency" (L1 C/A, L1 P(Y) or L2 P(Y)) users; it is necessitated by the fact that the SV clock offset estimates reflected in the a_{f0} clock correction coefficient (see paragraph 20.3.3.3.3.1) are based on the effective PRN code phase as apparent with ~~two~~ dual-frequency (L1 P(Y) and L2 P(Y)) ionospheric corrections. Thus, the user who utilizes the L1 C/A ~~P(Y)~~ signal only shall modify the code phase offset in accordance with paragraph 20.3.3.3.3.1 with the equation

$$(\Delta t_{SV})_{L1\ C/A\sout{P(Y)}} = \Delta t_{SV} - T_{GD}$$

where T_{GD} is provided to the user as subframe 1 data. For the user who utilizes L1 P(Y) only, the code phase modification is given by

$$(\Delta t_{SV})_{L1\ P(Y)} = \Delta t_{SV} - T_{GD}$$

PICWG comment to specify L2 P(Y) here

For the user who utilizes L2 P(Y) only, the code phase modification is given by

$$(\Delta t_{SV})_{L2\ P(Y)} = \Delta t_{SV} - \gamma T_{GD}$$

where, denoting the nominal center frequencies of L1 and L2 as f_{L1} and f_{L2} respectively,

$$\gamma = (f_{L1}/f_{L2})^2 = (1575.42/1227.6)^2 = (77/60)^2.$$

IS200-584 [added to RFC]: Proposed Text (IS):

The correction terms, T_{GD}, $ISC_{L1C/A}$ and ISC_{L2C}, are initially provided by the CS to account for the effect of inter-signal biases between L1 P(Y) and L2 P(Y), L1 P(Y) and L1 C/A, and between L1 P(Y) and L2C, respectively, based on measurements made by the SV contractor during SV manufacture. The values of T_{GD} and ISCs for each SV may be subsequently updated to reflect the actual on-orbit group delay differential. For maximum accuracy, the single frequency L1 C/A user must use the correction terms to make further modifications to the code phase offset in paragraph 20.3.3.3.~~1~~2 with the equation:

$$(\Delta t_{SV})_{L1C/A} = \Delta t_{SV} - T_{GD} + ISC_{L1C/A}$$

where T_{GD} (see paragraph 20.3.3.3.3.2) and $ISC_{L1C/A}$ are provided to the user as Message Type 30 data, described in paragraph 30.3.3.3.1.1. For the single frequency L2C user, the code phase offset modification is given by:

$$(\Delta t_{SV})_{L2C} = \Delta t_{SV} - T_{GD} + ISC_{L2C}$$

where, ISC_{L2C} is provided to the user as Message Type 30 data.

…

DOORS ID	IS200-576		
Paragraph	30.3.3.2.4	**Comment Number**	5, 161
Comment Type	S – Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Rhonda Slattery (Aerospace), Roger Kirpes (Rockwell Collins)		
Comment	1. How does this apply to single frequency C/A users? Where are they getting the CNAV messages? I think, following your rationale in IS200-320, this should just be L2C and L1 C/A and L2C dual frequency users who use CNAV. Dual frequency users who use LNAV basically aren't covered by either. Am I misinterpreting this clarification? 2. The document provided with comment #4 suggests changes to IS-GPS-200 30.3.3.2.4 generalizing applicability of statements to any L1 signal dual frequency user with L2C. However, the reference paragraph, 30.3.3.3.1.1.2, is only applicable to the L1 C/A and L2C dual frequency user.		
Directorate Response	Updated the text to be consistent with changes elsewhere: no single frequency L1C/A user can acquire CNAV. Dual frequency users: should specify L1 C/A and L2C so users won't be confused with using L2 P(Y) and L1 (any).		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS200-576:

PIRN TEXT (IS)	PROPOSED TEXT
… URA_{NED0} accounts for zeroth order SIS-contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A or single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1/L2 users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects. …	… URA_{NED0} accounts for zeroth order SIS-contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency ~~L1C/A or single-frequency~~ L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A and~~/~~L2C users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects. …

DOORS ID	IS705-265		
Paragraph	20.3.3.1.1.4	**Comment Number**	6, 162
Comment Type	S – Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Rhonda Slattery (Aerospace), Roger Kirpes (Rockwell Collins)		
Comment	1. Why are we not changing [IS-GPS-705] to be parallel to IS200-320? Add CNAV as needed. 2. The document provided with comment #6 suggests changes to IS-GPS-705 20.3.3.2.4 generalizing applicability of statements to any L1 signal or L2 signal dual frequency user with L5. However, the reference paragraph, 20.3.3.3.1.2, is only applicable to the L1 C/A and L2C dual frequency user with L5.		
Directorate Response	Updated the text to be consistent with IS-GPS-200 changes. In addition, specified L1 C/A and L5 and L2C and L5 dual-frequency users to align with the reference paragraphs mentioned.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS705-265 [new change]:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
… URA_{NED0} accounts for zeroth order SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1/L2/L5 users who correct the code phase as described in Section 20.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1/L2 and L1/L5 users who correct for group delay and ionospheric effects as described in Section 20.3.3.3.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects. …	N/A	… URA_{NED0} accounts for zeroth order SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency ~~L1/L2/~~L5 users who correct the code phase as described in Section 20.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1C/A/L~~2~~5 and L~~1~~2C/L5 users who correct for group delay and ionospheric effects as described in Section 20.3.3.3.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects. …

DOORS ID	IS800-193 [NEW], IS705-265 [NEW]		
Paragraph	3.5.3.8.0-6, 20.3.3.2.4.0-6	**Comment Number**	9
Comment Type	S – Substantive	**Disposition**	***Accept***
Comment Originator(s)	Rhonda Slattery (Aerospace)		
Comment	Not exactly sure what to do with these, but it seems, to be parallel to the changes in 200, we need to clarify that these are dual frequency L1C-L2/L5, not any other signals.		
Directorate Response	Due to URA clarifications made in IS-GPS-200, additional clarification is needed in IS-GPS-800 to be consistent with IS-GPS-200 changes. In this case, single-frequency users reading this section would only be single-frequency L1C users (for CNAV-2), not L1C/A. Dual frequency users who utilize CNAV-2 need to be specified too: L1/L2 and L1/L5 to L1C/L2 and L1C/L5.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
See following slides	See following slides	See following slides

IS800-193 [new change]:

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
… URA_{NED0} accounts for zeroth order SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A or single-frequency L2C users who correct the code phase as described in Section 3.5.3.9; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1/L2 and L1/L5 users who correct for group delay and ionospheric effects as described in Section 3.5.3.9; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.	N/A	… URA_{NED0} accounts for zeroth order SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C~~/A or single-frequency L2C~~ users who correct the code phase as described in Section 3.5.3.9; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency ~~L1~~L1C/L2C and ~~L1~~L1C/L5 users who correct for group delay and ionospheric effects as described in Section 3.5.3.9; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

DOORS ID	IS200-147, IS200-337, IS200-340, IS200-343, IS200-346, IS200-447, IS200-586, IS200-588, IS705-280, IS705-281, IS705-283, IS705-284, IS705-286, IS800-202, IS800-205, IS800-206, IS800-207, IS800-208, IS800-226		
Paragraph	IS-GPS-200: 3.3.4, 20.3.3.3.3., 20.3.3.3.3.1, 20.3.3.3.3.2, 20.3.3.3.3.3, 20.3.3.5.2.5, 30.3.3.3.1.1.2, 30.3.3.3.1.2 IS-GPS-705: 20.3.3.3.1.2.2, 20.3.3.3.1.2.3, 20.3.3.3.1.3 IS-GPS-800: 3.5.3.9.2, 3.5.3.9.3, 3.5.4.1.2	**Comment Number**	10
Comment Type	S – Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Rhonda Slattery (Aerospace)		
Comment	The terms dual frequency and two frequency are both used. Are these interchangeable? Is there a distinction that isn't defined?		
Directorate Response	7/23/2018: Update one frequency to single-frequency and two frequency to dual-frequency to be consistent with the GPS SPS PS.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
"…one frequency…" "…two frequency…"	N/A	"…~~one~~single-frequency…" "…~~two~~dual-frequency…"

DOORS ID	IS200-1282		
Paragraph	6.3.6.2.1	**Comment Number**	117
Comment Type	S - Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Anne Kastenholz (Boeing)		
Comment	The asterisk in the "Initial G2 Setting (Octal)" column doesn't appear to be related to the footnote denoted by the asterisk. Consider removing the asterisk from this column.		
Directorate Response	The note says that the octal notation includes that for "the initial settings as shown in this table". That points to the initial G2 settings. Update “initial settings” in the note to “initial G2 settings” to be clear to the reader of the document.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

PIRN Text (IS):

IS200-1282:

Initial G2 Setting (Octal)*

First 10 Chips (Octal)*±

PICWG comment
to change “initial settings”
to “initial G2 settings”

Disposition: Reject → Accept with Comments

Table 6-I Additional C/A-/P-Code Phase Assignments (sheet 1 of 5)

PRN Signal No.	C/A G2 Delay (Chips)	C/A Initial G2 Setting (Octal)*	C/A First 10 Chips (Octal)*±	P X2 Delay (Chips)	P P-code Relative Advance (Hours) **	P First 12 Chips (Octal)
64	729	0254	1523	27	$P_{27}(t+24)$	5112
65	695	1602	0175	28	$P_{28}(t+24)$	0667
66	780	1160	0617	29	$P_{29}(t+24)$	6111
				30	$P_{30}(t+24)$	5266
				31	$P_{31}(t+24)$	4711
				32	$P_{32}(t+24)$	0166
				33	$P_{33}(t+24)$	6251
				34	$P_{34}(t+24)$	5306
				35	$P_{35}(t+24)$	0761
				36	$P_{36}(t+24)$	6152
				37	$P_{37}(t+24)$	1247
				1	$P_{1}(t+48)$	1736
				2	$P_{2}(t+48)$	2575
				3	$P_{3}(t+48)$	3054
				4	$P_{4}(t+48)$	3604
				5	$P_{5}(t+48)$	7520
				6	$P_{6}(t+48)$	5472
94	814	1550	0227	20	$P_{20}(t+48)$	3777
95	446	1234	0543	21	$P_{21}(t+48)$	3555

* In the octal notation for the first 10 chips of the C/A-code or the initial settings as shown in this table, the first digit (1/0) represents a “1” or “0”, respectively, for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A-code for PRN Signal Assembly No. 64 are: 1101010011).

** $P_i(t+N)$: P-code sequence of PRN number i shifted by N hours. See Section 6.3.6.2.1.

NOTE: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

* In the octal notation for the first 10 chips of the C/A-code or the initial settings as shown in this table, the first digit (1/0) represents a "1" or “0”, respectively, for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A-code for PRN Signal Assembly No. 64 are: 1101010011).

** $P_i(t+N)$: P-code sequence of PRN number i shifted by N hours. See Section 6.3.6.2.1.

Proposed Text:
No change to (IS)

DOORS ID	Global (PIRNs/PCNs)		
Paragraph	N/A	**Comment Number**	15
Comment Type	S – Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Steven Brown (Lockheed Martin)		
Comment	Only Gov't has the DOORS break down…makes it impossible to know where to add the new objects		
Directorate Response	Additionally: for inserted objects, add context by showing the object text that comes before that new object The government understands that the public does not utilize DOORS. The IDs are left in the PIRNs/PCNs to uniquely identify what objects to look at when reviewing the CRMs. The section numbers indicate where in the document the objects are added.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	N/A	N/A

Example

ICD240-336 :

Insertion after ICD240-91, ICD240-92, ICD240-93, ICD240-94, ICD240-95:

Context added for insertions

"NANUs are used to notify users of scheduled and unscheduled satellite outages and general GPS information. The paragraphs that follow describe the different types of NANUs. The NANU descriptions are arranged into four groups, as follows:

- Scheduled outages
- Unscheduled outages
- General text message
- Others

"

Section Number :
10.1.0-6

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change. The NANU examples include POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information.

DOORS ID	ICD870-651 [Added to RFC]		
Paragraph	3.1	**Comment Number**	46
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	GPS Information Products are not posted to the USCG NIS. The USCG NIS is the Coast Guard Navigation Information Service as described on page 2 of this document, it is not a website or portal. It is a 24-hour business helpdesk.		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
The USCG provides a Portal accessible from the public Internet to allow users, with a standard web browser, to discover and retrieve publicly releasable GPS products.	The USCG provides a ~~Portal~~webpage accessible from the public Internet to allow users, with a standard web browser, to discover and retrieve publicly releasable GPS products.

DOORS ID	ICD870-652 [Added to RFC]		
Paragraph	3.1	**Comment Number**	47
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The USCG does not provide a Portal, we provide a .gov webpage accessible to the public. The portal we created was intended to allow the Control Station to upload products, or allow for automated upload, it was never intended for internet users.		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
Figure 3-1 depicts a generalized GPS Product Distribution Process which begins with a ***End-User*** interacting with a GPS Product redistribution node (e.g., USCG NIS) to retrieve the desired GPS Products. The diagram reflects that a ***potential data Corruption Source*** actor may introduce data corruption at any time during this re-distribution process. The GPS Product End-User may then validate and/or transform the Information Product before use in a Processing System. The roles of ***Potential Data Corruption Source*** and ***GPS Product End-User*** may be performed by the same or by different individuals.	Figure 3-1 depicts a generalized GPS Product Distribution Process which begins with a ***End-User*** interacting with a GPS Product redistribution node ~~(e.g., USCG NIS)~~ to retrieve the desired GPS Products. The diagram reflects that a ***potential data Corruption Source*** actor may introduce data corruption at any time during this re-distribution process. The GPS Product End-User may then validate and/or transform the Information Product before use in a Processing System. The roles of ***Potential Data Corruption Source*** and ***GPS Product End-User*** may be performed by the same or by different individuals.

DOORS ID	ICD870-665 [Added to RFC]		
Paragraph	3.1	**Comment Number**	48
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The NAVCEN website belongs to NAVCEN, not to the Navigation Information Service (NIS)		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
Appendices 1-5 of this ICD documents the minimum information content and formats which are required to achieve backward compatibility compliance. The GPS Ontology including Transition and Support Products will be published in the USCG NIS web site, currently http://www.navcen.uscg.gov.	Appendices 1-5 of this ICD documents the minimum information content and formats which are required to achieve backward compatibility compliance. The GPS Ontology including Transition and Support Products will be published in the USCG ~~NIS~~Navigation ~~web~~Center ~~site~~website, currently https://www.navcen.uscg.gov.

DOORS ID	ICD870-55 [Added to RFC]		
Paragraph	3.2.5	**Comment Number**	49
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The USCG does not provide a Portal, we provide a .gov webpage accessible to the public.		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
The USCG provides a Portal accessible from the public Internet to allow users, with a standard web browser, to discover and retrieve publicly releasable GPS products.	The USCG provides a ~~Portal~~webpage accessible from the public Internet to allow users, with a standard web browser, to discover and retrieve publicly releasable GPS products.

DOORS ID	ICD870-719 [Added to RFC]		
Paragraph	3.2.5	**Comment Number**	50
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The diagram depicts "USCG NAVCEN", which is correct, the description says "NAVCEN Information System (NIS)" which is incorrect. The NAVCEN NIS is not a System, it is a Service.		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
As shown in Figure 3-6, the NAVCEN Information System (NIS) is the distribution point for authoritative GPS Products disseminated to the public. The NAVCEN receives these products from the GPS Control Segment (OCX) and the GPS community (led by the Air Force GPS Program Office). The GPS products consist of regularly published operational GPS information products (see Table 3-I) as well as Transition and Support Products (see Table 3-III).	As shown in Figure 3-6, the NAVCEN ~~Information System (NIS)~~ is the distribution point for authoritative GPS Products disseminated to the public. The NAVCEN receives these products from the GPS Control Segment (OCX) and the GPS community (led by the Air Force GPS Program Office). The GPS products consist of regularly published operational GPS information products (see Table 3-I) as well as Transition and Support Products (see Table 3-III).

DOORS ID	ICD870-701 [Added to RFC]		
Paragraph	3.3	**Comment Number**	51
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The website belongs to USCG NAVCEN, not the USCG NIS		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
[excerpt] As shown in Figure 3-2, the steps for a user to verify the data integrity where the user has an application which directly processes ASCII text file formats: 1. Download the desired Information Product and associated IEPD (see Table 3-III) from USCG NIS web site or an alternate redistribution site. Note: Because the IEPD for an Information Product will change very infrequently, this step could be performed once for a new IEPD revision and then reused repeatedly without downloading again. …	[excerpt] As shown in Figure 3-2, the steps for a user to verify the data integrity where the user has an application which directly processes ASCII text file formats: 1. Download the desired Information Product and associated IEPD (see Table 3-III) from USCG ~~NIS web~~NAVCEN ~~site~~website or an alternate redistribution site. Note: Because the IEPD for an Information Product will change very infrequently, this step could be performed once for a new IEPD revision and then reused repeatedly without downloading again. …

DOORS ID	ICD870-702 [Added to RFC]		
Paragraph	3.3	**Comment Number**	52
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The website belongs to USCG NAVCEN, not the USCG NIS		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
[excerpt] As shown in Figure 3-2, the steps for a user to verify the data integrity where the user has a modern application which directly processes CS native XML formats; 1. Download the desired Information Product (see Table 3-III) from the USCG NIS web site. …	[excerpt] As shown in Figure 3-2, the steps for a user to verify the data integrity where the user has a modern application which directly processes CS native XML formats; 1. Download the desired Information Product (see Table 3-III) from the USCG ~~NIS web~~NAVCEN ~~site~~website. …

DOORS ID	ICD870-68 [Added to RFC]		
Paragraph	3.3	**Comment Number**	53
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The website belongs to USCG NAVCEN, not the USCG NIS		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
The GPS CS unclassified certificate (and corresponding CS public key) will be made available to all consumers for data integrity verification via the USCG NIS web site.	The GPS CS unclassified certificate (and corresponding CS public key) will be made available to all consumers for data integrity verification via the USCG ~~NIS web~~NAVCEN ~~site~~website.

DOORS ID	ICD870-704 [Added to RFC]		
Paragraph	3.3	**Comment Number**	54
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The USCG does not provide a Portal, we provide a .gov webpage accessible to the public. The portal we created was intended to allow the CS to upload products, or allow for automated upload, it was never intended for internet users.		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
The USCG Portal will make the standalone offline Validate and Transform utility available on the public Internet.	The USCG ~~Portal~~NAVCEN will make the standalone offline Validate and Transform utility available on the public Internet.

DOORS ID	ICD870-716 [Added to RFC]		
Paragraph	3.3	**Comment Number**	55
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	The website belongs to USCG NAVCEN, not the USCG NIS		
Directorate Response	Agree.		

BASELINE TEXT (WAS)	**PROPOSED TEXT**
User platform requirements for running the Validate and Transform Utility will be described on the USCG NIS website. The Utility will be digitally signed and users should validate the Authenticity of the certificate during installation.	User platform requirements for running the Validate and Transform Utility will be described on the USCG ~~NIS~~NAVCEN website. The Utility will be digitally signed and users should validate the Authenticity of the certificate during installation.

DOORS ID	ICD-GPS-870		
Paragraph	Sections 10, 20, 30, & 40	**Comment Number**	57, 59, 61, 64
Comment Type	S - Substantive	**Disposition**	***Defer***
Comment Originator(s)	CWO Rebecca Ruch (USCG NAVCEN)		
Comment	Appendix explains the NANU Data format/OA Data file/SOF Data file/Almanac Data files, but it will no longer be called a NANU/OA/SOF/SEM & YUMA almanacs. Table 3-I it describes the GPS Advisory/Ops Status/GPS Advisory Collection/Public Common Almanac and references the Legacy types. Shouldn't all sections be updated to define the new names? This is applicable to all of 10/20/30/40 Appendix 1/2/3/4		
Directorate Response	Table 3-I specifies the new GPS products. In discussion with contractor: found that the sample files in the sections are consistent with the legacy format and will be provided by the GPS community. Keyword renaming may be needed, but any changes related to this topic will be tracked as a new concern as this change is out of scope of the RFC.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
N/A	N/A	N/A

DOORS ID	ICD-GPS-240		
Paragraph	General	**Comment Number**	22
Comment Type	S - Substantive	**Disposition**	***Defer***
Comment Originator(s)	Kanwaljit Sandhoo (MITRE)		
Comment	Concur with the changes. However, there are some concerns about ensuring the support for dual frequency and backward compatibility operations. Removing the redundancies and simplifying the access to the information will lead to safer operations. The FAA expects 24 SVs in the GPS constellation with L5 signal by 2028. There is no operational concept for civil aviation dual frequency operations prior to achieving the full operational capability (FOC). However, other civil users may be able to use the mixed constellation of less than 24 SVs with L5 signal for dual frequency operations. This RFC does not address the operational advisories for dual frequency operations using various code-pairs (like L1C/A & L5, L1C & L5, L1C & L2C). Therefore, our recommendation is to update ICD 240B with the operational advisory for the dual frequency operations.		
Directorate Response	Outside of scope of current RFC. Will be tracked as a new concern.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
N/A	N/A	N/A

DOORS ID	IS-GPS-200, IS-GPS-705, IS-GPS-800		
Paragraph	General	**Comment Number**	25
Comment Type	S - Substantive	**Disposition**	***Defer***
Comment Originator(s)	Kanwaljit Sandhoo (MITRE)		
Comment	DOT Comment: It might be helpful for the civil GPS user community, if each satellite could broadcast the actual received carrier power values under the ICD/IS assumptions (e.g., to allow computation of expected C/N_0 at a 5° elevation angle) for each of the civil signal components.		
Directorate Response	Outside of scope of current RFC. Will be tracked as a new concern.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	N/A	N/A

DOORS ID	IS-GPS-200		
Paragraph	General Acronym list: 6.1	**Comment Number**	158
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	Roger Kirpes (Rockwell Collins)		
Comment	"LNAV" data is used when referring to D(t) rather then the generic term "NAV" data. This illustrates that this is a distinction which has only partially been made in this document, but should be made everywhere.		
Directorate Response	Update instances of NAV data that refer to legacy navigation accordingly for consistency and distinction between Legacy Navigation (LNAV) and Civil Navigation (CNAV). Also include “LNAV – Legacy Navigation” in the acronym list.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
[multiple locations] NAV	N/A	[multiple locations] LNAV Acronym list [IS200-1488]: LNAV – Legacy Navigation

DOORS ID	IS-GPS-705		
Paragraph	20.3.3	**Comment Number**	172
Comment Type	S - Substantive	**Disposition**	***Accept with Comments***
Comment Originator(s)	Denis Bouvet (Thales)		
Comment	Section 6.4.3 refers to IS-GPS-200, explaining that PRN 37 is reserved for SATZAP procedures. Does it mean that the SATZAP procedure will be also applicable to L5 signals? If so, can you clarify in section 20.3.3 of IS-GPS-705 whether the PRN number is set to 37 when the SATZAP procedure is activated for the faulty satellite?		
Directorate Response	Confirmed that this is the case for L5 as well. No change is needed. IS-GPS-705 readers should refer to 6.4.3 of IS-GPS-200 and is sufficient.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
IS-GPS-705: **6.4.3 PRNs 33 and 37** See IS-GPS-200. IS-GPS-200: **6.4.3 PRNs 33 and 37** PRN 33 should not be used by satellites because of its prior use in specialized ground applications. PRN 37 should not be used by satellites until after PRN 37 is no longer needed for SATZAP purposes.	N/A	*[No change]*

DOORS ID	IS800-115, IS800-875		
Paragraph	3.2.3.5, 3.5.2	**Comment Number**	155
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	Lt Col Blair Thompson, Lt Col Steven Lewis, Lt Col Steven Brown, CMSgt Todd Scott (Reserve National Security Space Institute (RNSSI), Advanced Navigation Operations Course Instructors)		
Comment	These pages have figures that are not legible		
Directorate Response	Updated for legibility.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS800-115 [added to RFC]: *Baseline Text (WAS):*

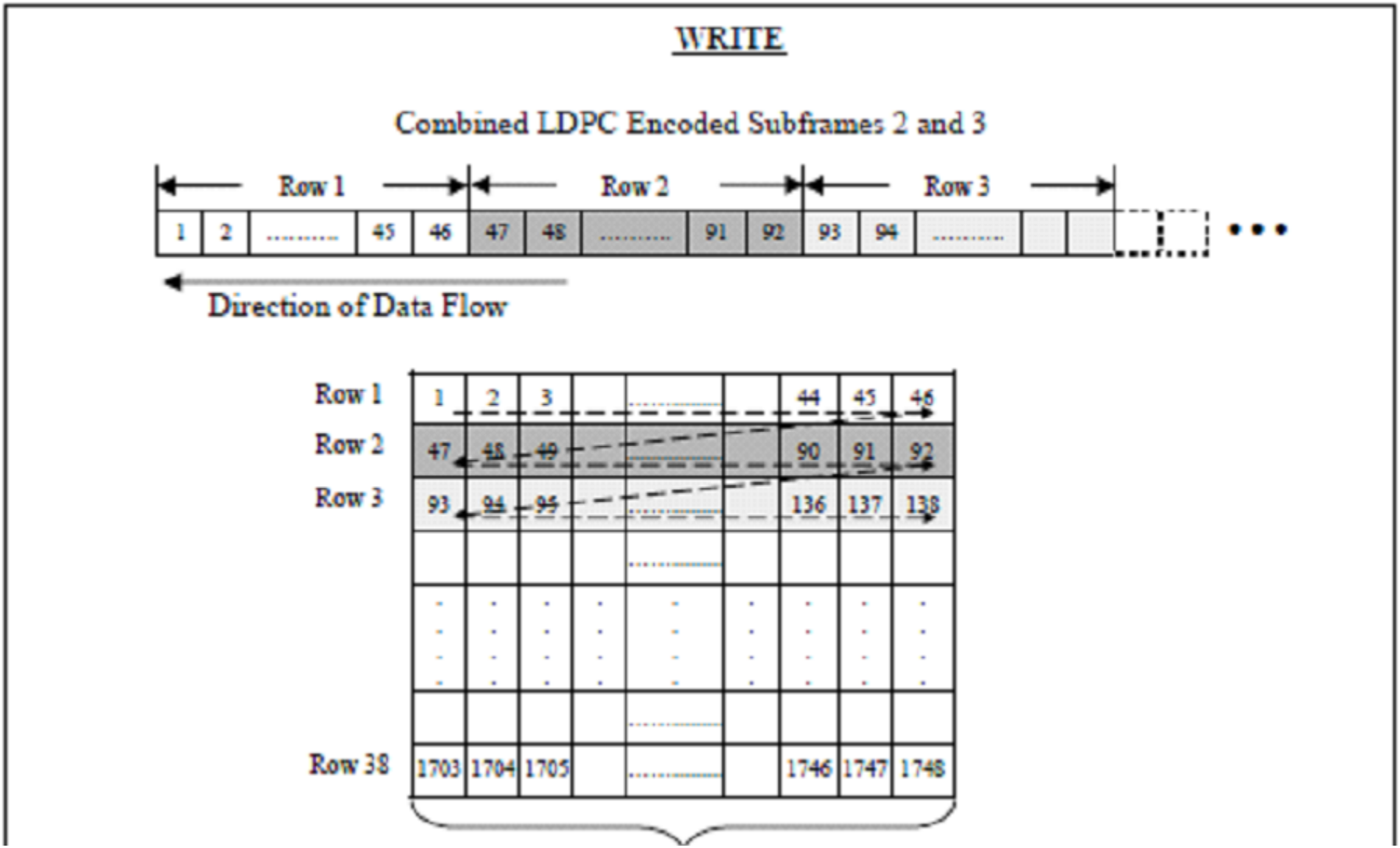


Figure 3.2-6. Conceptual Block Interleaver

IS800-115 [added to RFC]:

Proposed Text:

WRITE

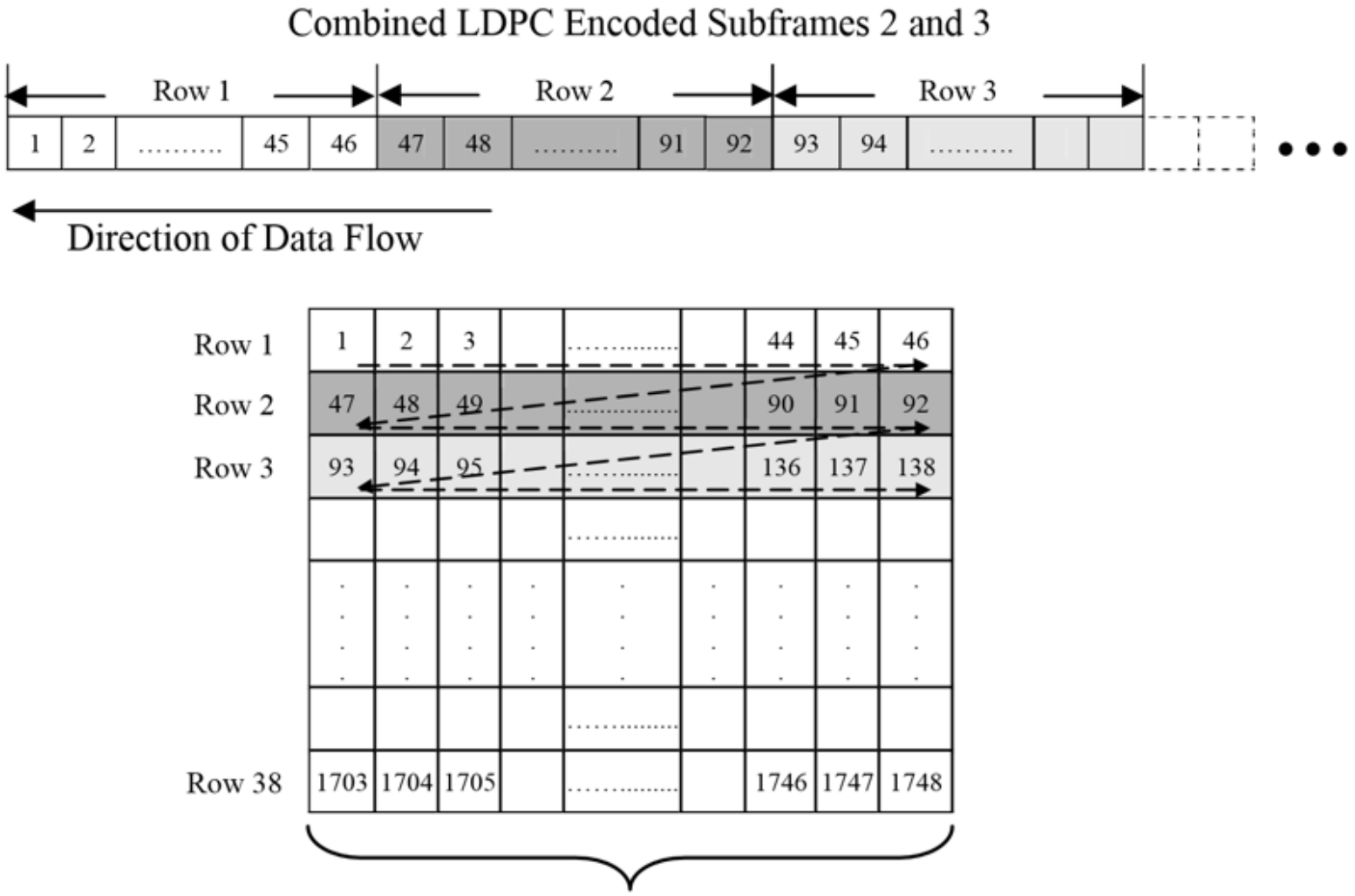


Figure 3.2-6. Conceptual Block Interleaver

IS800-875: Baseline Text (WAS):

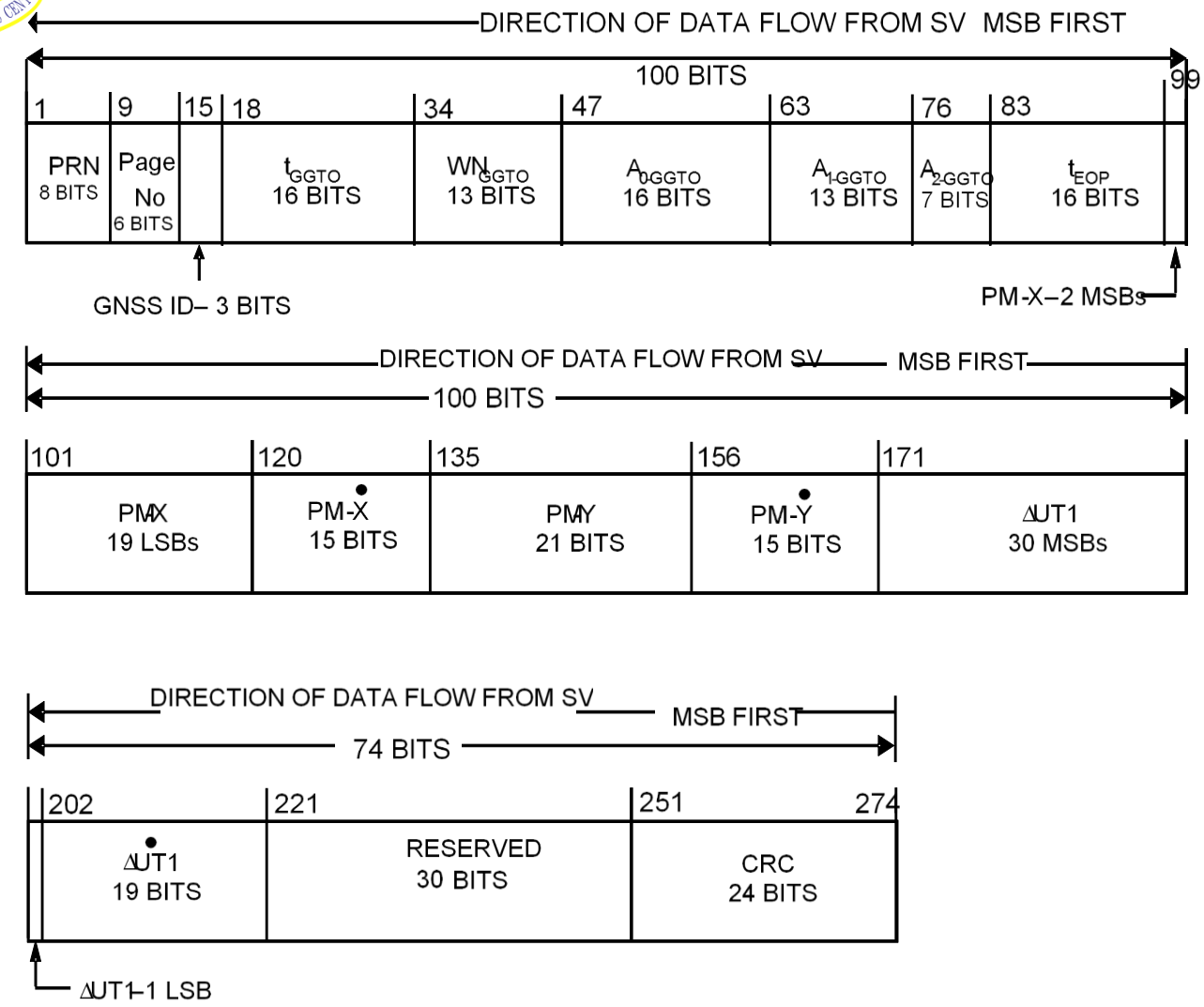


Figure 3.5-3 Subframe 3, Page 2

IS800-875:

Proposed Text:

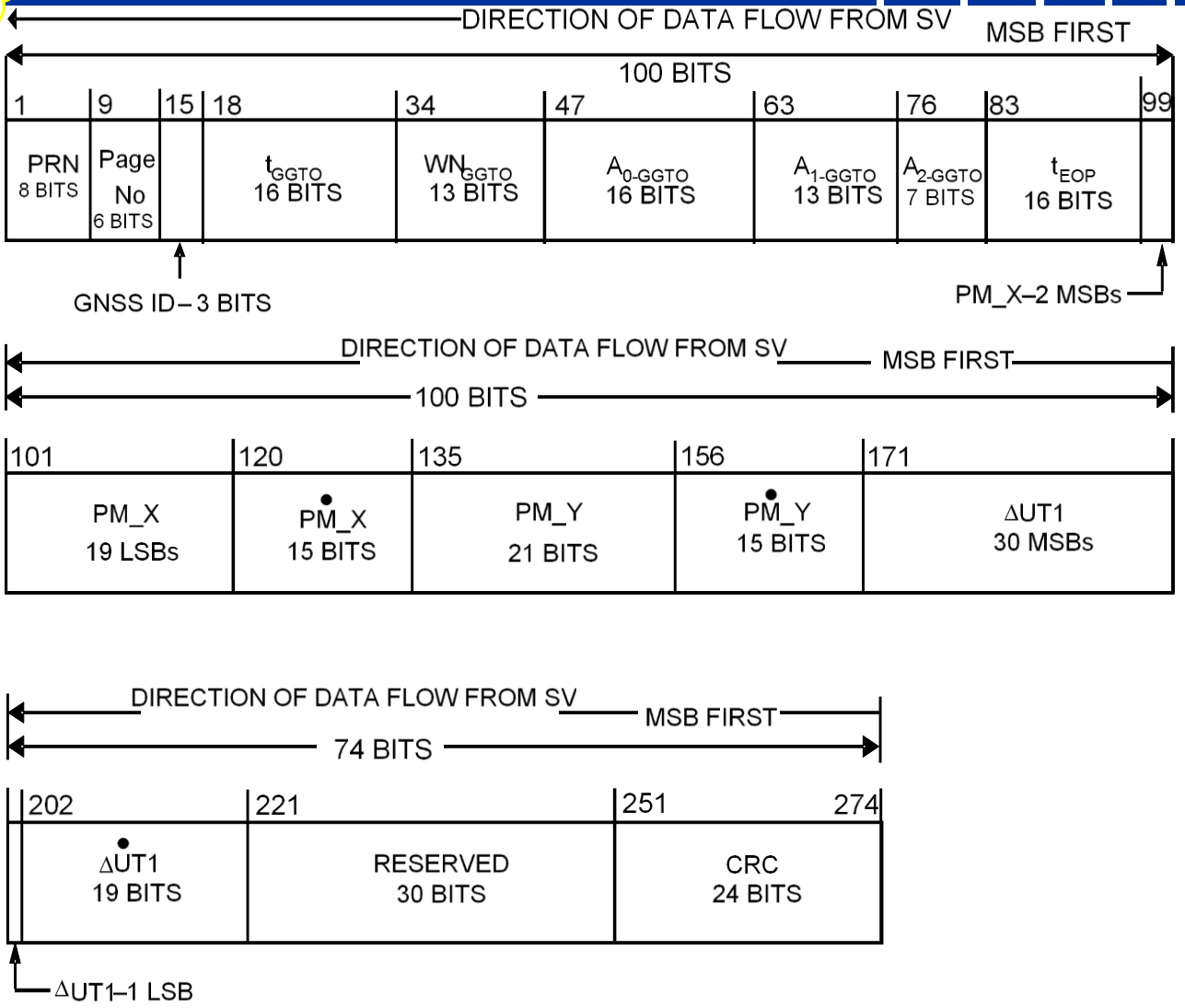


Figure 3.5-3 Subframe 3, Page 2

DOORS ID	IS200-552, Table 30-I		
Paragraph	30.3.3.1.3	**Comment Number**	156
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	Lt Col Blair Thompson, Lt Col Steven Lewis, Lt Col Steven Brown, CMSgt Todd Scott (RNSSI)		
Comment	This table has an alignment problem. It almost looks as if URAed is 3 bits, and not the 5 it should be.		
Directorate Response	Updated for legibility.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS200-552 [added to RFC]: *Baseline Text (WAS):*

Table 30-I. Message Types 10 and 11 Parameters (1 of 2)

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
WN	Data Sequence Propagation Week Number	13	1		weeks
URA_{ED} Index	ED Accuracy Index	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	CEI Data sequence propagation time of week	11	300	0 to 604,500	seconds
ΔA ****	Semi-major axis difference at reference time	26*	2^{-9}		meters
$\dot{A}$	Change rate in semi-major axis	25*	2^{-21}		meters/sec
Δn_0	Mean Motion difference from computed value at reference time	17*	2^{-44}		semi-circles/sec
$\Delta \dot{n}_0$	Rate of mean motion difference from computed value	23*	2^{-57}		semi-circles/sec^2
$M_{0\text{-}n}$	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.0 to 0.03	dimensionless
ω_n	Argument of perigee	33*	2^{-32}		semi-circles

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;
** See Figure 30-1 for complete bit allocation in Message Type 10;
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.
**** Relative to A_{REF} = 26,559,710 meters.

IS200-552 [added to RFC]:

Proposed Text:

Table 30-I. Message Types 10 and 11 Parameters (1 of 2)

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
WN	Data Sequence Propagation Week Number	13	1		weeks
URA_{ED} Index	ED Accuracy Index	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	CEI Data sequence propagation time of week	11	300	0 to 604,500	seconds
ΔA ****	Semi-major axis difference at reference time	26*	2^{-9}		meters
$\dot{A}$	Change rate in semi-major axis	25*	2^{-21}		meters/sec
Δn_0	Mean Motion difference from computed value at reference time	17*	2^{-44}		semi-circles/sec
$\Delta \dot{n}_0$	Rate of mean motion difference from computed value	23*	2^{-57}		semi-circles/sec^2
$M_{0\text{-}n}$	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.0 to 0.03	dimensionless
ω_n	Argument of perigee	33*	2^{-32}		semi-circles

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 30-1 for complete bit allocation in Message Type 10;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

**** Relative to A_{REF} = 26,559,710 meters.

DOORS ID	IS800-159, Table 3.5-1		
Paragraph	3.5.3	**Comment Number**	157
Comment Type	S - Substantive	**Disposition**	***Accept***
Comment Originator(s)	Lt Col Blair Thompson, Lt Col Steven Lewis, Lt Col Steven Brown, CMSgt Todd Scott (RNSSI)		
Comment	This table has an alignment problem. ITOW is misaligned		
Directorate Response	Updated for legibility.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS800-159: Baseline Text (WAS):

Table 3.5-1. Subframe 2 Parameters (1 of 3)

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
WN	Data Sequence Propagation Week Number	13	1		weeks
ITOW	Interval time of week	8		0 to 83	(see text)
t_{op}	CEI Data sequence propagation time of week	11	300	0 to 604,500	seconds
L1C health		1			(see text)
URA_{ED} Index	ED accuracy index	5*			(see text)
t_{oe}	Ephemeris/clock data reference time of week	11	300	0 to 604,500	seconds
ΔA ****	Semi-major axis difference at reference time	26*	2^{-9}		meters
$\dot{A}$	Change rate in semi-major axis	25*	2^{-21}		meters/sec
Δn_0	Mean Motion difference from computed value at reference time	17*	2^{-44}		semi-circles/sec
$\Delta \dot{n}_0$	Rate of mean motion difference from computed value	23*	2^{-57}		semi-circles/sec^2
$M_{0\text{-}n}$	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.0 to 0.03	dimensionless
ω_n	Argument of perigee	33*	2^{-32}		semi-circles

* Parameters so indicated are in two's complement notation;
** See Figure 3.5-1 for complete bit allocation in Subframe 2;
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.
**** Relative to A_{REF} = 26,559,710 meters.

IS800-159: Proposed Text:

Table 3.5-1. Subframe 2 Parameters (1 of 3)

Parameter		No. of Bits**	Scale Factor (LSB)	~~Effective~~Valid Range***	Units
WN	Data Sequence Propagation Week Number	13	1		weeks
ITOW	Interval time of week	8		0 to 83	(see text)
t_{op}	CEI Data sequence propagation time of week	11	300	0 to 604,500	seconds
L1C health		1			(see text)
URA_{ED} Index	ED accuracy index	5*			(see text)
t_{oe}	Ephemeris/clock data reference time of week	11	300	0 to 604,500	seconds
ΔA ****	Semi-major axis difference at reference time	26*	2^{-9}		meters
$\dot{A}$	Change rate in semi-major axis	25*	2^{-21}		meters/sec
Δn_0	Mean Motion difference from computed value at reference time	17*	2^{-44}		semi-circles/sec
$\Delta \dot{n}_0$	Rate of mean motion difference from computed value	23*	2^{-57}		semi-circles/sec^2
$M_{0\text{-}n}$	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.0 to 0.03	dimensionless
ω_n	Argument of perigee	33*	2^{-32}		semi-circles

* Parameters so indicated are in two's complement notation;
** See Figure 3.5-1 for complete bit allocation in Subframe 2;
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.
**** Relative to A_{REF} = 26,559,710 meters.

DOORS ID	IS-GPS-200, IS-GPS-705, IS-GPS-800		
Paragraph	IS200: Table 20-IV and Table 30-II IS705: Table 20-II IS800: Table 3.5-2	**Comment Number**	152
Comment Type	A – Administrative	**Disposition**	***Reject***
Comment Originator(s)	Lt Col Blair Thompson, Lt Col Steven Lewis, Lt Col Steven Brown, CMSgt Todd Scott (RNSSI)		
Comment	The tables currently do not have a title. Adding the title "Broadcast Navigation User Equations" reduces ambiguity.		
Directorate Response	Tables are currently titled "Elements of Coordinate System."		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

Context (IS-GPS-200)

Table 20-IV. Elements of Coordinate Systems (sheet 1 of 2)

$\mu = 3.986005 \times 10^{14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A = \left(\sqrt{A}\right)^2$	Semi-major axis
$n_0 = \sqrt{\frac{\mu}{A^3}}$	Computed mean motion (rad/sec)
$t_k = t - t_{oe}$*	Time from ephemeris reference epoch
$n = n_0 + \Delta n$	Corrected mean motion
$M_k = M_0 + nt_k$	Mean anomaly
$M_k = E_k - e \sin E_k$	Kepler's Equation for Eccentric Anomaly (may be solved by iteration) (radians)
$\nu_k = \tan^{-1}\left\{\frac{\sin \nu_k}{\cos \nu_k}\right\}$	True Anomaly
$= \tan^{-1}\left\{\frac{\sqrt{1-e^2}\sin E_k / (1 - e\cos E_k)}{(\cos E_k - e)/(1 - e\cos E_k)}\right\}$	

* t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total time difference between the time t and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is, if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.

DOORS ID	IS-GPS-200, IS-GPS-705, IS-GPS-800		
Paragraph	IS200: Table 20-IV and Table 30-II IS705: Table 20-II IS800: Table 3.5-2	**Comment Number**	150, 151
Comment Type	A – Administrative	**Disposition**	***Defer***
Comment Originator(s)	Lt Col Blair Thompson, Lt Col Steven Lewis, Lt Col Steven Brown, CMSgt Todd Scott (RNSSI)		
Comment	Eccentric Anomaly True Anomaly Suggest simpler methods for solving Kepler's equations and removing unnecessary, redundant equations.		
Directorate Response	Accept presentation as a special topic; defer change to be considered in a GPS concern.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
Special Topic	Special Topic	Special Topic

Open RFC Discussion

DOORS ID	IS705-371		
Paragraph	20.3.4.1, Table 20-XII Message Broadcast Intervals	**Comment Number**	ICWG Comment
Comment Type	S – Substantive	**Disposition**	***Accept***
Comment Originator(s)	Andrew Hansen (DOT/FAA)		
Comment	Do not proceed with making the Midi Almanac optional for L5 because it needs to be required for FAA use of the L5 CNAV data (for a few years to come)		
Directorate Response	Agreed at the Public ICWG. The four asterisks added to the Midi Almanac Maximum broadcast intervals has been removed.		

BASELINE TEXT (WAS)	**PIRN TEXT (IS)**	**PROPOSED TEXT**
See following slides	See following slides	See following slides

IS705-371: PIRN Text (IS):

Table 20-XII. Message Broadcast Intervals

Message Data	Message Type Number	Maximum Broadcast Intervals †
Ephemeris	10 & 11	24 sec
Clock	Type 30's	24 sec
ISC, IONO	30*	144 sec
Reduced Almanac	31* or 12	10 min**,****
Midi Almanac	37*	60 min**,****
EOP	32*	15 min****
UTC	33*	144 sec
Diff Correction	34* or 13 & 14	15 min***,****
GGTO	35*	144 sec****
Text	36* or 15	As needed****

* Also contains SV clock correction parameters.
** Complete set of SVs in the constellation.
*** When Differential Corrections are available.
**** Optional (interval applies if/when broadcast).

† The intervals specified are maximum. As such, the broadcast intervals may be shorter than the specified value.

Proposed Text: Revert to baseline text

Post-PICWG Review Comments

- Following the Public ICWG, an internal follow-up review was conducted to adjudicate the changes
- The following slides discuss the additional comments and the changes made to the PIRNs

Post-PICWG Review Comments

CRM – COMBINED REVIEW STATUS

Disposition/Type	Critical	Substantive	Administrative	Totals	Concurrence
Accept	0	2	5	7	7
Accept with Change	0	1	0	1	1
Reject	0	1	0	1	1
Defer	0	0	0	0	0
Grand Totals:	0	4	5	9	9

DOORS ID	IS200-50		
Paragraph	Table 3-III. Signal Configuration	**Comment Number**	1
Comment Type	A – Administrative	**Disposition**	***Accept***
Comment Originator(s)	Jim Parker (Lockheed Martin)		
Comment	All previous tables in the IRN were changed to have notes at the bottom left aligned but not this table. Why?		
Directorate Response	Was missed upon adding - was added much later in the RFC cycle and change was overlooked. Will left-align bottom note text. Accept as a change.		

PROPOSED TEXT

Table 3-III. Signal Configuration [excerpt]

Notes: 1) The configuration identified in this table reflects only the content of Section 3.2.3 and does not show all available codes/signals on L1/L2.

⊕ = "exclusive-or" (modulo-2 addition)
D(t) = LNAV data at 50 bps
$D_C(t)$ = CNAV data at 25 bps with FEC encoding resulting in 50 sps

* Terminology of "in-phase" and "quadrature-phase" is used only to identify the relative phase quadrature relationship of the carrier components (i.e. 90 degrees offset of each other).

** The two carrier components on L2 may not have the phase quadrature relationship. They may be broadcast on same phase (ref. Section 3.3.1.5).

[Notes left aligned]

DOORS ID	IS200-87		
Paragraph	3.3.1.7.2.0-1	**Comment Number**	2
Comment Type	A – Administrative	**Disposition**	***Accept***
Comment Originator(s)	Jim Parker (Lockheed Martin)		
Comment	Changing NAV/CNAV to just NAV seems like a bad idea. Should be changed to LNAV/CNAV. The problem is that NAV could be interpreted as something that should have been changed to LNAV but was missed.		
Directorate Response	Agreed.		

PICWG TEXT (IS)	**PROPOSED TEXT**
...Corrections for the bias components of the group delay differential are provided to the US in the NAV message using…	...Corrections for the bias components of the group delay differential are provided to the US in the LNAV/CNAV message using…

DOORS ID	IS200-1282		
Paragraph	Table 6-1 Additional C/A-/P-Code Phase Assignments (sheet 1 of 5)	**Comment Number**	3
Comment Type	A – Administrative	**Disposition**	***Accept***
Comment Originator(s)	Jim Parker (Lockheed Martin)		
Comment	Rationale omits reason for adding "G2" to the first note.		
Directorate Response	Added additional rationale based on PICWG comment update.		

PICWG TEXT (IS)	**PROPOSED TEXT**
Rationale : 3/19/18: In Table 6-1, sheet 1 of 5, the "First 10 Chips (Octal)**" column header is inconsistent with the 4 other sheets. This one has two asterisks, but the other 4 have one asterisk - which is the correct note (talks about octal notations).	**Rationale** : PICWG Comment: Update table note to specify that the initial settings pertain to the Initial G2 Settings to reduce confusion. 3/19/18: In Table 6-1, sheet 1 of 5, the "First 10 Chips (Octal)**" column header is inconsistent with the 4 other sheets. This one has two asterisks, but the other 4 have one asterisk - which is the correct note (talks about octal notations).

DOORS ID	IS200-552		
Paragraph	Table 30-I. Message Types 10 and 11 Parameters (1 of 2)	**Comment Number**	4
Comment Type	A – Administrative	**Disposition**	***Accept***
Comment Originator(s)	Jim Parker (Lockheed Martin)		
Comment	All previous tables in the IRN were changed to have notes at the bottom left aligned but not this table. Why?		
Directorate Response	Was missed upon adding - was added much later in the RFC cycle and change was overlooked. Will left-align bottom note text. Accept as a change.		

PROPOSED TEXT

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;

** See Figure 30-1 for complete bit allocation in Message Type 10;

*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

**** Relative to A_{REF} = 26,559,710 meters.

[Notes left aligned]

DOORS ID	IS200-46		
Paragraph	3.2.3.0-1	**Comment Number**	5
Comment Type	S – Substantive	**Disposition**	***Accept***
Comment Originator(s)	Roger Kirpes (Rockwell Collins)		
Comment	Make additional "LNAV" clarifications		
Directorate Response	Agreed.		

PICWG TEXT (IS)	**PROPOSED TEXT**
The L1 consists of two carrier components which are in phase quadrature with each other. Each carrier component is bi-phase shift key (BPSK) modulated by a separate bit train. One bit train is the modulo-2 sum of the P(Y)-code and NAV data, D(t), while the other is the modulo-2 sum of the C/A-code and the NAV data, D(t).	The L1 consists of two carrier components which are in phase quadrature with each other. Each carrier component is bi-phase shift key (BPSK) modulated by a separate bit train. One bit train is the modulo-2 sum of the P(Y)-code and LNAV data, D(t), while the other is the modulo-2 sum of the C/A-code and the LNAV data, D(t).

DOORS ID	IS200-48		
Paragraph		**Comment Number**	6
Comment Type	S – Substantive	**Disposition**	***Reject***
Comment Originator(s)	Roger Kirpes (Rockwell Collins)		
Comment	Make additional "LNAV" clarifications		
Directorate Response	IS200-48 text was deleted as a part of RFC-318. Please refer to IRN: https://www.gps.gov/technical/icwg/IRN-IS-200H-004A.pdf		

DOORS ID	ICD870-88, ICD240-336		
Paragraph	10.1.0-1, 10.1.0-6	**Comment Number**	7
Comment Type	S – Substantive	**Disposition**	***Accept with comments***
Comment Originator(s)	Stephan Hillman (Aerospace)		
Comment	In order to establish clear expectations for developers both within OCX and OCS as well as externals, the text should clearly define which portions of the POC information are subject to change. There is also the question of which fields should be optional or allow multiple entries (see below). There are 5 potential areas of change: Category: Examples are "CIVIL NON-AVIATION", "CIVIL AVIATION", "MILITARY", and "MILITARY ALTERNATE". Are these categories fixed or subject to change? Organization: Examples are "NAVCEN", "FAA Satellite Operations Group", "GPS Operations Center", and "JOINT SPACE OPERATIONS CENTER". Are these subject to change? Phone Number: Self evident and assumed that these may change, but it should be called out. Need to note that field includes both Commercial and optional DSN numbers. URL: Only some contain this. Optional? GPSOC has two URLs listed. Should this be limited to one or should the template allow multiples? E-mail: Only some contain this. Optional?		
Directorate Response	See following slides		

Directorate Response	Added additional language to ICD870-88 to specify which areas are subject to change: "Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change, specifically the Organization Name and Organization Primary Contact Information (i.e. Contact Website URI, Contact Email ID, Contact Telephone Number, and Contact DSN Telephone Number). The first NANU example, Figure 10-1, includes POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information." Similar language for ICD870-189, ICD240-336, and ICD240-159.

PIRN TEXT (IS)	PROPOSED TEXT
ICD870-88: Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change. The first NANU example, Figure 10-1, includes POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information.	**ICD870-88**: Users should be advised that the Point of Contact (POC) information contained in the NANU samples are subject to change, specifically the Organization Name and Organization Primary Contact Information (i.e. Contact Website URI, Contact Email ID, Contact Telephone Number, and Contact DSN Telephone Number). The first NANU example, Figure 10-1, includes POC information that reflects the time of release of this ICD. However, users should refer to the POC information provided in the most recent NANUs for up-to-date information.

DOORS ID	ICD870-704		
Paragraph	3.3.0-12	**Comment Number**	8
Comment Type	S – Substantive	**Disposition**	***Accept***
Comment Originator(s)	Stephan Hillman (Aerospace)		
Comment	Changing "Portal" to "NAVCEN" is not consistent or appropriate. Prior changes of "Portal" to "Website" are acceptable and would be appropriate here.		
Directorate Response	Agreed.		

PICWG TEXT (IS)	**PROPOSED TEXT**
The USCG Portal will make the standalone offline Validate and Transform utility available on the public Internet.	The USCG ~~Portal~~Website will make the standalone offline Validate and Transform utility available on the public Internet.

DOORS ID	ICD870-80		
Paragraph	3.3.0-12	**Comment Number**	9
Comment Type	A - Administrative	**Disposition**	***Accept***
Comment Originator(s)	Stephan Hillman (Aerospace)		
Comment	Reference to the NIS was removed from the document, so why was then NIS added to the Acronym list?		
Directorate Response	Agreed. Removed NIS reference from acronym list		

PROPOSED TEXT

[ICD870-80] Removed from PIRN

Post-PICWG Review Comments

- The following items were also added to the PIRNs as a result of an action

Obj ID	Change
IS200-83	Change NAV to LNAV/CNAV
IS200-147	Change NAV to LNAV/CNAV
IS200-158	Change NAV to LNAV/CNAV
IS200-159	Change NAV to LNAV/CNAV
IS200-191	Change NAV to LNAV/CNAV
IS200-458	Change NAV to LNAV
IS200-672	Change NAV to CNAV
IS200-341	Change NAV to LNAV/CNAV
IS200-441	Change NAV to LNAV/CNAV
IS705-25	Change NAV to CNAV
IS705-31	Change NAV to L5 CNAV
IS705-37	Change NAV to CNAV (two places)
IS705-61	Change NAV to CNAV

Obj ID	Change
IS705-65	Change NAV to CNAV
IS705-73	Change NAV to CNAV
IS705-1519	Change NAV to LNAV
IS705-331	Change NAV to CNAV
IS705-336	Change NAV to LNAV
IS705-373	Change NAV to CNAV
IS800-267	Change NAV to LNAV
IS800-893	Change NAV to LNAV
IS800-298	Change NAV to CNAV-2
	Change NAV to CNAV-2
	Change Appendix 20 -> Appendix II of IS-GPS-200
IS800-299	Change Appendix 30 -> Appendix III of IS-GPS-200
IS800-370	Change NAV to LNAV

Global Positioning Systems (GPS)

Public Forum

12 September 2018
0830 – 1630 hrs PT

United States Air Force GPS Directorate
Phone Number: 1-310-653-2663 Meeting ID: 8337375 Passcode: 123456
DCS Website: https://conference.apps.mil/webconf/gpspublicmeeting

Roll Call

Rules of Engagement

UNCLASSIFIED

ABSOLUTELY NO PROPRIETARY, CLASSIFIED, OR COMPETITION SENSITIVE INFORMATION IS TO BE DISCUSSED DURING THIS MEETING.

Rules of Engagement

- Please place your phones on mute when not speaking to minimize background noise
- Comments against the topics listed on the official agenda will get priority during discussion, all others will be addressed during the open discussion
- Topics that warrant additional discussion may be side-barred
- Meeting minutes and final IRNs will be generated and distributed as a product of this meeting
- For in-person attendees, please raise your hand before speaking and the microphone will be brought to you
- Please announce your name and organization before addressing the group

Meeting Purpose

- The purpose of the meeting is to:

1) Obtain ICWG approval on the proposed language generated for the enterprise RFCs that may impact the public documents

2) Discuss any new open forum items against the Public Signals in Space documents

Agenda – Part 2 (Public Forum)

Reconvene

Roll Call

Special Topic Presentations

- Status of GPS Spectrum & Adjacent Band Compatibility
- GPS III Signal in Space (Presented by Lockheed Martin)
- Navigation Message Correction Table (NMCT) Clarity – SV ID 32
- MT 38, 39, 40 Integrity Support Messages (ISMs)
- Walk-on Topics

Open Discussion

Action Item Review (If Necessary)

Closing Remarks

Adjourn

Status of GPS Spectrum & Adjacent Band Compatibility

Capt Robyn Anderson
Capt David Besson

Global Positioning Systems Directorate

Special Topic: Spectrum

2018 GPS Directorate Public Forum

Capt Robyn Anderson Capt David Besson
GPSD Spectrum Management

Overview

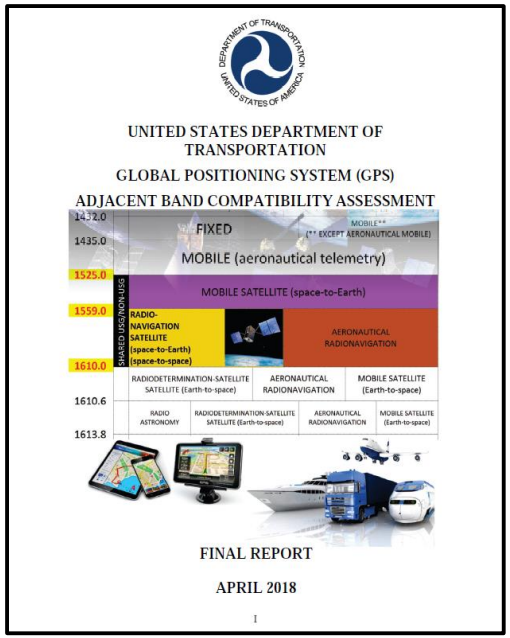
- Status of GPS Spectrum
- Adjacent Band Compatibility
- How to Stay Informed

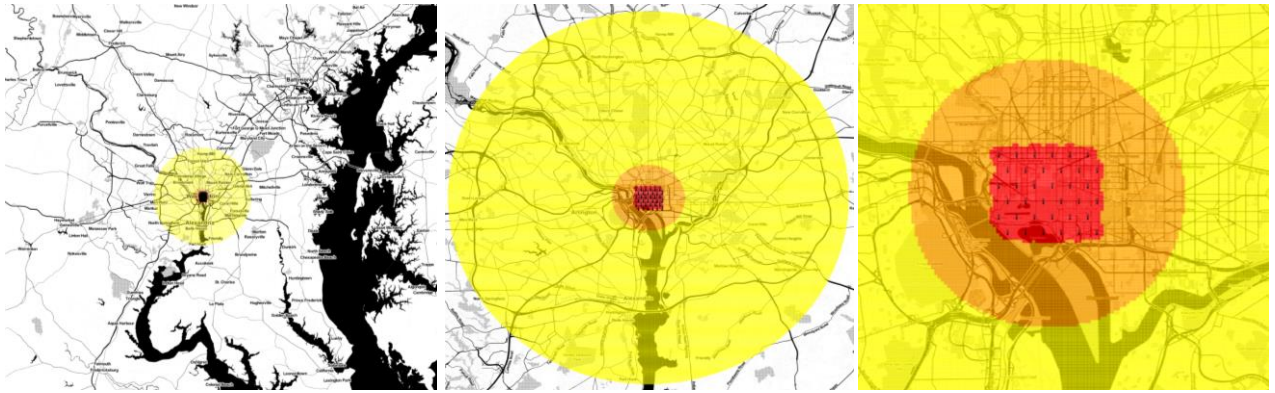
Status of GPS Spectrum

- Realizing modernized civil signals
  - L1C, L2C, L5
- Exploring multi-GNSS
- Strengthening international partnerships
- Fortifying spectrum protection efforts

Adjacent Band Compatibility

- Test results are publically available at transportation.gov
- PNT EXCOM position in progress
- FCC Proceedings IB 11-109 and IB 12-340



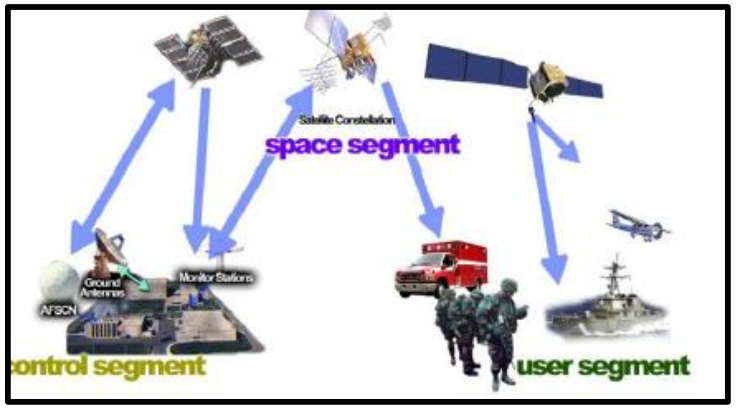


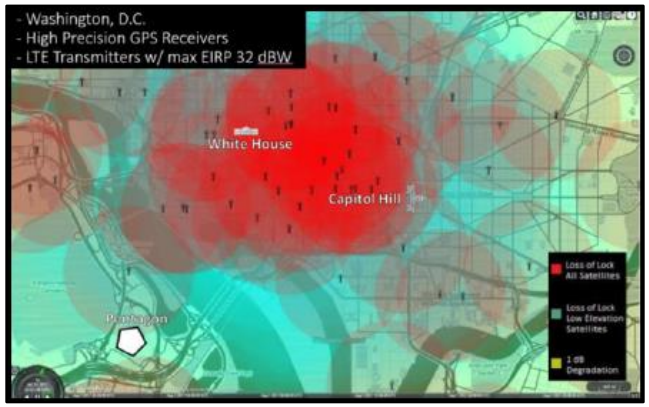
Case: Micro-urban cell towers @ 9 dBW
36 towers at assumed spacing of 433m
10 MHz centered at 1530 MHz
IPC violation: ~ 35 km

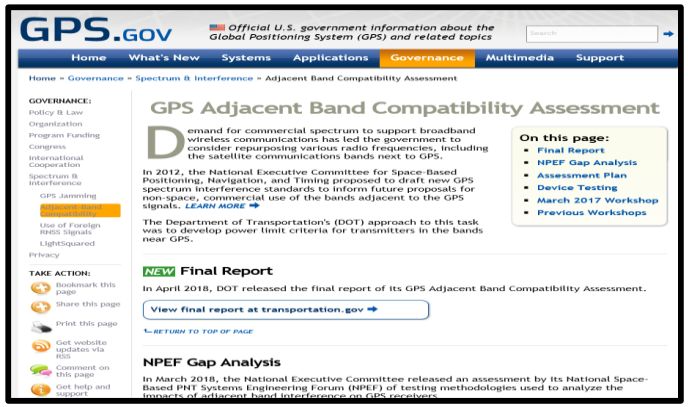
https://www.transportation.gov/pnt/global-positioning-systemgps-adjacent-band-compatibility-assessment

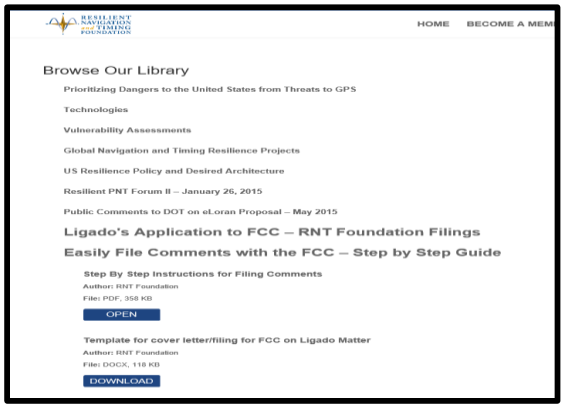
Stay Informed, Stay Engaged

- GPS.gov/spectrum/ABC
- Resilient PNT Foundation (rntfnd.org)
- Contact GPS Directorate
- Semi-annual PNT Advisory Board Meetings









Thank you.

- Capt Robyn Anderson
  - robyn.anderson.1@us.af.mil
  - (310) 653 – 2041

- Capt David Besson
  - david.besson.1@us.af.mil
  - (310) 653 – 3523

GPS III Signal in Space
(Presented by Lockheed Martin)

Steven Brown
GPS III SIS ICD/IS Lead

GPS III Presentation to Public ICWG

12 September 2018

Steven Brown
GPS III SIS ICD/IS Lead

Overview

- Purpose/Facts
- LNAV Time of Ephemeris (t_{oe}) Requirement
- CNAV Time of Ephemeris (t_{oe}) Requirement
- CNAV2 Time of Ephemeris (t_{oe}) Requirement
- Newly Uploaded Data – Cutover t_{oe} and t_{oc}
- Curve Fit Intervals
- 4-hour Fit Intervals – Benefits

Purpose/Facts

- **Purpose**:
  - Communicate how GPS Block III Signal in Space (SIS) Navigation Message broadcast will differ from previous satellite blocks
- **Facts:**
  - GPS III is compliant with ALL Signal in Space (SIS) IS/ICDs including
    - IS-GPS-200 NAVSTAR GPS Space Segment/User Segment Interfaces
    - IS-GPS-705 NAVSTAR GPS Space Segment/User Segment L5 Interface
    - IS-GPS-800 NAVSTAR GPS Space Segment/User Segment L1C Interface
  - GPS III generates Navigation Messages on-board the satellite
    - Allows for smaller, non redundant data uploads
    - Allows for GPS III to broadcast more Navigation Signals with less error over longer periods without ground contact
  - IIA/IIR/IIR-M/IIF repeats the navigation messages loaded by the Control Segment (CS)

IS-GPS-200 LNAV t_{oe} Requirement

- **IS-GPS-200J LNAV – from 20.3.4.5 Reference Times**

  The CS (Block II/IIA/IIR/IIR M/IIF) and SS (GPS III) shall assure that the toe value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted from the prior CEI data sequence propagation (see paragraph 20.3.4.4). As such, when a new CEI data sequence propagation is cutover for transmission, the CS (Block IIA/IIR/IIR-M/IIF) and SS (GPS III) shall introduce a small deviation in the toe resulting in the toe value that is offset from the hour boundaries (see Table 20 XIII). This offset toe will be transmitted by an SV in the first CEI data set of the new CEI data sequence propagation and the second CEI data set, following the first CEI data set, may also continue to reflect the same offset in the toe.

  When the toe, immediately prior to a new CEI data sequence propagation cutover, already reflects a small deviation (i.e. a new CEI data sequence propagation cutover has occurred in the recent past), then the CS (Block II/IIA/IIR/IIR-M/IIF) and SS (GPS III) shall introduce an additional deviation to the toe when a new CEI data sequence propagation is cutover for transmission.

IS-GPS-200/705 CNAV t_{oe} Requirement

- **IS-GPS-200J and IS-GPS-705E CNAV – from IS-GPS-200 30.3.4.5 Reference Times**

  As such, when a new CEI data sequence propagation is cutover for transmission, the CS (Block IIR-M/IIF) and SS (GPS III) shall introduce a small deviation in the toe resulting in the toe value that is offset from the nominal location of 1.5 hours into the fit interval (see Table 30-XIII). This offset toe will be transmitted by an SV in the first data set after a new CEI data sequence propagation cutover and the second CEI data set, following the first CEI data set, may also continue to reflect the same offset in the toe.

  When the toe, immediately prior to a new CEI data sequence propagation cutover, already reflects a small deviation (i.e. a new CEI data sequence propagation cutover has occurred in the recent past), then the CS (Block IIR-M/IIF) and SS (GPS III) shall introduce an additional deviation to the toe when a new CEI data sequence propagation is cutover for transmission.

  - IS-GPS-705 refers back to IS-GPS-200

IS-GPS-800 CNAV2 t_{oe} Requirement

- **IS-GPS-800D CNAV2 – from 3.5.3 <u>Subframe 2.</u>**

  Any change in the subframe 2 ephemeris and clock data shall be accomplished with a simultaneous change in the toe value. The SV shall assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted from the prior CEI data sequence propagation.

Newly Uploaded Data: Cut Over t_{oc} /t_{oe}

- **Summarizing IS-GPS-200, IS-GPS-705, and IS-GPS-800**
  - After a new upload, the t_{oe} and t_{oc} value, for at least the first data set transmitted, is different from that transmitted prior to the cutover
  - Nominally, the toe and toc value is set to the mid point of the curve fit (reference IS200 Table 20-XIII, table 30-XIII; IS705 20.3.4.5; IS800 3.5.5.3)
- **Block IIA/IIR/IIR-M/IIF**
  - SV decrement t_{oe} and t_{oc} by one LSB and keep the same curve fit
  - Legacy t_{oe} and t_{oc} are decremented by 16 seconds
  - Modernized t_{oe} and t_{oc} are decremented by 5 minutes
- **Block III**
  - Decrements t_{oe} and t_{oc} by at least one LSB, but will also make a new curve fit
  - Legacy t_{oe} and t_{oc} are decremented by at least 16 seconds from the new midpoint
  - Modernized t_{oe} and t_{oc} are decremented by 5 minutes from the new midpoint
  - Block III alerts users to a new data set not only with a change in t_{oe} and t_{oc} but also a change in curve fit

Curve fit: t_{oc} /t_{oe}

Example 1

Time	Event	Block IIA/IIR/IIR-M/IIF				GPS III			
		Legacy Curve Fit*	Mod'ized Curve Fit*	Legacy t_oe/t_oc	Mod'ized t_oe/t_oc	Legacy Curve Fit*	Mod'ized Curve Fit*	Legacy t_oe/t_oc	Mod'ized t_oe/t_oc
1:30:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00	00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00
2:00:00	Cutover to new CEI data Seq. Prop	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00
2:30:00		02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00
3:00:00		02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00
3:30:00		02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00
4:00:00	Cutover to next CEI data Seq. Prop	04:00:00 - 08:00:00	04:00:00 - 07:00:00	6:00:00	5:30:00	04:00:00 - 08:00:00	04:00:00 - 07:00:00	6:00:00	5:30:00
4:30:00		04:00:00 - 08:00:00	04:00:00 - 07:00:00	6:00:00	5:30:00	04:00:00 - 08:00:00	04:00:00 - 07:00:00	6:00:00	5:30:00

- **After a New CEI Data Sequence Propagation set is uploaded, and the cutover is on a 2 hour boundary then the curve fit, t_{oe} and t_{oc} will be the same as a Block IIs**

** Curve fit times are not explicitly transmitted by GPS, but can be inferred based on the t_{oe} and t_{oc} as the midpoint of the curve fit and in the case of LNAV the IODE/Fit interval flag*

Curve fit: t_{oc} /t_{oe}

Example 2

Time	Event	Block IIA/IIR/IIR-M/IIF				GPS III			
		Legacy Curve Fit*	Mod'ized Curve Fit*	Legacy t_oe/t_oc	Mod'ized t_oe/t_oc	Legacy Curve Fit*	Mod'ized Curve Fit*	Legacy t_oe/t_oc	Mod'ized t_oe/t_oc
0:45:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00	00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00
1:00:00	Cutover to new CEI data Seq. Prop	00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:00:00 - 05:00:00	01:00:00 - 04:00:00	2:59:44	2:25:00
1:15:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:00:00 - 05:00:00	01:00:00 - 04:00:00	2:59:44	2:25:00
1:30:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:00:00 - 05:00:00	01:00:00 - 04:00:00	2:59:44	2:25:00
1:45:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:00:00 - 05:00:00	01:00:00 - 04:00:00	2:59:44	2:25:00
2:00:00	Cutover to next CEI data Seq. Prop	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	4:00:00	3:30:00
2:15:00		02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	4:00:00	3:30:00

- **After a New CEI Data Sequence Propagation set is uploaded to a GPS III, and the cutover is on an odd hour boundary then the curve fit, t_{oe} and t_{oc} will be different from Block IIs**
- **Block IIs will offset the first 2 t_{oe}s and t_{oc}s. GPS III does not**
- **After 0400 cutover Block IIs and GPS III will look the same until a new upload**

* *Curve fit times are not explicitly transmitted by GPS, but can be inferred based on the t_{oe} and t_{oc} as the midpoint of the curve fit and in the case of LNAV the IODE/Fit interval flag*

Curve fit: t_{oc} /t_{oe}

Example 3

Time	Event	Block IIA/IIR/IIR-M/IIF				GPS III			
		Legacy Curve Fit*	Mod'ized Curve Fit*	Legacy t_oe/t_oc	Mod'ized t_oe/t_oc	Legacy Curve Fit*	Mod'ized Curve Fit*	Legacy t_oe/t_oc	Mod'ized t_oe/t_oc
0:45:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00	00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00
1:00:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00	00:00:00 - 04:00:00	00:00:00 - 03:00:00	2:00:00	1:30:00
1:15:00	Cutover to newly uploaded data set	00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:15:00 - 05:15:00	01:15:00 - 04:15:00	3:14:40	2:40:00
1:30:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:15:00 - 05:15:00	01:15:00 - 04:15:00	3:14:40	2:40:00
1:45:00		00:00:00 - 04:00:00	00:00:00 - 03:00:00	1:59:44	1:25:00	01:15:00 - 05:15:00	01:15:00 - 04:15:00	3:14:40	2:40:00
2:00:00	Cutover to next data set	02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	4:00:00	3:30:00
2:15:00		02:00:00 - 06:00:00	02:00:00 - 05:00:00	3:59:44	3:25:00	02:00:00 - 06:00:00	02:00:00 - 05:00:00	4:00:00	3:30:00

- **After a New CEI Data Sequence Propagation set is uploaded to a GPS III, and the cutover is not on a an hour boundary then the curve fit, t_{oe} and t_{oc} will be different from Block IIs**
- **Block IIs will offset the first 2 t_{oe}s and t_{oc}s. GPS III does not.**
- **After 0400 cutover Block IIs and GPS III will look the same until a new upload**

* *Curve fit times are not explicitly transmitted by GPS, but can be inferred based on the t_{oe} and t_{oc} as the midpoint of the curve fit and in the case of LNAV the IODE/Fit interval flag*

4 Hour Curve Fits - Benefits

- **Block IIA/IIR/IIR-M/IIFs**
  - Have 32 hours of 4 hour curve fits before transition to longer curve fits
    - 6 hours, 8 hours, 14 hours, 26 hours
  - Longer curve fits introduce additional error due to loss of precision
- **Per IS-GPS-200, Table 20-XII Note 2**
  - IODC values for blocks with 1-, 2- or 4-hour transmission intervals (at least the first 14 days after a new CEI data sequence propagation) shall be any number in the range 0 to 1023 excluding those values of IODC that correspond to IODE values in the range 240-255, subject to the constraints on re-transmission given in paragraph 20.3.4.4. The CS can define the GPS III SV time of transition from the 4 hour curve fits into extended navigation (beyond 4 hour curve fits). Following the transition time, the SV will follow the timeframes defined in the table, including appropriately setting IODC values
- **Block III can stay in 4 hour curve fits for 62 days** (spanned, as defined in IS-GPS-200, Table 20-XII)
  - Better accuracy
  - Simpler and more constant fit intervals

Summary

- Purpose/Facts
- LNAV Time of Ephemeris (t_{oe}) Requirement
- CNAV Time of Ephemeris (t_{oe}) Requirement
- CNAV2 Time of Ephemeris (t_{oe}) Requirement
- Newly Uploaded Data – Cutover t_{oe} and t_{oc}
- Curve Fit Intervals
- 4-hour Fit Intervals – Benefits

Conclusion

- **GPS III is compliant with all SIS ISs/ICDs**
- **GPS III SIS implementation**
  - GPS III alerts users to a new data set not only with a change in t_{oc} and t_{oe} but also a change in curve fit
    - More ways to know if a new data set is available
  - GPS III can stay in 4 hour curve fits for all 62 days
    - Better accuracy
    - Simpler and more constant fit intervals

Navigation Message Correction Table (NMCT) Clarity – SV ID 32

Mr. Philip Kwan
Karl Kovach

IS-200 clarification on broadcast NMCT table when SV is assigned PRN 32 (SV ID 32)

Philip Kwan (SE&I)
Karl Kovach (Aerospace)
12 September 2018

Navigation Message Correction Table (NMCT) Context

- **In LNAV, the NMCT in Subframe 4 Page 13 (SF4 P13) has 30 slots to contain Estimated Range Deviations (ERDs)**
  - **Estimated pseudorange error; used to correct the user's measured pseudorange**
  - **31 possible IDs: SV IDs 1 – 31**
  - **SV ID 32 is not a part of the NMCT**
- **The 30 slots contain the 30 SV IDs <u>other than the one transmitting the message</u>**
  - **For PRN 1, it will transmit an NMCT containing SV IDs 2 – 31.**
  - **For PRN 31, it will transmit an NMCT containing SV IDs 1 – 30.**
- **The NMCT is preceded by 2 bits: Availability Indicator (AI), which describes if the NMCT is encrypted or unencrypted or if no NMCT is available. (Table below obtained from IS-GPS-200J)**

AI	Navigation Message Correction Table Availability
00	The correction table is unencrypted and is available to both precise positioning service users and standard positioning service users.
01	The correction table is encrypted and is available only to authorized users (normal mode).
10	No correction table available for either precise positioning service users or standard positioning service users.
11	Reserved in order to preserve future use of these values in a future revision of this IS. Until such a revision, the User Segment developing to this version of this IS should interpret this value as indicating that no correction table is available for either precise positioning service users or standard positioning service users, i.e. until such a revision, the User Segment developing to this version of this IS should interpret this value as functionally equivalent to an AI setting of 10.

Problem

- **What happens for a transmitting SV with SV ID 32? There are 31 possible SV IDs and 30 slots**
  - **No statement in IS-GPS-200J saying that an SV with SV ID 32 cannot transmit an NMCT**
  - **IS-GPS-200J only states that SV ID 32 is not a part of the NMCT**

Solution

- **An SV with SV ID 32 does not transmit an NMCT**

- **How is this represented?**
- **Answer: The availability indicator for SV ID 32 is defaulted to “10” for “No correction table available for either precise positioning service users or standard positioning service users.”**

Redlines

- **IS-GPS-200J, Appendix II (LNAV-L), Section 20.3.3.5.1.9, below the availability indicator table:**

- **IS200-425:**
- **…There are 31 possible SV IDs that these ERD slots may correspond to, ranging from SV ID 1 to SV ID 31. SV ID 32 is not a valid SV ID for any of the slots in an NMCT, and the AI for SV ID 32 will be either 10 or 11. The correspondence between the 30 ERD slots and the 31 possible SV IDs depends on the SV ID of the particular transmitting SV in accordance with the following two rules:…**

- **Consider splitting multiple shall statements in IS200-425**

Add “11” as an additional possibility due to a comment at the Public Forum

LNAV-U: PRNs 33 – 63 (SV IDs 65 – 95)

- **Does this affect Appendix IV of IS-GPS-200J for LNAV-U?**

- **LNAV-U consists of the LNAV message format for PRNs 33 – 63, which correspond to SV IDs 65 – 95**
  - **Section 40.3.3.5.1.9 (NMCT) does not have any issue**
    - **There are only 31 assigned SV IDs for LNAV-U**
- **No corrections needed**

Thank you

- **References: IS-GPS-200J NAVSTAR GPS Space Segment/Navigation User Segment Interfaces**
- **Special thanks to Karl Kovach (Aerospace)**

MT 38, 39, 40 Integrity Support Messages (ISMs)

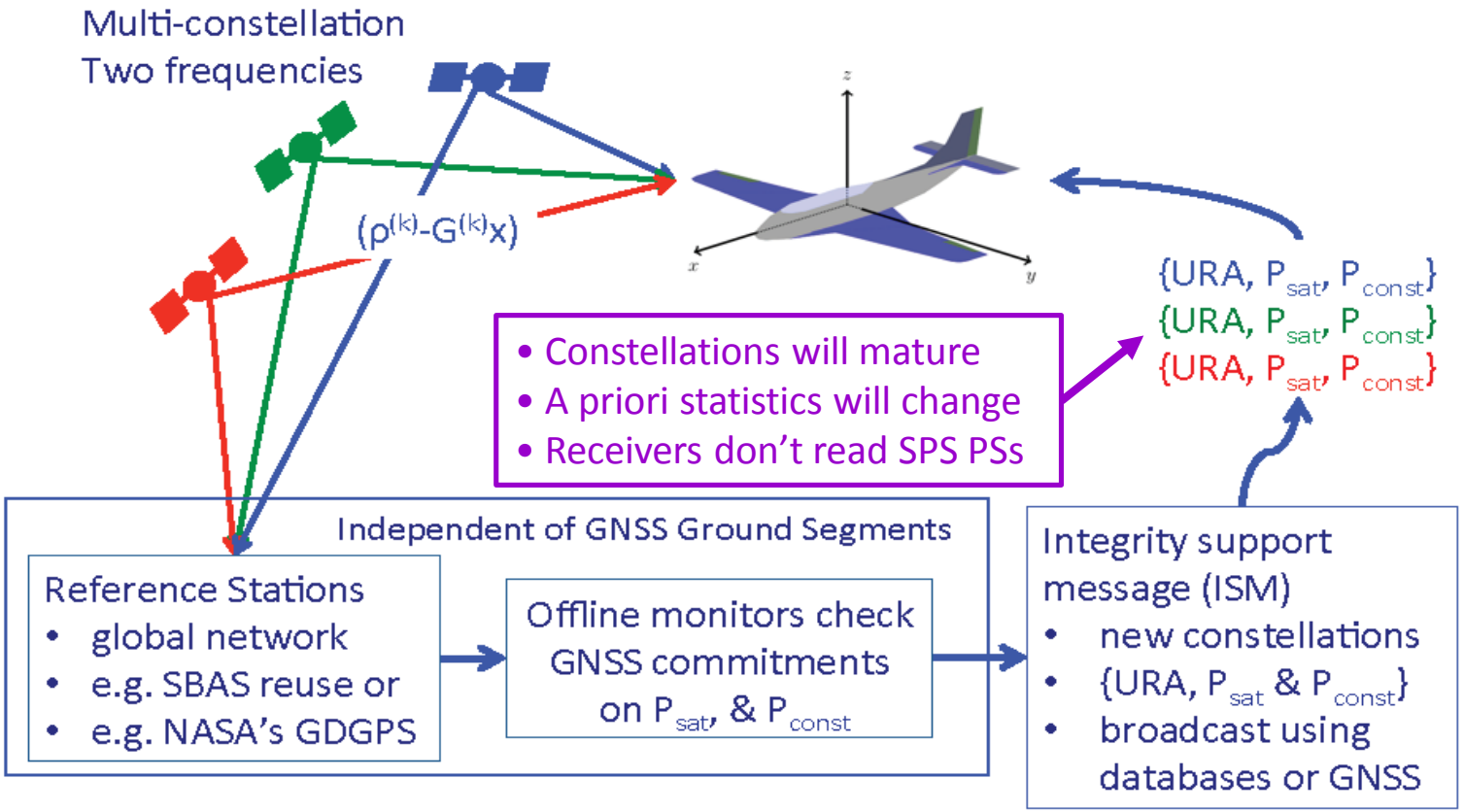
Karl Kovach

Outline

- **Integrity Support Message (ISM)**
- **GPS MT-38/39/40 Proposal**
  - MT-38 – ARAIM Parameters
  - MT-39 – ISM Management
  - MT-40 – ISM Signature Key
- **MT-38/39/40 Details**
  - L2CM signal, IS-GPS-200
  - L5I5 signal, IS-GPS-705
  - $L1C_D$ signal, IS-GPS-800
- **Concluding Remarks**

ISM Principles

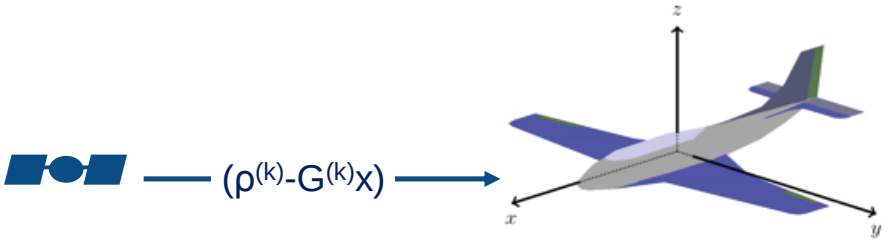
Advanced RAIM to Support Lateral + Vertical Navigation Worldwide



RAIM Reminders

Baseline RAIM has been Supporting Horizontal Navigation Since 1993

GPS constellation
Single frequency
Possibly with SA

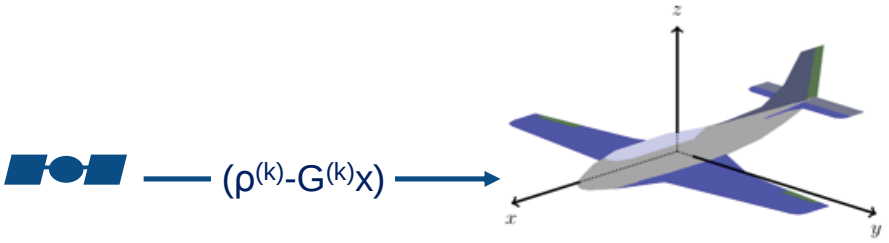


- RAIM runs at same rate as PVT solution (e.g., 1 Hz typical)
- RAIM is basically a statistical consistency test
  - 4 measurements will always be consistent = no RAIM
  - 5 measurements may be inconsistent = "Fault Detection" (FD)
    - Each subset of 4 will always be consistent = no more info
  - 6 measurements may be inconsistent = FD
    - 5 of the 6 subsets of 5 may be inconsistent = "Fault Exclusion" (FE)
  - 7 measurements may be inconsistent = FD+FE = "FDE"
    - 6 of the 7 subsets of 6 may be inconsistent = FE
- RAIM works provided ≤ 1 faulty measurement at a time
  - 2 faulty measurements might – or might <u>not</u> – be detected

RAIM Can Be Helped

Baseline RAIM has been Supporting Horizontal Navigation Since 1993

GPS constellation
Single frequency
Possibly with SA

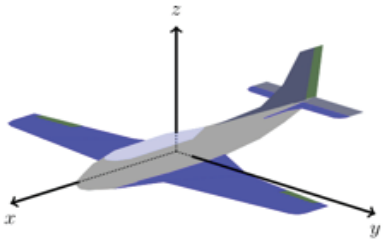


- RAIM is inescapably a statistical consistency test
  - If a priori statistics too tight
    - → Too many false detections / false exclusions
      - → Poor usability (users hate this)
  - If a priori statistics too loose
    - → Can only detect/exclude huge faults
      - → Poor availability (users hate this)

ISM is to Help RAIM

Advanced RAIM to Support Lateral and Vertical Navigation

GPS constellation+
Dual frequency+
SA gone forever



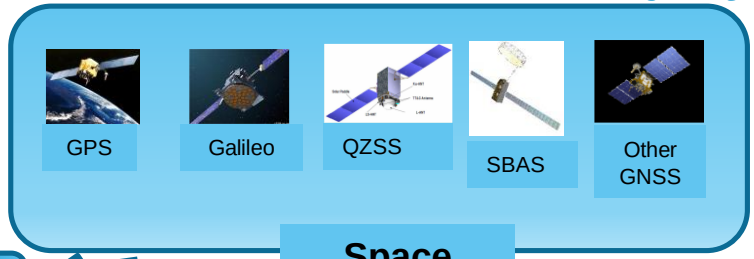
- ISM provides the proper a priori statistics
  - Not too tight
  - Not too loose
  - Just right for current conditions
- Optimum RAIM performance!

Outline

- **Integrity Support Message (ISM)**
- **GPS MT-38/39/40 Proposal**
  - MT-38 – ARAIM Parameters
  - MT-39 – ISM Management
  - MT-40 – ISM Signature Key
- **MT-38/39/40 Details**
  - L2CM signal, IS-GPS-200
  - L5I5 signal, IS-GPS-705
  - $L1C_D$ signal, IS-GPS-800
- **Concluding Remarks**

GPS MT-38 "Big Picture"

** Service Provider



CNAV MT-38

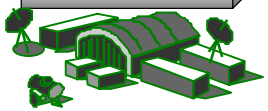
ISM SP**

ISM Content

FAA

ISM Packages

JSPOC



MCS

Control

NGA MS (12)
USAF (6)

GPS GA

CNAV MT-38

User

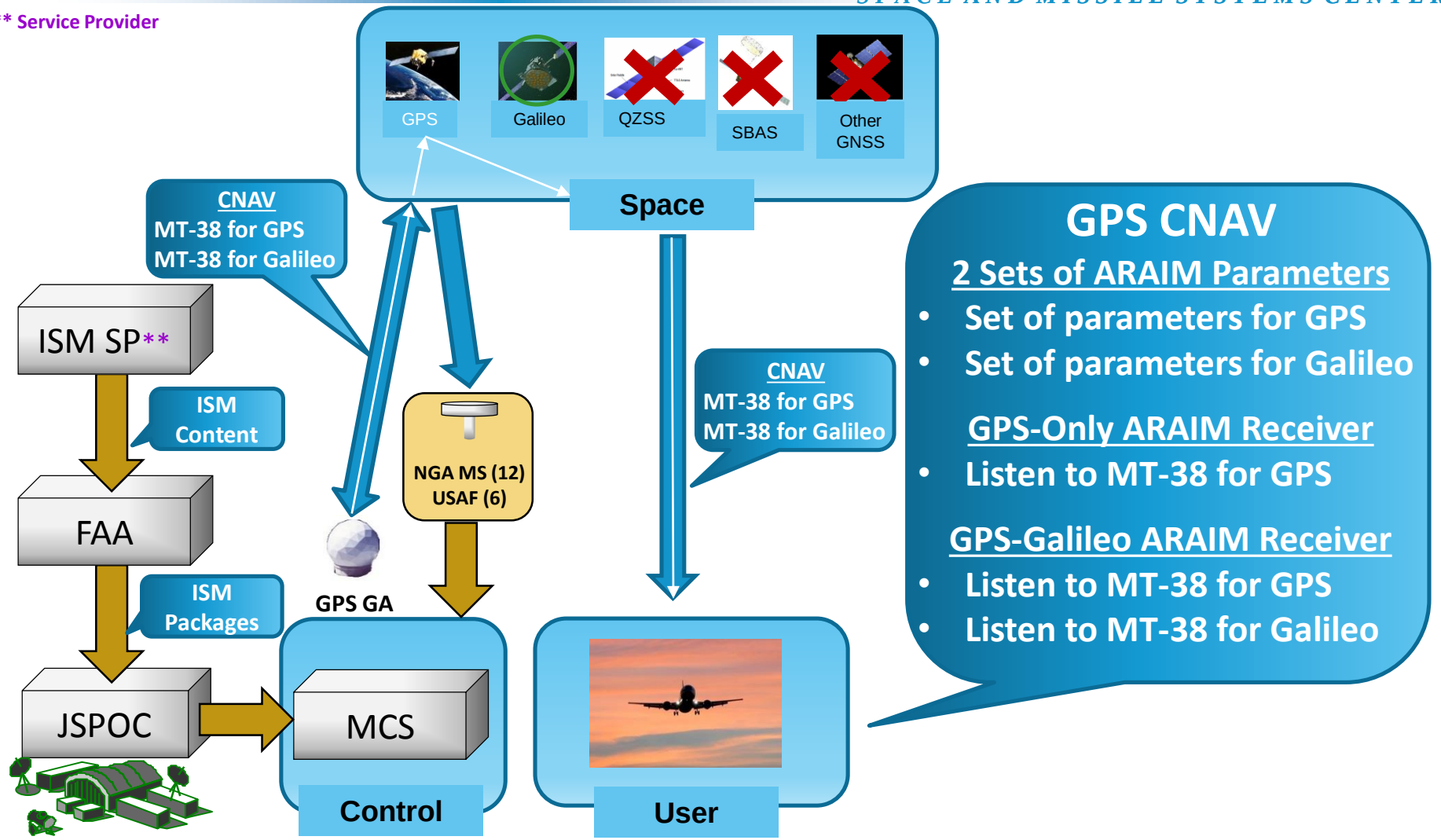
ARAIM Parameters

- US/EU aviation receivers*
  - RTCA/FAA
  - EUROCAE/EASA
- Foreign aviation receivers*
- Global all civil receivers*
- US military receivers*
- Foreign military receivers*

* Only if CNAV capable

GPS MT-38 “Simple First Case”

** Service Provider



International Politics However…

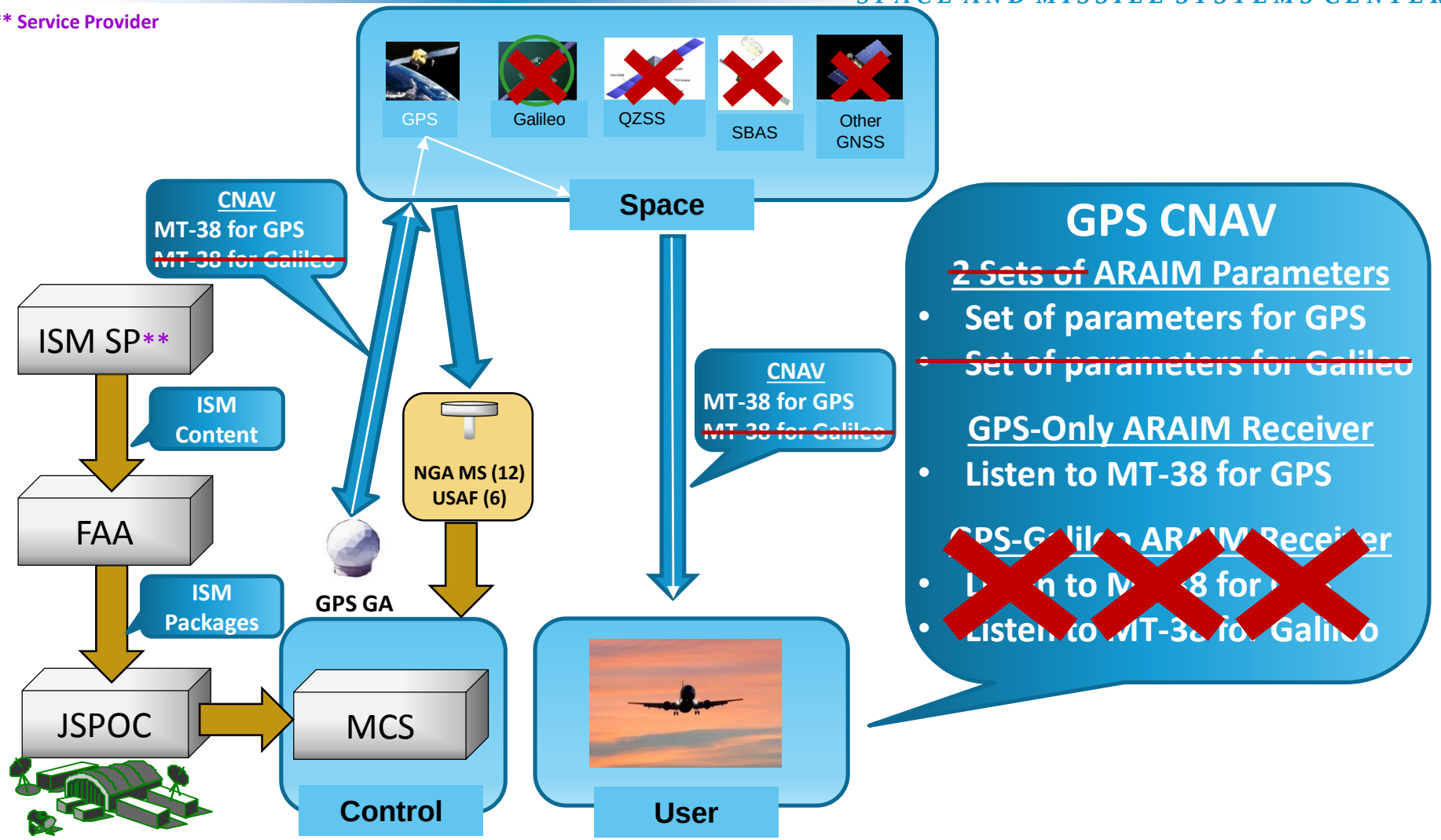
- **National Space Policy of the U.S.A (POTUS, 28 Jun 10)**
  - The United States shall:

> ***"Engage with foreign GNSS providers to encourage compatibility and interoperability, promote transparency in civil service provision, and enable market access for U.S. industry"***

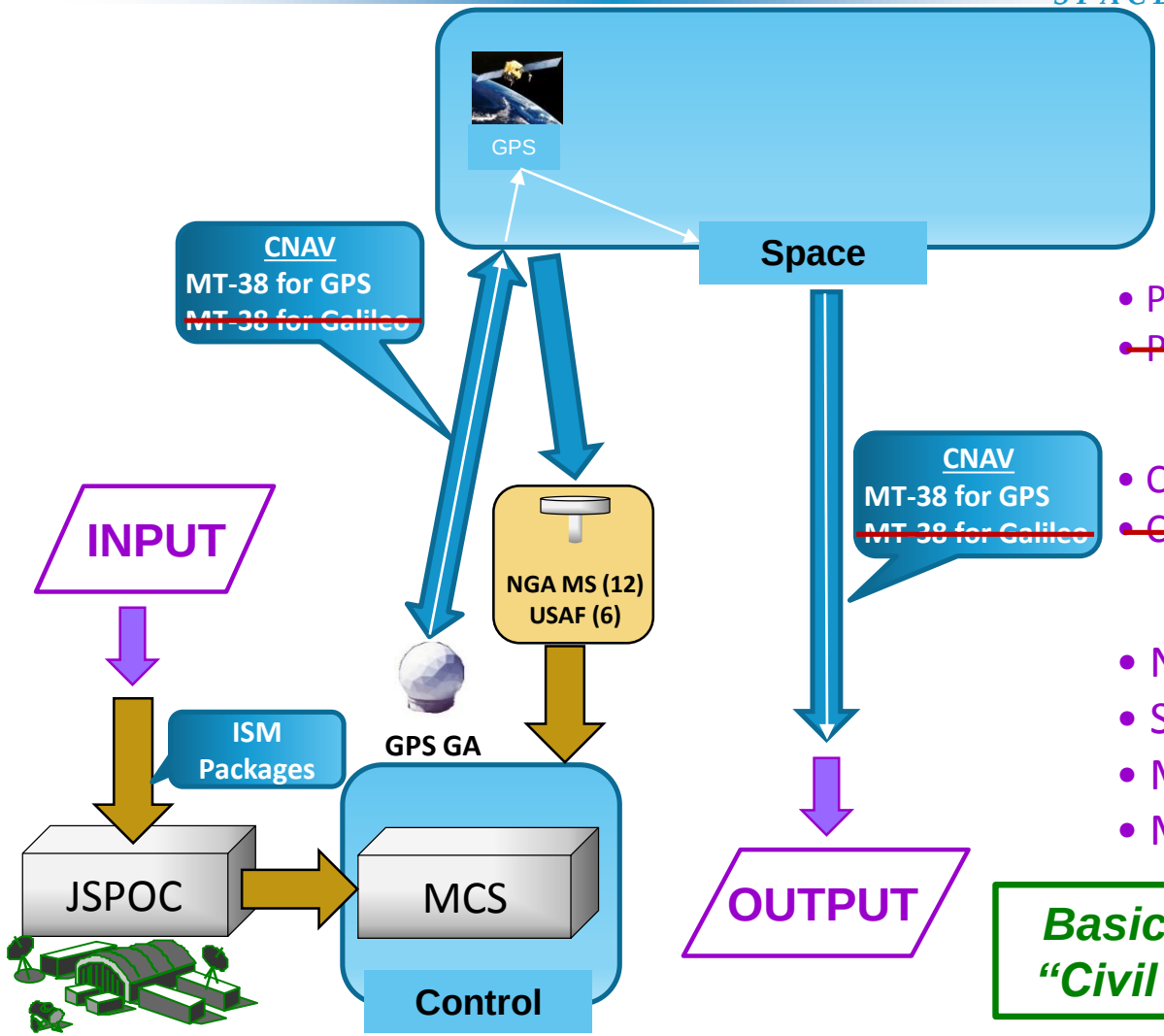
- **The EU may NOT be ready for so much cooperation**
  - GPS might not broadcast an ISM for Galileo (yet)
- **Just broadcasting ISM for GPS still very worthwhile**
  - International civil aviation almost exclusively based on GPS
- **The MT-38/-39/-40 design is fine with this situation**
  - Maybe some other GNSS will beat Galileo to the table…

GPS MT-38 "Very Simple First Case"

** Service Provider



GPS MT-38 "Enterprise Perspective"



INPUT

- Package of data for MT-38 for GPS
- ~~Package of data for MT-38 for Galileo~~

OUTPUT

- CNAV Broadcast MT-38 for GPS
- ~~CNAV Broadcast MT-38 for Galileo~~

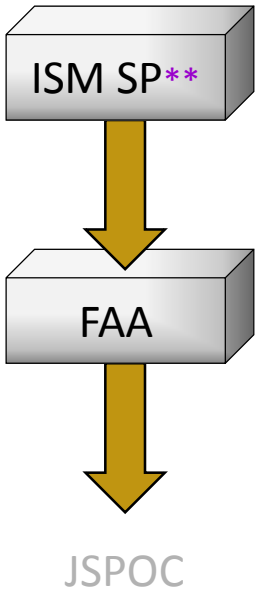
Notes

- New input packages ≈ monthly
- Same MT-38s from all satellites
- MT-38 transitions can take a day
- MT-38 repeat ≈ 144 sec [TBR]

Basically $^{1}/_{1,000}^{th}$ of Modernized "Civil Text Message" Capability

GPS MT-38 “Source Perspective”

** Service Provider

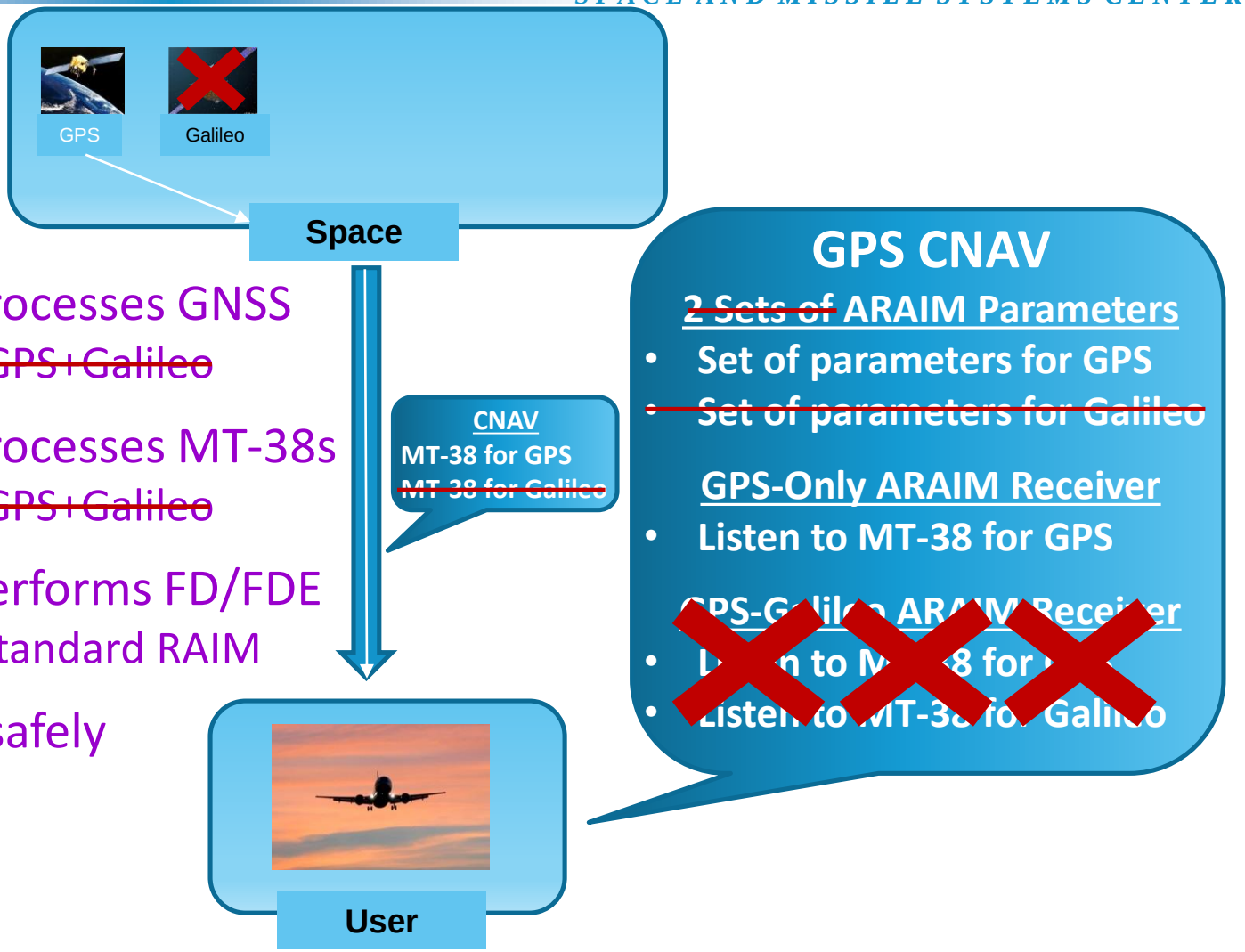


- FAA will be “source” of the ISM data packages
  - Direct service provider of ISM data for GPS
    - Pay heed to DoD’s *SPS PS* commitments
    - Possible refinement using the WAAS network
    - Possible refinement using outside contractor
  - Responsible for the ISM data for GPS

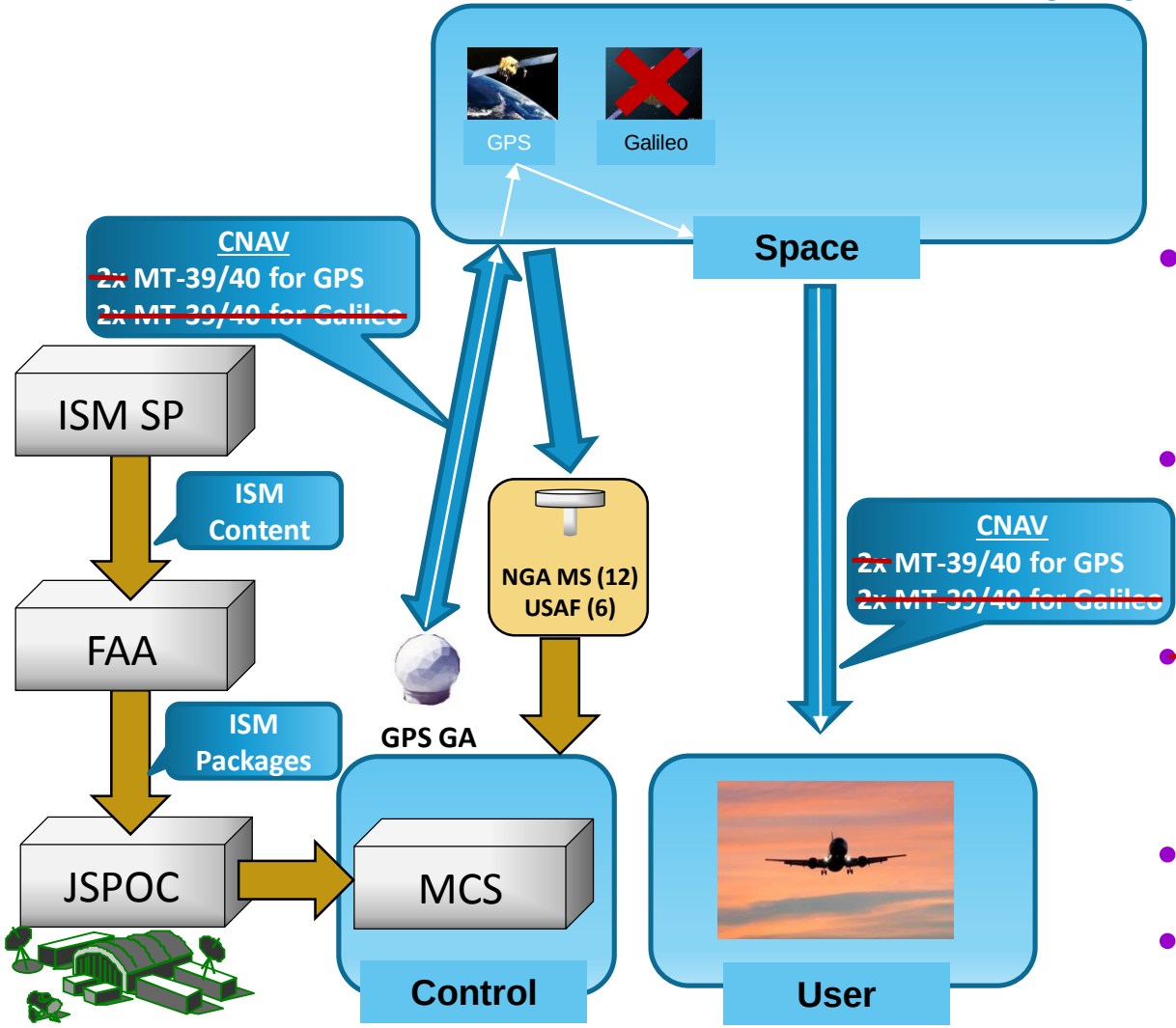
~~- Indirect provider of ISM data for Galileo~~
  - ~~Make arrangement with European authorities~~
  - ~~Suitable European “service provider” (e.g., GSA)~~
    - ~~Pay heed to EU’s *OS SDD* commitments~~
    - ~~Possible refinement using the EGNOS network~~
    - ~~Possible refinement using outside contractor~~
    - ~~Responsible for the ISM data for Galileo~~

GPS MT-38 "User Perspective"

- User receiver processes GNSS
  - GPS-only ~~or GPS+Galileo~~
- User receiver processes MT-38s
  - GPS-only ~~or GPS+Galileo~~
- User receiver performs FD/FDE
  - Better than standard RAIM
- User navigates safely
  - Life is good



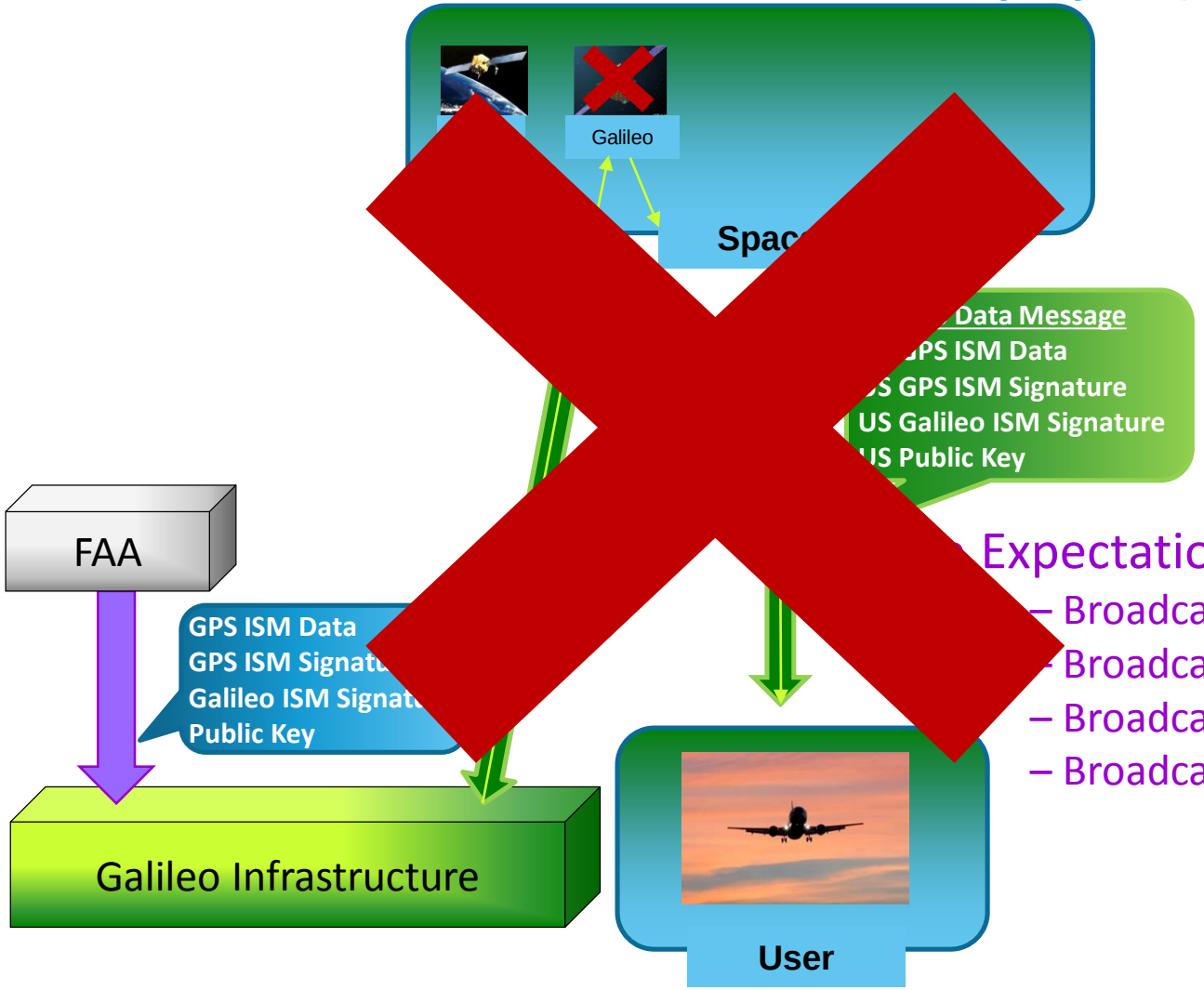
GPS MT-39/40 Special Features



- Digital Signatures*
  - Not technically required
  - Addresses other concerns
- FAA to digitally sign MT-38s
  - MT-38 for GPS
  - ~~MT-38 for Galileo~~
- ~~EU to digitally sign MT-38s~~
  - ~~MT-38 for GPS~~
  - ~~MT-38 for Galileo~~
- MT-39 is digital signature
- MT-40 is public key

* See FIPS PUBs 180-4 & 186-4

MT-38/39/40 *Quid Pro Quo*



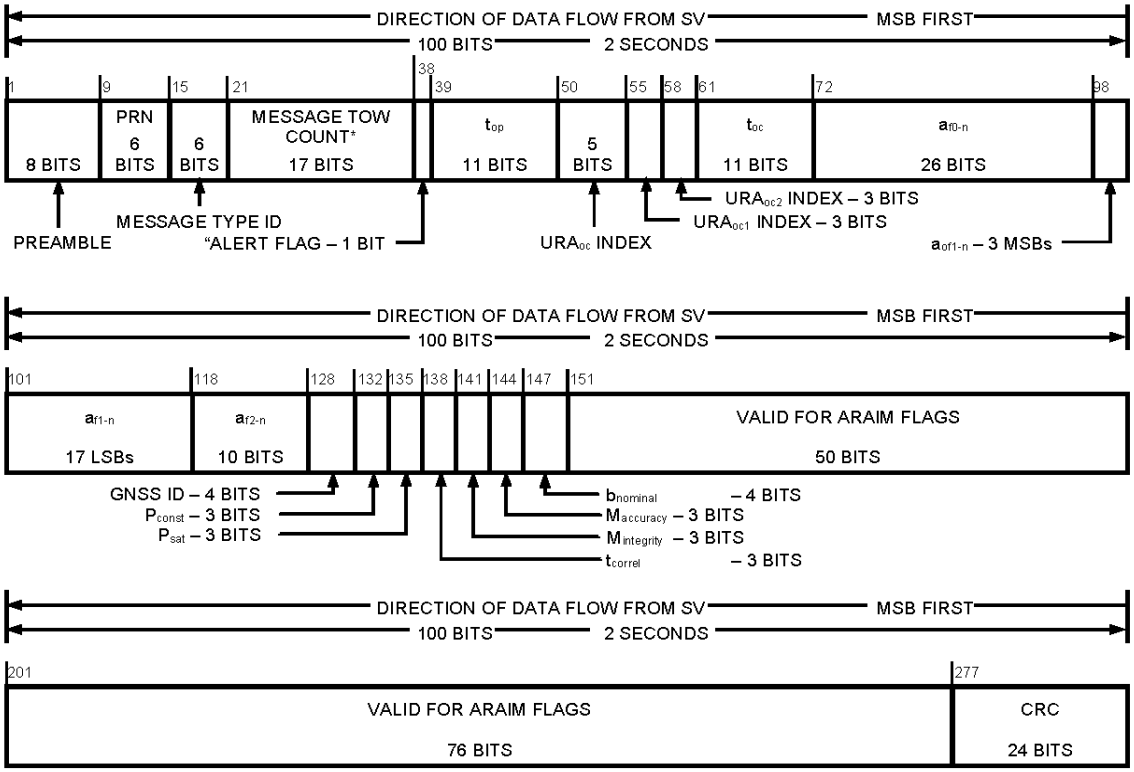
Expectations from Galileo

- Broadcast US GPS ISM data
- Broadcast US GPS ISM signature
- Broadcast US Galileo ISM signature
- Broadcast US public key

Outline

- **Integrity Support Message (ISM)**
- **GPS MT-38/39/40 Proposal**
  - MT-38 – ARAIM Parameters
  - MT-39 – ISM Management
  - MT-40 – ISM Signature Key
- **MT-38/39/40 Details**
  - L2CM signal, IS-GPS-200
  - L5I5 signal, IS-GPS-705
  - $L1C_D$ signal, IS-GPS-800
- **Concluding Remarks**

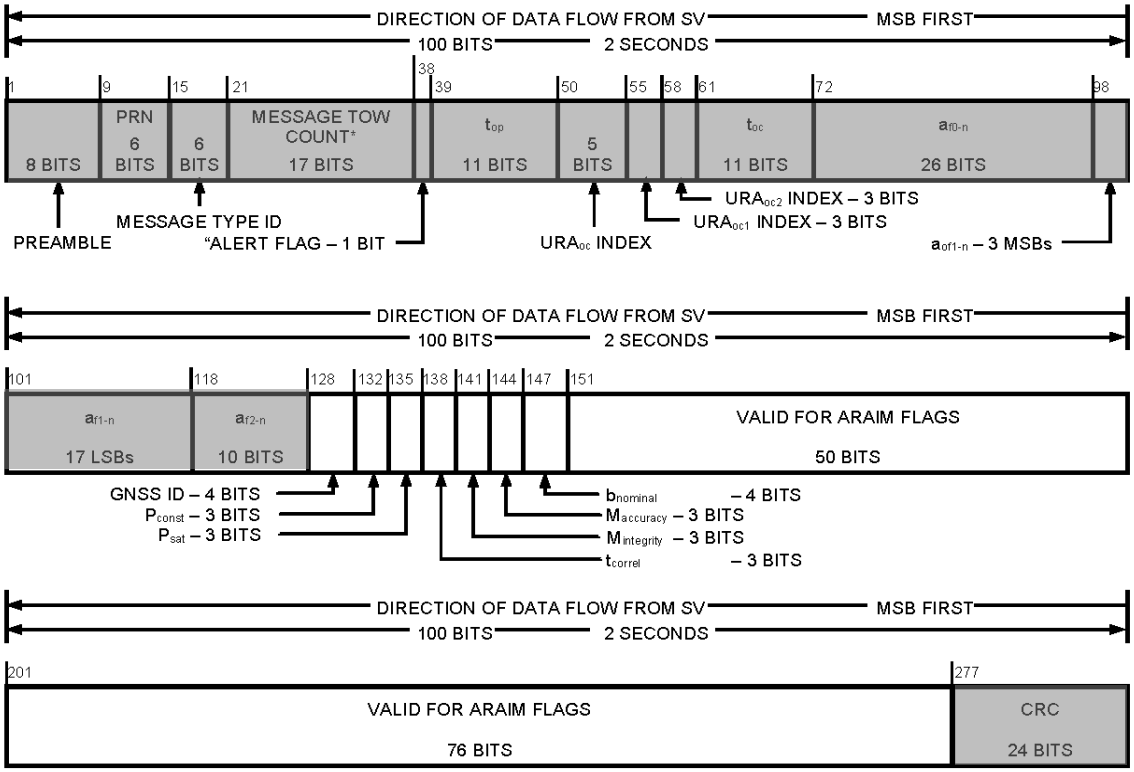
GPS MT-38 Details – 1



* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

Figure 20-15. Message Type 38 – Off-Line Integrity Support Message (ISM)

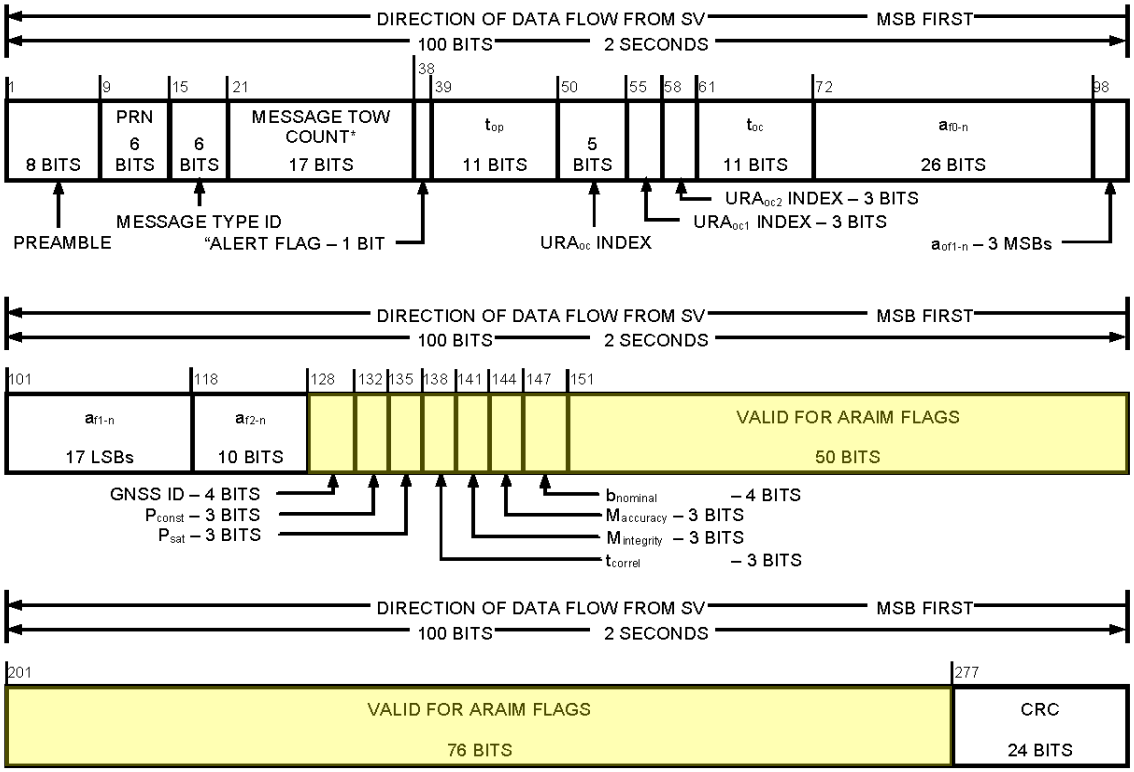
GPS MT-38 Details – I



* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

Figure 20-15. Message Type 38 – Off-Line Integrity Support Message (ISM)

GPS MT-38 Details – I



* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

Figure 20-15. Message Type 38 – Off-Line Integrity Support Message (ISM)

GPS MT-38 Details – II

Table 20-XII. ISM Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
GNSS ID	GNSS Constellation ID	4	1	8	see text
P_{const}	Probability of constellation integrity fault	3			see text
P_{sat}	Probability of satellite integrity fault	3			see text
t_{correl}	Correlation time constant	3			see text
$M_{integrity}$	URA multiplier for integrity	3			see text
$M_{accuracy}$	URA multiplier for accuracy	3			see text
$b_{nominal}$	Nominal pseudorange bias	4			see text
Flags	Valid for ARAIM flags	63 x (2)			see text

* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB.
** See Figure 20-15 for complete bit allocation in Message Type 38.
*** Unless otherwise indicated in this column, effective range is the maximum range attainable with indicated bit allocation and scale factor.

GPS MT-38 Details – III

20.3.3.10.2 GNSS Constellation ID.

Bits 129 through 131 of message type 38 shall identify the other GPS-like navigation system to which the associated ISM parameters apply. The four bits are defined as follows:

0000 = No data available
0001 = Galileo
0010 = GLONASS
0011 = BeiDou
0100 = GPS
0101 = SBAS
0110 = QZSS
0111 = IRNSS
1000 through 1111 = Reserved for other systems

GPS MT-38 Details – IV

Table 20-XIII. ARAIM Validity Flag Mapping

Bits	Galileo	GLONASS	BeiDou	GPS	SBAS	QZSS	IRNSS
151-152	SVID 1	Freq. 1	RCN 1	PRN 1	PRN 120	PRN 183	PRN 1
153-154	SVID 2	Freq. 2	RCN 2	PRN 2	PRN 121	PRN 184	PRN 2
155-156	SVID 3	Freq. 3	RCN 3	PRN 3	PRN 122	PRN 185	PRN 3
157-158	SVID 4	Freq. 4	RCN 4	PRN 4	PRN 123	PRN 186	PRN 4
159-160	SVID 5	Freq. 5	RCN 5	PRN 5	PRN 124	PRN 187	PRN 5
161-162	SVID 6	Freq. 6	RCN 6	PRN 6	PRN 125	PRN 188	PRN 6
163-164	SVID 7	Freq. 7	RCN 7	PRN 7	PRN 126	PRN 189	PRN 7
165-166	SVID 8	Freq. 8	RCN 8	PRN 8	PRN 127	PRN 190	Invalid
167-168	SVID 9	Freq. 9	RCN 9	PRN 9	PRN 128	PRN 191	Invalid
169-170	SVID 10	Freq. 10	RCN 10	PRN 10	PRN 129	PRN 192	Invalid
171-172	SVID 11	Freq. 11	RCN 11	PRN 11	PRN 130	PRN 193	Invalid
173-174	SVID 12	Freq. 12	RCN 12	PRN 12	PRN 131	PRN 194	Invalid
175-176	SVID 13	Freq. 13	RCN 13	PRN 13	PRN 132	PRN 195	Invalid
177-178	SVID 14	Freq. 14	RCN 14	PRN 14	PRN 133	PRN 196	Invalid
179-180	SVID 15	Freq. 15	RCN 15	PRN 15	PRN 134	PRN 197	Invalid
181-182	SVID 16	Freq. 16	RCN 16	PRN 16	PRN 135	PRN 198	Invalid
183-184	SVID 17	Freq. 17	RCN 17	PRN 17	PRN 136	PRN 199	Invalid
185-186	SVID 18	Freq. 18	RCN 18	PRN 18	PRN 137	PRN 200	Invalid
187-188	SVID 19	Freq. 19	RCN 19	PRN 19	PRN 138	PRN 201	Invalid
189-190	SVID 20	Freq. 20	RCN 20	PRN 20	PRN 139	PRN 202	Invalid
191-192	SVID 21	Freq. 21	RCN 21	PRN 21	PRN 140	Invalid	Invalid
193-194	SVID 22	Freq. 22	RCN 22	PRN 22	PRN 141	Invalid	Invalid
195-196	SVID 23	Freq. 23	RCN 23	PRN 23	PRN 142	Invalid	Invalid
197-198	SVID 24	Freq. 24	RCN 24	PRN 24	PRN 143	Invalid	Invalid
199-200	SVID 25	Freq. 25	RCN 25	PRN 25	PRN 144	Invalid	Invalid
201-202	SVID 26	Freq. 26	RCN 26	PRN 26	PRN 145	Invalid	Invalid
203-204	SVID 27	Freq. 27	RCN 27	PRN 27	PRN 146	Invalid	Invalid
205-206	SVID 28	Freq. 28	RCN 28	PRN 28	PRN 147	Invalid	Invalid
207-208	SVID 29	Freq. 29	RCN 29	PRN 29	PRN 148	Invalid	Invalid
209-210	SVID 30	Freq. 30	RCN 30	PRN 30	PRN 149	Invalid	Invalid
211-212	SVID 31	Freq. 31	RCN 31	PRN 31	PRN 150	Invalid	Invalid
213-214	SVID 32	Freq. 32	RCN 32	PRN 32	PRN 151	Invalid	Invalid
215-216	SVID 33	Invalid	RCN 33	PRN 33	PRN 152	Invalid	Invalid
217-218	SVID 34	Invalid	RCN 34	PRN 34	PRN 153	Invalid	Invalid
219-220	SVID 35	Invalid	RCN 35	PRN 35	PRN 154	Invalid	Invalid
221-222	SVID 36	Invalid	RCN 36	PRN 36	PRN 155	Invalid	Invalid
223-224	Invalid	Invalid	RCN 37	PRN 37	PRN 156	Invalid	Invalid
225-226	Invalid	Invalid	Invalid	PRN 38	PRN 157	Invalid	Invalid
227-228	Invalid	Invalid	Invalid	PRN 39	PRN 158	Invalid	Invalid
229-230	Invalid	Invalid	Invalid	PRN 40	Invalid	Invalid	Invalid
231-232	Invalid	Invalid	Invalid	PRN 41	Invalid	Invalid	Invalid
233-234	Invalid	Invalid	Invalid	PRN 42	Invalid	Invalid	Invalid
235-236	Invalid	Invalid	Invalid	PRN 43	Invalid	Invalid	Invalid
237-238	Invalid	Invalid	Invalid	PRN 44	Invalid	Invalid	Invalid

GPS MT-38 Details – V

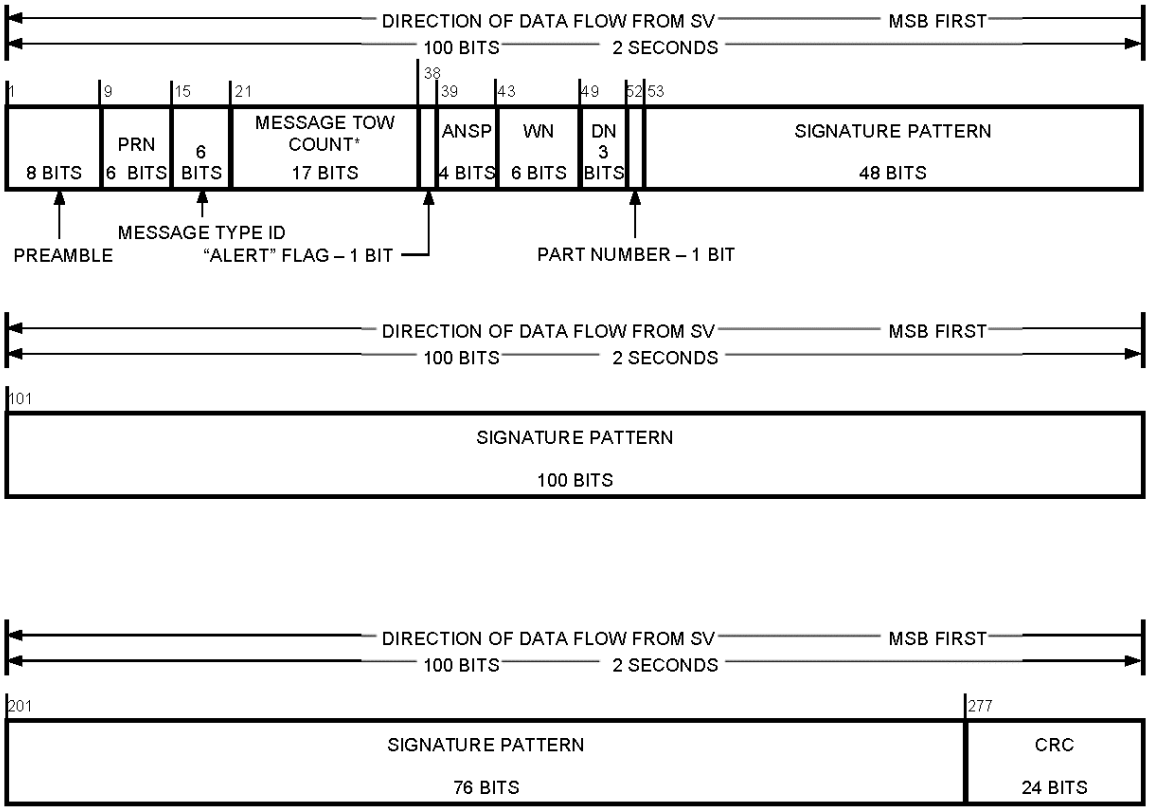
20.3.3.10.9 Valid for ARAIM Flags.

Bits 151 through 276 of message type 38 shall provide the assumed validity flags for ARAIM at the current time for the associated GNSS constellation. Two bits are allocated to each satellite in the associated GNSS constellation as follows:

00 = No such satellite exists or this satellite is not addressed in this ISM
01 = Do not use this satellite
10 = OK to use these ISM parameters for this satellite
11 = Do not use these ISM parameters for this satellite

The mapping of the two-bit validity flags to the particular satellites in each specified GNSS constellations is given in Table 20-XIII.

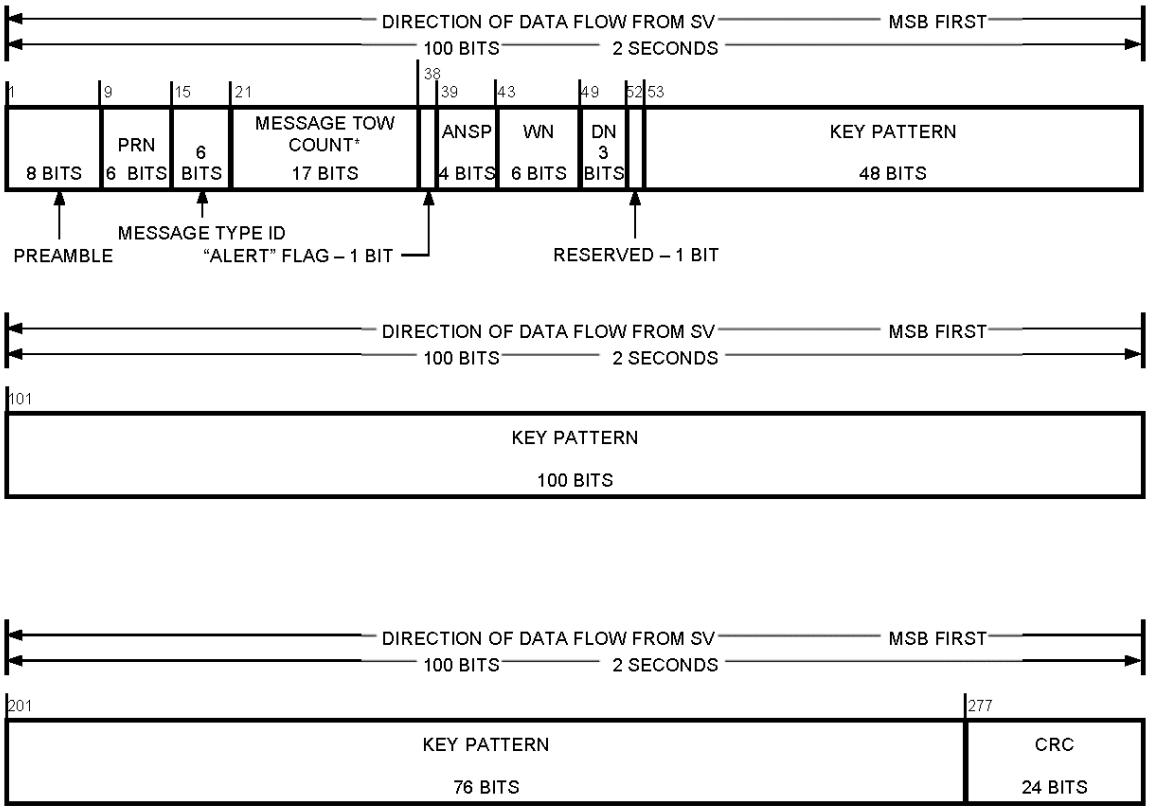
GPS MT-39 Details



* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

Figure 20-16. Message Type 39 – ISM Management Message (IMM)

GPS MT-40 Details



* MESSAGE TOW COUNT = 17 MSB OF ACTUAL TOW COUNT AT START OF NEXT 6-SECOND MESSAGE

Figure 20-17. Message Type 40 – ISM Signature Key Message (IKM)

Outline

- **Integrity Support Message (ISM)**
- **GPS MT-38/39/40 Proposal**
  - MT-38 – ARAIM Parameters
  - MT-39 – ISM Management
  - MT-40 – ISM Signature Key
- **MT-38/39/40 Details**
  - L2CM signal, IS-GPS-200
  - L5I5 signal, IS-GPS-705
  - $L1C_D$ signal, IS-GPS-800
- **Concluding Remarks**

Concluding Remarks

- **Expect the IS-GPS-705 PPIRN soon**
  - "Preliminary Proposed Interface Revision Notice"
    - Basically a draft PIRN
    - Remaining work is filling in digital signature details
- **One more round of PPIRN review with stakeholders**
  - US-EU Working Group C (including Galileo)
  - FAA
  - GP internal
  - DoD stakeholders
- **Teeing-up for RFC and PIRNs at next PICWG**
  - A 'live sky demo' might be useful at this stage

WALK-ON TOPICS

RNSSI 2018
PICWG Slides

RNSSI 2018
PICWG White Pape

ACTION ITEM REVIEW
(If Necessary)

Closing Remarks

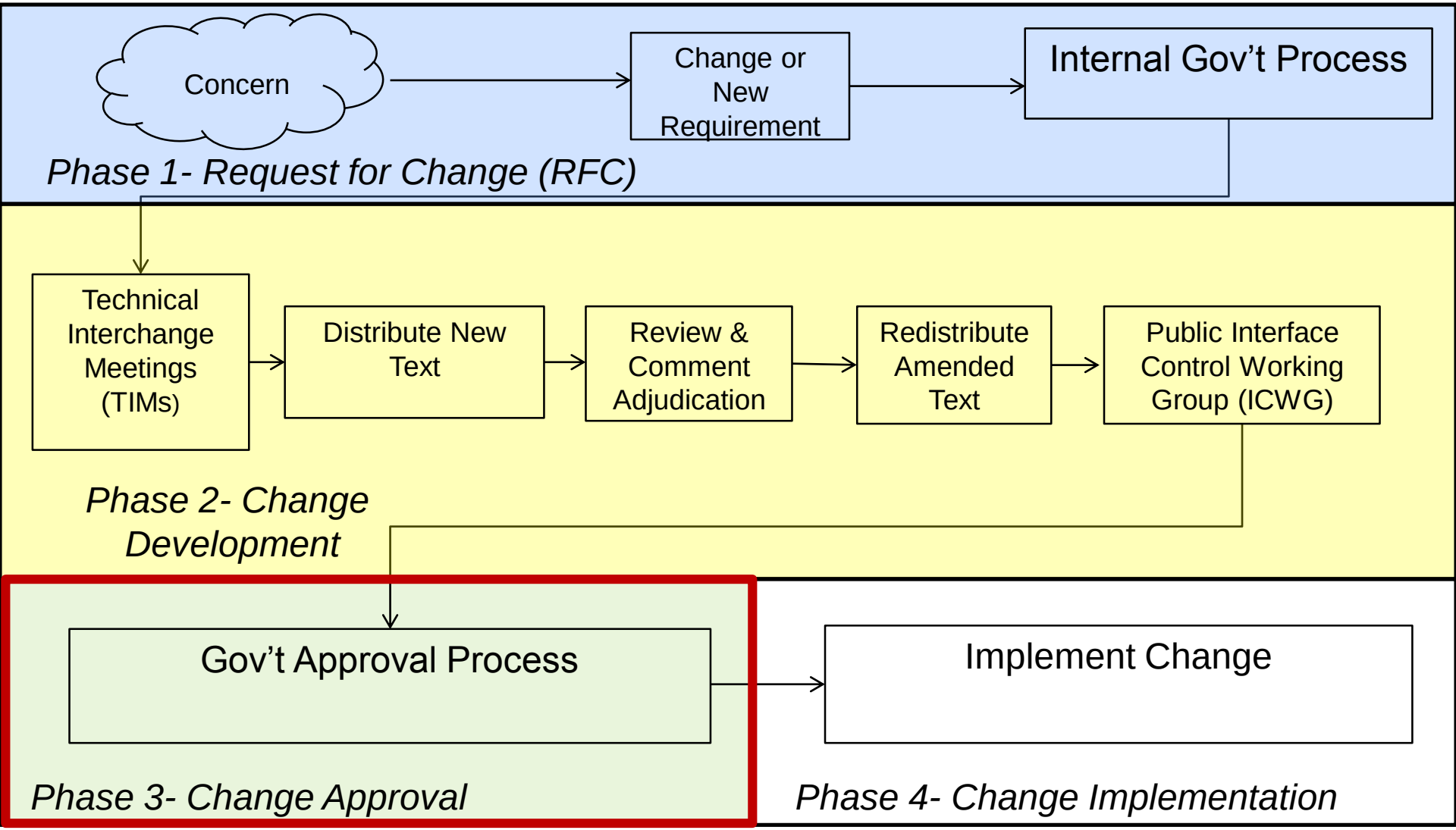
Mr. James Horejsi

Chief Engineer, Global Positioning Systems (GPS) Directorate Space and Missile Systems Center

Closing Comments

- 2019 Public ICWG (GPS public docs) is tentatively scheduled for September
  - Submit any GPS public document concern to the government workflow identified below
  - For consideration in the 2019 Public ICWG, the government requests any concern submission to be sent NLT **28 Feb 19**
- Changes to the signals-in-space documents will be sent out for a 2-week review after today's PICWG
- Direct any follow-up communication related to this meeting to smcgper@us.af.mil
- Final minutes will be posted to GPS.gov following Government approval
- Final updates to the public documents will be available on GPS.gov following approval by the Configuration Control Board & Public Affairs
- Please provide feedback to the GPS requirements team to enable the continual improvement of this meeting

Change Management High Level Process Flow



Thank You

for attending the

2018 Public ICWG!!!