

# Global Positioning System (GPS)

## Public Interface Control Working Group (ICWG) & Public Forum

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September 27, 2023  
0830-1700 PDT

# Post-Public ICWG Version

Modified pages are marked with



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POC: SSC/CG

United States Space Force  
Positioning, Navigation, and Timing Mission Area  
Major Cobb Brandon  
Captain Rick Merchant



# Dial-in Information



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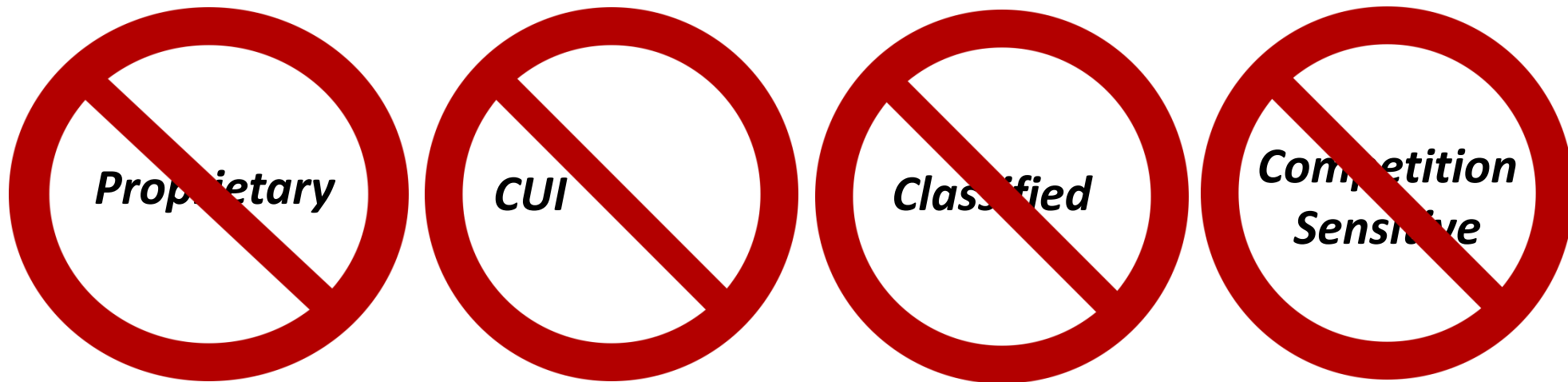


# Roll Call



# Rules of Engagement

# UNCLASSIFIED



**ABSOLUTELY NO PROPRIETARY, CUI, 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
- For dial-in attendees, DO NOT take calls from phone while on telecom
- Comments against the topics listed on the official agenda will get priority during discussion
- Topics that warrant additional discussion may be side-barred
- Walk-on topics may be discussed during the open discussion
- Meeting minutes and final Proposed Change Notices (PCNs) will be generated and distributed as a product of this meeting
- Please announce your name and organization before addressing the group

# Rules of Engagement (Cont'd)

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

# Rules of Engagement (Cont'd)

The purpose of the meeting is to:

- 1) Obtain ICWG approval on the proposed language generated for the enterprise RFCs that impact the public documents
- 2) Discuss any new open forum items against the Public Signals in Space documents

# Agenda

Public ICWG (1 <sup>st</sup> Half of Day)		
	Presenter	Times
GPS Public ICWG and Public Forum Meeting Overview	Capt. Rick Merchant	08:30 08:45
Opening Remarks / GPS Overview	Maj. Stewart Brandon	08:45 09:05
<b>2023 Public ICWG RFC Discussion</b>		
• RFC-502 - 2023 Proposed Changes to the Public Documents	Tony Anthony	09:05 10:30
<b>Break</b>		<b>10:30 10:40</b>
• RFC-477 - OCX XML Products For Civil Users	Danny Froerer	10:40 11:00
Action Item Review		11:00 11:15
<b>Lunch Break (1 hour)</b>		<b>11:15 12:15</b>

Public Forum Presentations (2 <sup>nd</sup> Half of Day)		
	Presenter	Times
• Status – ISM Proposed Changes to the Requirements Baseline	Capt. Merchant	12:15 12:35
• ISM CSOC IPT Recommendation	Dr. Hansen	12:35 13:05
• Next Generation OCX XML	S. Hillman	13:05 13:25
<del>• USCG Presentation</del>	<del>————</del>	<del>13:25 13:45</del>
<b>Break</b>		<b>13:45 13:55</b>
• PRN Expansion	Karl Kovach	13:55 14:15
<del>Walk-on Topics, Open Discussion</del>	<del>————</del>	<del>14:15 14:45</del>
PRAT - Public Req. Accountability Tool	Tony Anthony	14:45 15:15
Action Item Review		15:15 15:35
Closing Remarks	Maj. Brandon	15:35 15:40



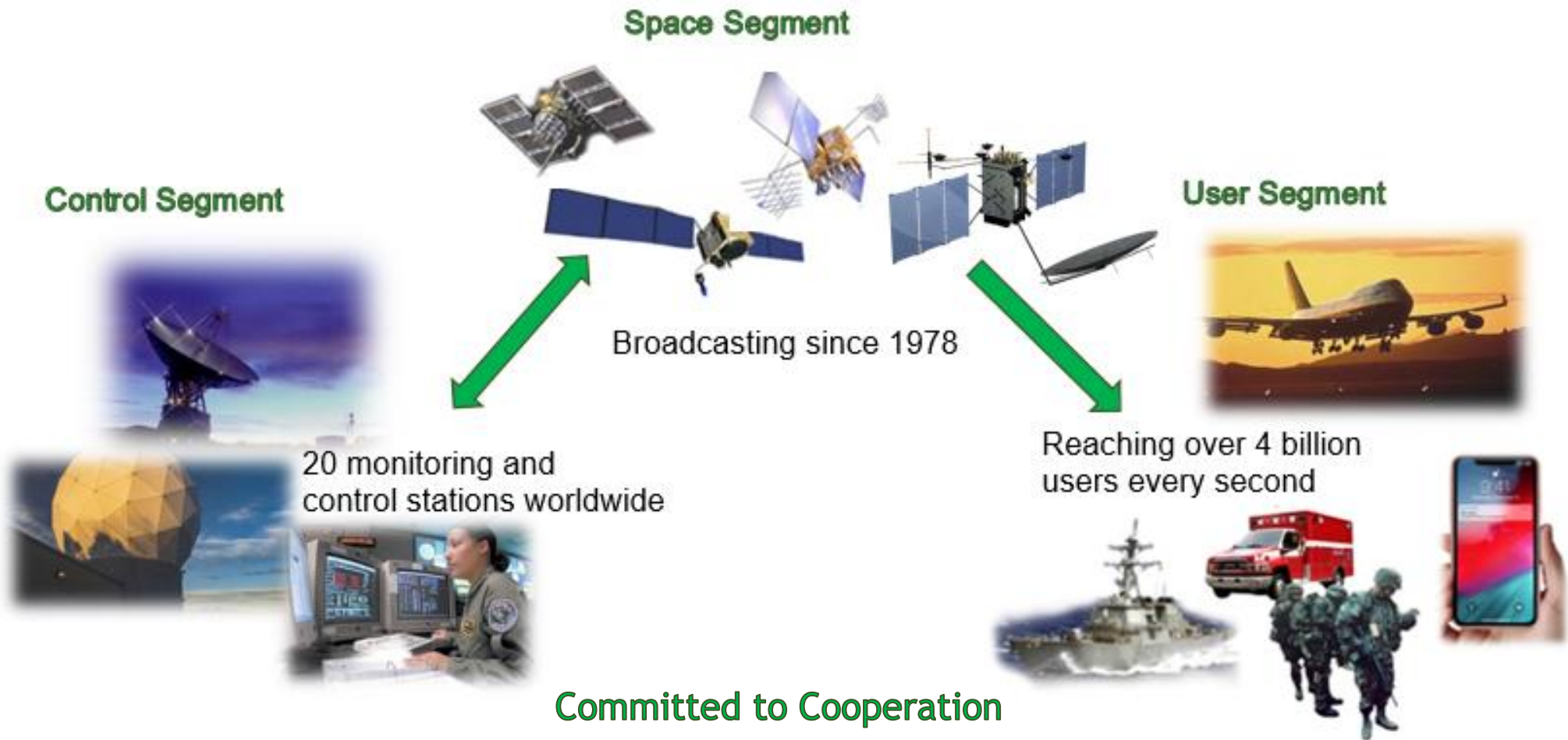


# Opening Remarks

Global Positioning System (GPS) Position, Navigation, and Timing  
Mission Area  
September 27, 2023

**Major Stewart C. Brandon**  
Chief, Positioning, Navigation and Timing  
Requirements and Integration Branch

# GPS Overview (DoD)



Department of Defense • Army • Navy • Air Force • Space Force • USMC • NGA • DISA • USNO • NSA • PNT EXCOM  
 National Nuclear Security Administration (NNSA) • Department of Transportation • Federal Aviation Administration  
 Department of Homeland Security • U.S. Coast Guard • International Civil Aviation Organization  
 Global Navigation Satellite Systems • Galileo • Beidou • GLONASS • QZSS • NAVIC  
 International Committee on GNSS • International Telecommunication Union

# GPS Overview

## Global Positioning Satellites: Encompassing the DoD and Civil Industry Partners

- GPS is utilized across the world with
- 6B+ users! GPS impacts almost every industry some of these industries include:
  - Agriculture
  - Maritime
  - Public Safety
  - Recreation
  - Space
  - Aviation
  - Finance
  - Telecommunications
  - Telematics
  - Oil/Gas
- GPS economic benefit ~\$1.4 Trillion\*



*GPS consistently met all technical performance commitments: Accuracy, Integrity, Availability and Continuity Integrity, Availability and Continuity*



# GPS Constellation Status

**38 Satellites • 31 Set Healthy**  
**Baseline Constellation: 24 Satellites**



Satellite Block	Quantity	Average Age (yrs)	Oldest
GPS IIR	13 (5*)	20.7	26.1
GPS IIR-M	8 (1*)	14.9	17.9
GPS IIF	11 (1*)	8.6	13.3
GPS III	5	2.4	4.7

\*Not set healthy

As of 2 Aug 23

## GPS Signal in Space (SIS) Performance

Week ending on 3 Sept 23

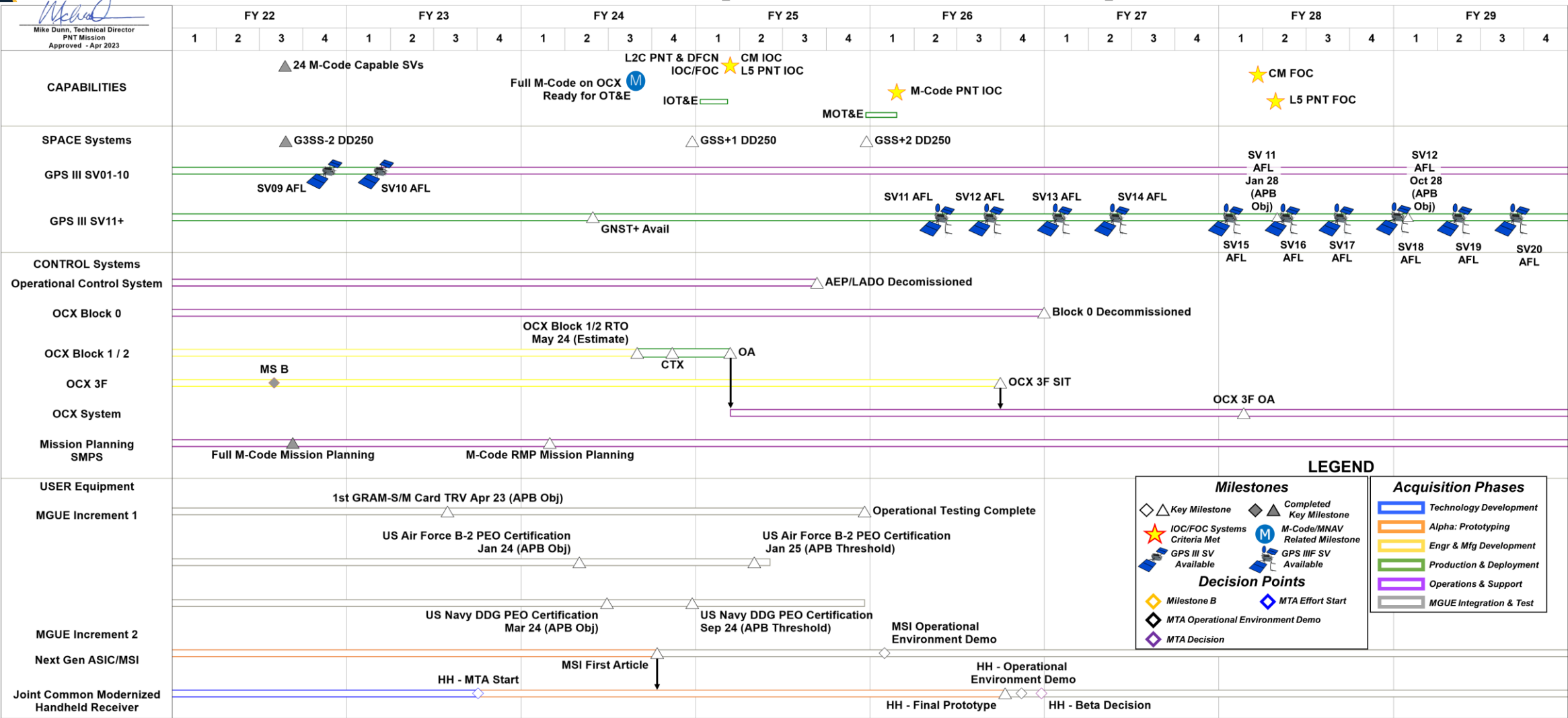
Average URE*	Best Day URE	Worst Day URE
49.1 cm	31.5 cm (20 Apr 21)	64.8 cm (20 May 22)

\*All User Range Errors (UREs) are Root Mean Square values

# GPS Enterprise Roadmap



Mike Dunn, Technical Director  
PNT Mission  
Approved - Apr 2023



**LEGEND**

**Milestones**

- ◇ Key Milestone
- ★ IOC/FOC Systems Criteria Met
- ⚡ GPS III SV Available
- ⚡ GPS III F SV Available
- ◇ Milestone B
- ◇ MTA Operational Environment Demo
- ◇ MTA Decision
- ⬢ Completed Key Milestone
- ⬢ M-Code/MNAV Related Milestone
- ⬢ MTA Effort Start

**Acquisition Phases**

- Technology Development
- Alpha: Prototyping
- Engr & Mfg Development
- Production & Deployment
- Operations & Support
- MGUE Integration & Test

AEP	Architecture Evolution Plan	DFCN	Dual-Frequency Civil Navigation	HH	Handheld	MOT&E	Multi-Service Operational Test & Evaluation	PNT	Positioning, Navigation & Timing
AFL	Available for Launch	FOC	Full Operational Capability	IOC	Initial Operating Capability	MSI	Miniature Serial Interface	RMP	Regional Military Protection
APB	Acquisition Program Baseline	GRAM-S/M	GPS Receiver Application Module – Standard Elec Module/Modernized	IOT&E	Initial Operational Test & Evaluation	MTA	Middle Tier Acquisition	RTO	Ready for Transition to Ops
ASIC	Application-Specific Integrated Circuit	G3SS	GPS III Satellite Simulator	JLTV	Joint Light Tactical Vehicle	OA	Operational Acceptance	SMPS	SAASM Mission Planning System
CM	Constellation Management	GNST+	GPS III F Non-Flight Satellite Testbed	LADO	Launch, Anomaly, and Disposal Operations	OCX	Next Gen Operational Control System	SIT	System Integration Test
CTX	Constellation Transfer	GSS	GPS Satellite Simulator	M-Code	Military Code	OT&E	Operational Test and Evaluation	SV	Space Vehicle
DDG	Arleigh Burke Guided Missile Destroyer			MGUE	Military GPS User Equipment	PEO	Program Executive Officer	TRV	Technical Requirements Verification



# GPS III

- SV01 Set healthy and available for use on 13 Jan 20
- SV02 Set healthy and available for use on 1 Apr 20
- SV03 Set healthy and available for use on 1 Oct 20
- SV04 Set healthy and available for use on 2 Dec 20
- SV05 Set healthy and available for use on 25 May 22
- SV06 Set healthy and available for use on 16 Feb 23
- SV07 in storage - AFL 20 May 21; TLD June 2024
- SV08 in storage - AFL 10 Jun 21; TLD Q1 FY25
- SV09 in storage - AFL 23 Aug 22; TLD FY26
- SV10 in storage - AFL 8 Dec 22; TLD FY26



***Six GPS III satellites declared operational***



# GPS III Follow-On (GPS IIIF)

- GPS IIIF additional features
  - Regional Military Protection (RMP) and redesigned Nuclear Detonation Detection System (NDS)
  - Search-and-Rescue (SAR) payload - faster detection and location of distress signals
  - Laser Retroreflector Array (LRA) - provides more precise ranging data
  - Partnering with Air Force Research Laboratory (AFRL) for future technology opportunities
    - Demo on Navigation Technology Satellite (NTS-3)
      - Digital Reprogrammable Payloads
      - Advanced Clocks
  - Status: Milestone C Completed 13 Jul 20; GPS IIIF Non-Flight Satellite Testbed (GNST+) build-up completed Jul 23; SV11 launch forecasted for FY2027



*Ensuring the Gold Standard today and into the future*



# Next Generation Operational Control System (OCX)

- Next-generation command, control and cyber-defense for GPS
  - Enhanced command and control capability
  - Modernized architecture
  - Robust information assurance and cyber security
- Incremental Development
  - OCX Block 0: Launch and Checkout System (LCS) for GPS III
  - OCX Blocks 1 and 2: Controls and manages all GPS IIR, GPS IIR-M, GPS IIF, and GPS III spacecraft; and controls all legacy and new GPS signals
  - OCX 3F: Adds support to OCX for GPS IIF vehicle and new capabilities including Regional Military Protection
- Current Status
  - LCS successfully supported Launch and Checkout for GPS III SV01-SV05
  - OCX Block 1 completed factory integration and in Golden Dry Run for factory qualification
  - Constellation Transfer (CTX) 4QFY24; Operational Acceptance target FY25



***OCX program continues to execute and is nearing completion***



# GPS Modernization



## SPACE SEGMENT (SATELLITES)

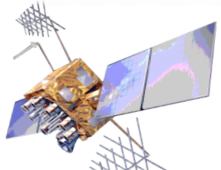
### Legacy (GPS IIA/IIR)

- Basic GPS
- NUDET (Nuclear Detonation Detection System (NDS))



### GPS IIR-M

- 2nd Civil Signal (L2C)
- New Military Signal
- Increased Anti-Jam Power



### GPS IIF

- 3rd Civil Signal (L5)
- Longer Life
- Better Clocks



### GPS III (SV01-10)

- Accuracy & Power
- Increased Anti-Jam Power
- Inherent Signal Integrity
- 4th Civil Signal (L1C)
- Longer Life
- Improved Clocks



### GPS IIIF (SV11-32)

- Unified S-Band Telemetry, Tracking, & Commanding
- Search & Rescue (SAR) Payload
- Laser Retroreflector Array
- Redesigned NDS Payload
- Regional Military Protect (RMP)

## CONTROL SEGMENT (GROUND)

### Legacy (OCS)

- Mainframe System
- Command & Control
- Signal Monitoring

### Architecture Evolution Plan (AEP)

- Distributed Architecture
- Increased Signal Monitoring Coverage
- Security & Accuracy
- Launch And Disposal Operations



### OCX Block 0

- GPS III Launch & Checkout

### GPS III Contingency Ops (COps)

- GPS III Mission on AEP

### M-Code Early Use (MCEU)

- Update OCS to operationalize Core M-Code on AEP

### OCX Blocks 1 and 2

- Fly GPS IIR/-M, GPS IIF, GPS III
- Modernize Cyber Architecture
- Operationalize Civil Signals (L1C, L2C, L5)
- Full M-Code

### OCX Block 3F

- Incorporates GPS IIIF Command & Control
- Integrates new capabilities



## USER SEGMENT (RECEIVERS)

### Legacy (PLGR/GAS-1/MAGR)

- First Generation System



Visit [GPS.gov](http://GPS.gov) for more info

### SAASM-era User Equipment

- Anti-Jam capability
- Electronic Protection



### Military GPS User Equipment

- M-Code Receivers
- Common GPS Modules
- Increased Access Power w/ M-Code
- Increased Accuracy
- Increased Availability
- Increased Anti-Tamper Anti-Spoof
- Increased Acquisition in Jamming





# GPS Requirements Management

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September 27, 2023

Major Stewart Brandon  
Chief, Positioning, Navigation, and  
Timing Requirements and  
Integration Branch

# GPS Requirements Team



## Space Force

- Maj Stewart Brandon, Chief, Positioning, Navigation and Timing Requirements & Integration Branch
- Maj Adam Rich, Deputy Chief, Positioning, Navigation and Timing Requirements & Integration Branch
- Capt Rick Merchant, Chief, PNT Spectrum Management
- 2d Lt Zachary Carroll, Chief, PNT Requirements & Technology

## Aerospace

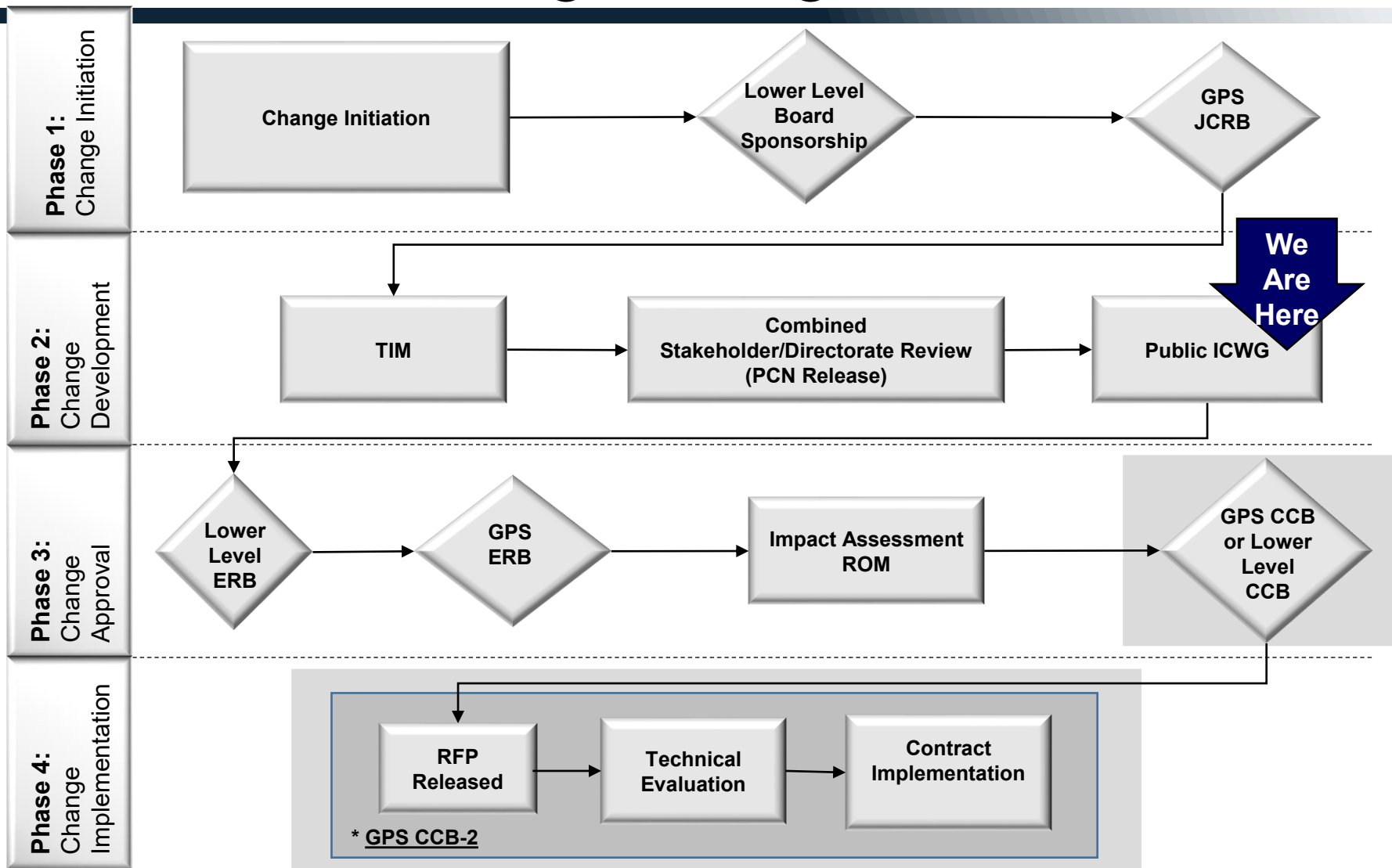
- Dr. Rhonda Slattery, Enterprise Requirements Lead
- Mr. Karl Kovach, Civil Requirements Lead
- Mr. Bert Hayden, Senior Engineer Specialist

## Systems Engineering and Integration (SE&I)

- Mr. Don Latterman, Senior Technical Advisor
- Mr. Tony Anthony, Responsible Engineer
- Mr. Danny Froerer, Responsible Engineer



# Technical Baseline Change Management Process Flow Chart



JCRB= Joint Change Review Board  
ERB= Engineering Review Board

TIM= Technical Interchange Meeting  
ROM= Rough Order of Magnitude

PCN= Proposed Change Notice  
CCB= Configuration Control Board

ICWG= Interface Control Working Group  
RFP= Request for Proposal



# Action Items and Feedback

- We will record actions during the discussions and share during the Action Item agenda item
- If you have further actions or feedback after the 2023 PICWG please submit to [ssccgepr@spaceforce.mil](mailto:ssccgepr@spaceforce.mil)



# *QUESTIONS?*

# RFC-502 Positioning, Navigation and Timing Mission Public ICWG Slides

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## **PUBLIC-ICWG/AWG #2**

27-SEP-2023

## **DOCUMENT CLASSIFICATION**

Unclassified

## **REQUEST FOR CHANGE (RFC) NUMBER**

RFC-502

## **RFC TITLE**

*2023 Proposed Changes to the Public Documents*

### **GOVERNMENT POC**

Capt. Rick Merchant, SSC/CGEP, 310.653.1871

### **SE&I POC**

Tony Anthony, SSC/CGE/SE&I, 310.418.7693

### **CM POC**

Veronica Quebedeaux, SSC/CGE/SE&I, 310.414.2856





# Bottom Line Up Front

- Being a Public RFC supporting the Public ICWG, this RFC's path and approvals are more complex than for most RFCs - many steps are doubled
- The Public Interface Control Working Group meeting today serves the purpose of the official Adjudication Working Group as defined for the TBCMP
- What is agreed to today will most likely be applied to the public documents
  - IS-GPS-200
  - IS-GPS-705
  - IS-GPS-800





# RFC-502: 2023 Proposed Changes to the Public Documents

**RFC CHANGE TYPE:** Correction or Clarification to Baseline

## 1) PROBLEM STATEMENT:

Item	Problem	Pre-RFC	PRAT*
1	Finalize the CNAV Schedules Technical Baseline changes	1187	2022-03
2	Determine if a clarifying note is needed on the equal applicability of the $b_{nom}$ computation to LNAV and CNAV; provide note as needed	1266	2022-04
3	Resolve the Data ID Issue (a commercial vendor did not want Data IDs other than 2)	1203	2021-05
4	Add the maximum power for GPS III/IIIF SVs to IS-GPS-200	1231	
5	Accommodate all administrative fixes possible from Boeing's list of fixes	--	

\* PRAT – Public Requirements Accountability Tool

# RFC-502: 2023 Proposed Changes to the Public Documents



## 2) SOLUTION:

Make updates to public documents IS-GPS-200, IS-GPS-705, IS-GPS-800 as appropriate

Item	Problem
1	Update the CNAV message schedule information
2	Publish the resolution for the Data ID Issue to IS-GPS-200
3	Add the maximum power for GPS III/IIIF SVs to IS-GPS-200
4	Fix the two figures that have the most readability problems

## 3) SPONSOR, DRIVER & IMPORTANT DATES: THIS RFC IS: ROUTINE

Sponsor: CGEP				Lead Driver Event: L2C PNT IOC/FOC and Dual Frequency Civil Navigation (DFCN) IOC/FOC & L5 PNT IOC				Lead Driver Event Date: 2025		
JCRB	TIM	Stakeholder Review	Comments Due	Resolve Comments	AWG	LL ERB	GPS ERB	Impact Assessment Period	LL CCB	CCB
6 Feb 23	15 Feb 23 1 Mar 23	15 Mar 23  7 Jul 23	14 Apr 23  11 Aug 23 & 22 Aug 23	30 Apr 23  25 Aug 23	17 May 23 (Gov AWG)  27 Sep 23 P-ICWG	31 May 23 "vector check"  25 Oct 23	1 Nov 23	3 Nov 23 – 3 Jan 24	17 Jan 24	23 Jan 24

## 4) APPROVAL AUTHORITY: (Select one)

<input checked="" type="checkbox"/>	Enterprise	Proposed Change (or Variance) affects multiple Segments' Technical Baseline(s), prime contractor documentation or external agencies outside of the GPS Directorate
<input type="checkbox"/>	Lower Level	Proposed Change (or Variance) affects one Segment's Technical Baseline or prime contractor documentation

# RFC-502 Stakeholder Review Status



## 15) REVIEW STATUS

Office	Response Required	No Impact	No Comments	Comments	No Response	EXTERNAL STAKEHOLDERS	Response Required	No Impact	No Comments	Comments	No Response
CGJA (PCA; GPA)	RR		X			USSF, SpOC 2 SOPS (SPOC 2 SOPS)	RR			X	
CGJC (ZACS-Civil; GPC)	RR	X				Space Delta 8 (was 50OG)	RR			X	
CGJG (ZACS-NGA; GPD)	RR		X			SpOC/PNT-MAT (was SpOC/S5M)	RR	X			
CGEP (ZACS-PNT; GPE)	RR		X			National Security Agency (NSA)	RR		X		
CGEV (PCET; GPEV)	RR		X			NGA	RR		X		
CGCC OCX 3F (PCCC)	RR		X			PNT—PO (ADAP, MAGR, DAGR); EGI-M	RR		X		
CGCC SMPS (PCCC; GPGC)	RR		X			AFLCMC/EBD			X		
CGCX (PCCX; GPGX)	RR		X			USSF/S5R	RR				
CGL (PCL; GPL)	RR		X			DOT/FAA	RR			X	
CGG (ECPG; GPL)	RR			X		PRIME CONTRACTORS					
CGJN (PCV; GPN; PCN)	RR		X			GPS IIR/IIR-M/III/IIIF On Orbit Sust - LM	RR			X	
CGX (PCT; GPT)	RR		X			GPS IIF On-Orbit Sust - Boeing	RR		X		
CGU (PCU; GPU)	RR			X		GPS III - LM	RR			X	
CGV3 (PCM3; GPV3)	RR			X		GPS IIIIF - LM	RR			X	
CGVF (PCMF; GPV4)	RR			X		GCS II – Sust - LM	RR	X			
SNWN (PCCN; GPGN)	RR		X			OCX 1/2 - RTX	RR		X		
SNPB	RR					OCX 3F - RTX	RR		X		
AEROSPACE	RR			X		MGUE Inc 1 - KTR A	RR		X		
MITRE	RR			X		MGUE Inc 1 - KTR B	RR		X		
SE&I	RR		X			MGUE Inc 1 - KTR C	RR			X	
EXTERNAL STAKEHOLDERS						MGUE Inc 2 MSI - BAE	RR			X	
PM-PNT (Army)			See CGJA (PCA; GPA) Response			MGUE Inc 2 MSI - L3H	RR		X		
NIWC PAC			See CGJN (PCV; GPN) Response			MGUE Inc 2 MSI - RTX	RR		X		
USNO			See CGJN (PCV; GPN) Response			SMPS Development - BAH	RR	X			
USMC			See CGJN (PCV; GPN) Response			SMPS Sust - Lockheed Martin	RR	X			
NAWCAD			See CGJN (PCV; GPN) Response			USNDS Ground 6 / ICADS 7 - Sandia	RR	X			

# Stakeholder Review Comment Resolution Matrix (CRM) Status - at May 31<sup>st</sup>, 2023 Lower Level Board



<b>16) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:</b>						
<b>Disposition/Type</b>	<b>Critical</b>	<b>Substantial</b>	<b>Administrative</b>	<b>Totals</b>	<b>Concurrence</b>	<b>Notes</b>
<b>Accept</b>	<b>5</b>	<b>17</b>	<b>19</b>	<b>41</b>	<b>41</b>	
<b>Accept with Comment</b>	<b>2</b>	<b>29</b>	<b>7</b>	<b>38</b>	<b>38</b>	
<b>Reject</b>	<b>3</b>	<b>15</b>	<b>2</b>	<b>20</b>	<b>20</b>	
<b>Defer</b>	<b>1</b>	<b>5</b>		<b>6</b>	<b>6</b>	
<b>Question</b>		<b>2</b>		<b>2</b>	<b>2</b>	
<b>Grand Totals:</b>	<b>11</b>	<b>68</b>	<b>28</b>	<b>107</b>	<b>107</b>	

# Stakeholder Review Comment Resolution Matrix (CRM) Status - at This Review



16) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:						
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence	Notes
Accept		8	5	13	13	
Accept with Comment	1	8	3	12	12	
Reject		2		2	2	
Defer		4	1	5	5	
Question	2		1	3	3	
Withdrawn	1	1	3	5	5	
Grand Totals:	4	23	13	40	40	

**100%  
Concurrence**

# Stakeholder Comment Resolution Matrix (CRM) Status - New Comments At the Public ICWG



16) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:						
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence	Notes
Accept		1		1	1	
Accept with Comment		3		3	3	
Reject						
Defer		1		1	1	
Question						
Withdrawn						
Grand Totals:		5		5	5	



# WN and WN<sub>op</sub> Fixes to all CEI Data Set Parameter Tables



<b>DOORS ID</b>	IS200-1639, IS705-1521, IS800-917		
<b>Paragraph</b>	Table 30-I Message Types 10 and 11 Parameters Table 20-I Message Types 10 and 11 Parameters Table 6.2-18 CEI Data Set Parameters	<b>Comment Number</b>	CRM #156, 164, 165
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	<p>156 Incorrect description of the WN term in the table describing MT-10 , Data Sequence Propagation Week Number -&gt; Week Number</p> <p>164 Table should include WN<sub>op</sub> with parameter name "CEI Data Sequence Propagation Week Number"</p> <p>165 WN parameter incorrectly characterized, Data Sequence Propagation Week Number -&gt; Week Number</p>		
<b>Government Response</b>	Accepted. These specific changes were vetted in RFC-495A. Although the CEI Data Set Notes changes were deferred from this RFC, these corrections to WN and WN <sub>op</sub> do not constitute changes to the Notes and will be corrected with this RFC.		



# WN and WN<sub>op</sub> Fixes to all CEI Data Set Parameter - Redlines

Paragraph	IS200-1639, IS705-1521, IS800-917																											
IS-GPS-200 Redlines		<table border="1"> <thead> <tr> <th>Symbol</th> <th>Parameter Name</th> <th>Subframe</th> <th>Message</th> </tr> </thead> <tbody> <tr> <td>...</td> <td></td> <td></td> <td></td> </tr> <tr> <td>WN</td> <td><del>Data Sequence Propagation</del> Week Number</td> <td>1</td> <td>10</td> </tr> <tr> <td>T<sub>GD</sub></td> <td>Group Delay Differential</td> <td>1</td> <td>30</td> </tr> <tr> <td>WN<sub>OP</sub></td> <td><u>CEI Data Sequence Propagation Week Number</u></td> <td>N/A</td> <td><u>30-37</u></td> </tr> <tr> <td>...</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Symbol	Parameter Name	Subframe	Message	...				WN	<del>Data Sequence Propagation</del> Week Number	1	10	T <sub>GD</sub>	Group Delay Differential	1	30	WN <sub>OP</sub>	<u>CEI Data Sequence Propagation Week Number</u>	N/A	<u>30-37</u>	...					
Symbol	Parameter Name	Subframe	Message																									
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WN	<del>Data Sequence Propagation</del> Week Number	1	10																									
T <sub>GD</sub>	Group Delay Differential	1	30																									
WN <sub>OP</sub>	<u>CEI Data Sequence Propagation Week Number</u>	N/A	<u>30-37</u>																									
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IS-GPS-705 Redlines		<table border="1"> <thead> <tr> <th>Symbol</th> <th>Parameter Name</th> <th>Message</th> </tr> </thead> <tbody> <tr> <td>...</td> <td></td> <td></td> </tr> <tr> <td>WN</td> <td>Week Number</td> <td>10</td> </tr> <tr> <td>...</td> <td></td> <td></td> </tr> <tr> <td>T<sub>GD</sub></td> <td>Group Delay Differential</td> <td>30</td> </tr> <tr> <td>WN<sub>OP</sub></td> <td><u>CEI Data Sequence Propagation Week Number</u></td> <td><u>30</u></td> </tr> <tr> <td>...</td> <td></td> <td></td> </tr> </tbody> </table>	Symbol	Parameter Name	Message	...			WN	Week Number	10	...			T <sub>GD</sub>	Group Delay Differential	30	WN <sub>OP</sub>	<u>CEI Data Sequence Propagation Week Number</u>	<u>30</u>	...							
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## Fixing WN in Tables



<b>DOORS ID</b>	IS200-552, IS800-159		
<b>Paragraph</b>	Table 30-I Message Types 10 and 11 Parameters Table 3.5-1 Subframe 2 Parameters	<b>Comment Number</b>	CRM #145, 163
<b>Comment Type</b>	Substantive Administrative	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	<p>145 Table 30-I WN description of WN in Type 10 message is incorrect, describes WN<sub>op</sub>, not WN</p> <p>163 WN parameter incorrectly characterized</p> <p style="text-align: center;">Data Sequence Propagation Week Number -&gt; Week Number</p>		
<b>Government Response</b>	Accept		

# WN Table Fixes Redlines



Paragraph	IS200-552, IS800-159																												
IS-GPS-200 Table 30-1 Redlines	<table border="1"> <thead> <tr> <th data-bbox="769 354 950 454"></th> <th data-bbox="950 354 1291 454">Parameter</th> <th data-bbox="1291 354 1431 454">No. of Bits**</th> <th data-bbox="1431 354 1572 454">Scale Factor (LSB)</th> <th data-bbox="1572 354 1763 454">Valid Range***</th> <th data-bbox="1763 354 1979 454">Units</th> </tr> </thead> <tbody> <tr> <td data-bbox="769 454 950 592">WN</td> <td data-bbox="950 454 1291 592"><del>Data Sequence</del> Propagation Week Number</td> <td data-bbox="1291 454 1431 592">13</td> <td data-bbox="1431 454 1572 592">1</td> <td data-bbox="1572 454 1763 592"></td> <td data-bbox="1763 454 1979 592">weeks</td> </tr> <tr> <td data-bbox="769 592 950 682">URAE<sub>ED</sub> Index</td> <td data-bbox="950 592 1291 682">ED Accuracy Index</td> <td data-bbox="1291 592 1431 682">5*</td> <td data-bbox="1431 592 1572 682"></td> <td data-bbox="1572 592 1763 682"></td> <td data-bbox="1763 592 1979 682">(see text)</td> </tr> <tr> <td data-bbox="769 682 950 753">⋮</td> <td data-bbox="950 682 1291 753">⋮</td> <td data-bbox="1291 682 1431 753">⋮</td> <td data-bbox="1431 682 1572 753">⋮</td> <td data-bbox="1572 682 1763 753">⋮</td> <td data-bbox="1763 682 1979 753">⋮</td> </tr> </tbody> </table>						Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units	WN	<del>Data Sequence</del> Propagation Week Number	13	1		weeks	URAE <sub>ED</sub> Index	ED Accuracy Index	5*			(see text)	⋮	⋮	⋮	⋮	⋮	⋮
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# WN and WN<sub>op</sub> In The Acronym Lists

<b>DOORS ID</b>	IS200-1488, IS705-1496		
<b>Paragraph</b>	6.1 Acronyms	<b>Comment Number</b>	CRM #152, 151, 161
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Reject Accept with Comments
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	<p>151, 161 Table should include WN<sub>op</sub>. WN<sub>op</sub> is required in the calculation of IAURA.</p> <p>152 WN is labeled incorrectly. Data Sequence Propagation Week Number -&gt; Week Number</p>		
<b>Government Response</b>	<p>The overarching decision after deliberation with the SMEs is that WN, WN<sub>op</sub> and other Parameters such as the CEI Data Set parameters are not Acronyms and should not be in the Acronym List. If WN were somehow used as a general term for Week Number it might be able to stay in the Acronym List, but all uses of WN in all these documents are clearly referring to the CEI Parameter. All of these suggestions made by these comments would be rejected except that #152 is pointing out a clear naming error. Other parameters that may be in the Acronym Lists will not be removed at this time.</p> <p>152 Because a naming error is being pointed out we will remove WN (and WN<sub>e</sub> which isn't used at all in this document) from the Acronym List.</p>		

# WN and $WN_{op}$ In The Acronym Lists - Redlines



Paragraph

IS200-1488

Red Lines

•  
•  
•

UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984
<del>WN</del>	-	<del>Data Sequence Propagation Week Number</del>
<del><math>WN_e</math></del>	-	<del>Extended Week Number</del>

## PRNs 33 and 37



<b>DOORS ID</b>	IS200-1334, IS200-1335		
<b>Paragraph</b>	6.4.3 PRNs 33 and 37	<b>Comment Number</b>	CRM #146, 150
<b>Comment Type</b>	Substantive Administrative	<b>Disposition</b>	Accept with Comments
<b>FAA</b>	FAA		
<b>Comment</b>	<p>146 Section does not say what the user should do if a satellite broadcasts PRN-33. It is also not clear how this relates to section 6.4.4 and why section 6.4.4 only requires PRNs 33 - 63 to be synchronized with GPS time.</p> <p>150 Should remove PRN37 as an alert mechanism from SPS PS since not included as an alert in Section 6.4.6. Also, if PRN37 is not being used for SATZAP, then should remove reference in IS, although this is not critical.</p>		
<b>Government Response</b>	Is in RFC-495A, but this new wording has been modified to more accurately state the intent, which addresses the point of CRM #146		

## PRNs 33 and 37 - Redlines



<b>Paragraph</b>	IS200-1334, IS200-1335
<b>Baseline</b>	<p><b>6.4.3 PRNs 33 and 37</b></p> <p>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.</p>
<b>RFC-495A Proposed Redlines</b>	<p><b>6.4.3 PRNs <del>33 and 37</del></b></p> <p>PRN 33 should not be used by satellites because of its prior use in specialized ground applications. <del>PRN 37 should not be used by satellites until after PRN 37 is no longer needed for SATZAP purposes.</del></p>
<b>Current Proposed IS</b>	<p><b>6.4.3 PRN 33</b></p> <p>Currently, the control segment should not command PRN 33 for satellites because of its prior use in specialized ground applications. Future users should include PRN 33 tracking capability in receivers and be able to use PRN 33 if it is included in the broadcast almanac.</p>

# Important Changes From RFC-495A



<b>DOORS ID</b>	N/A		
<b>Paragraph</b>	N/A	<b>Comment Number</b>	CRM #147, #157
<b>Comment Type</b>	Critical	<b>Disposition</b>	Question
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	<p>147 There are important comments that were accepted as part of RFC-495. Either provide clarity on whether these will be added to the next revision of IS-200 or add to RFC-502 changes. These comments follow. (<a href="#">CRM #148 through #154</a>)</p> <p>157 There are important comments that were accepted as part of RFC-495. Either provide clarity on whether these will be added to the next revision of IS-705 or add to RFC-502 changes. These comments follow. (<a href="#">Items #158 through #161</a>)</p>		
<b>Government Response</b>	<p>148, 153, 154 Are included below</p> <p>149 Is now included below</p> <p>150 Is now included above</p> <p>151, 152 Are not being included - these changes were never planned for RFC- 495A</p> <p>158 Was not in RFC-495A but is now included below</p> <p>159 Was not in RFC-495A but is now included below</p> <p>160 This administrative reformatting is below the threshold for reformatting</p> <p>161 CEI Notes changes were officially deferred per the PNT LLB</p>		

# Specific Alarm Indications - From RFC-495A

<b>DOORS ID</b>	IS200-1640		
<b>Paragraph</b>	6.4.6.2.2 Specific Alarm Indications	<b>Comment Number</b>	CRM #148, 153, 154
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accepted with Comments
<b>Comment Originator(s)</b>	FAA (repeated Thales comment from RFC-495A)		
<b>Comment</b>	<p>148 Repeats RFC-495A comment about CM-code signal (d)</p> <p>153 Repeats RFC-495A comment about Note 5 which applies to C/A-Code or P(Y)-Code Signal (a) (originally from Hamza Abdulsalam)</p> <p>154 Repeats RFC-495A comment about C/A-Code or P(Y)-Code Signal (c) (originally from Denis Bouvet)</p>		
<b>Government Response</b>	<p>Taken together, these comments implement the change that was vetted at RFC-495A's Engineering ERB, except for the Note 6 that was added in RFC-495A and administrative wording changes. Since Note 6 is only relevant to Block IIA SVs which are no longer in the constellation, Note 6 is being removed. The administrative changes are still relevant, so we are going to keep them. (see next slide for final redlines <a href="#">which also shows the change from "and" to "or" decided at Slide 45</a>)</p>		



# Specific Alarm Indications - Redlines

Paragraph

IS200-1760

Redlines

The following alarm indications are specific to the code signals listed below.

## C/A-Code or P(Y)-Code Signal

- (a) The failure of parity on 5 successive words of LNAV data (3 seconds) (see paragraphs 20.3.5 and 40.3.5). (See Note 5)
- (b) The broadcast IODE does not match the 8 LSBs of the broadcast IODC (excluding normal data set cutovers, see paragraph 20.3.3.4.1).
- (c) ~~The Bits transmitted~~ 61 bits through 298 transmitted in words 3-10 in subframe 1, 2, or 3 are all set to 0's or all set to 1's.
- (d) Default LNAV data is being transmitted in subframes 1, 2, or 3 (see paragraph 20.3.2).
- (e) The 8-bit preamble does not equal 100010112, decimal 139, or hexadecimal 8B (see paragraph 20.3.3).

## CM-Code Signal

- (a) The failure of the cyclic redundancy check (CRC) on 5 successive CNAV messages (60 seconds) (see paragraph 30.3.5).
- (b) The broadcast time of ephemeris (toe) is not current (i.e. not within the current curve-fit) or does not match the broadcast time of clock (toc) (excluding normal data set cutovers, see paragraphs 30.3.3.1.1 and 30.3.4.4).
- (c) The broadcast top is not consistent across the Message Types 10, 11 and Type 30's messages which comprise the current (i.e. not within the current curve-fit) CEI data set (excluding normal data set cutovers, see paragraph 30.3.4.4).
- (d) The transmitted bits (bits 39- ~~through~~ 276) in one or more of Message Types 10, 11 ~~and Type or~~ 30's through 37 are all set to 0's or all set to 1's.
- (e) The 8-bit preamble does not equal 100010112, decimal 139, or hexadecimal 8B (see paragraph 30.3.3).

## Notes:

1. *A SIS alarm indication exists when the satellite is not trackable because it is not transmitting the standard PRN code modulation on the L-band carrier signal. These SIS alarm indications are specifically called out above because of their relatively high probability of occurrence.*
2. *The SIS alarm indications related to the LNAV and CNAV message data are considered "weak" indications since receivers do not necessarily continuously read each satellite's LNAV or CNAV message data either by design or by circumstance (e.g., radio-frequency interference [RFI] can prevent reading LNAV or CNAV message data). These weak SIS alarm indications are assumed to have a five-minute lag time before receivers take notice of them for alerting purposes.*
3. *The SIS alarm indications related to the LNAV or CNAV message data are indicative of a problem onboard the satellite. GPS receivers may perceive similar indications caused by local effects that are unrelated to the broadcast SIS.*
4. *In addition to SIS alarm indications, other conditions may also cause GPS signals to become temporarily untrackable, such as ionospheric signal fades, local signal masking, or local interference.*
5. *An ~~alarm~~ indication (see C/A-Code or P(Y)-Code Signal (a)) does not apply to the default navigation data described in paragraph 20.3.2, when in subframes 4 or 5. Application of the user parity algorithm at paragraph 20.3.5.2 will result in failed parity checks for words 3-10 because the default LNAV data pattern is applied to bits 61- ~~through~~ 298. According to a) and d) default LNAV data broadcast in subframe 4 or in subframe 5 will not be considered as a do-not-use condition, and the user equipment may continue using the GPS L1 measurement as healthy so long as none of the other conditions leading to a GPS UNHEALTHY determination are present.*

# “Marginal Indications” Update



<b>DOORS ID</b>	IS200-1672		
<b>Paragraph</b>	6.4.6.3 "Marginal Indications"	<b>Comment Number</b>	CRM #149
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	Is there additional guidance on how to apply this marginal criteria? While receiver might be able to confirm a MT-0, it is difficult to determine that it replaced one of these message types, especially if the receiver fails to correctly decode some messages. Are there other cases where an MT-0 might replace a MT-31 to MT-39 due to lack of information other than clock information?		
<b>Government Response</b>	<p>This change differs from the RFC-495A wording significantly.</p> <p>Under “The health of the CM-code and CL-code signals”, Point 1 wording is quite a bit different plus it refers to Notes 1 and 2 that did not exist before. After study, these additional changes have been accepted.</p> <p>Note: there are administrative changes from RFC-495A that enhanced the explanation of Message Types, which we are keeping.</p>		

# “Marginal Indications”- Redlines

Paragraph

IS200-1762

RFC-495A  
Significant  
Redlines

...

The health of the CM-code and CL-code signals is marginal when the signals would otherwise have been defined as healthy except that one or more of the following three warning conditions is or are present:

1. ~~The CM-code signal broadcast does not have a current and consistent CEI data set within three times the maximum broadcast interval defined in paragraph 30.3.4.1 in accordance with toc, toe and t<sub>op</sub> rules in 30.3.4.4. Default CNAV data (i.e., Message Type 0) is may being be transmitted in lieu of Message Type any 10, message 11 type and/or when Message the Type correct 30's data on for the CM-code signal message (e.g., type is current unavailable and or consistent when CEI no data other set message is not scheduled, available within UE might be unable to confirm the maximum satellite broadcast interval of defined in inconsistent paragraph data 30.3.4.1)-set when See local paragraph conditions 30.3.3 prevent correctly receiving and decoding a continuous set of messages.~~
2. The URA alert flag is raised (i.e., bit 38 of each CNAV message is set to 1) and therefore the CM-code signal URA components do not apply to the CM-code and CL-code signals. This means the CM-code and CL-code signal URA may be worse than indicated by the URA index components transmitted in Message Type Types 10 and Message 30 Type through 30's 37. See paragraph 30.3.3.
3. Either or both the URAED index in Message Type 10 and the URANED0 index in Message Type Types 30's through 37 transmitted in the CM-code signal are equal to 15 or -16 ("N"=15 or "N"=-16). See paragraphs 30.3.3.1.1.4 and 30.3.3.2.4.

The P(Y)-code SIS health is marginal when the P(Y)-code SIS would otherwise have been defined as healthy except that one or more of the following three warning conditions is or are present:

...

Current  
Proposed  
Redlines

...

The health of the CM-code and CL-code signals is marginal when the signals would otherwise have been defined as healthy except that one or more of the following three warning conditions is or are present:

1. ~~Default CNAV data (i.e., Message Type 0) is being transmitted in lieu of Message Type 10, 11 and/or Message Type 30's on The the satellite CM-code does signal not (e.g., broadcast a current and consistent CEI data set is not within available three within times the maximum broadcast interval defined in paragraph 30.3.4.1). (see Notes 1 paragraph and 30.3.3-2)~~
2. The URA alert flag is raised (i.e., bit 38 of each CNAV message is set to 1) and therefore the CM-code signal URA components do not apply to the CM-code and CL-code signals. This means the CM-code and CL-code signal URA may be worse than indicated by the URA index components transmitted in Message Type Types 10 and Message 30 Type through 30's 37. See paragraph 30.3.3.
3. Either or both the URAED index in Message Type 10 and the URANED0 index in Message Type Types 30's through 37 transmitted in the CM-code signal are equal to 15 or -16 ("N"=15 or "N"=-16). See paragraphs 30.3.3.1.1.4 and 30.3.3.2.4.

Note 1: Default CNAV data (i.e. Message Type 0) may be transmitted in lieu of any message type when the correct data for the message type is unavailable or when no other message is scheduled.

Note 2: UE might be unable to confirm the satellite broadcast of a consistent data set when local conditions prevent correctly receiving and decoding a continuous set of messages.

## CEI Data Set Note Deferral

<b>DOORS ID</b>	IS200-1513, IS200-1649, IS200-1644, IS200-1645		
<b>Paragraph</b>	6.2.9 Clock, Ephemeris, Integrity (CEI) Data Set 6.2.9.1 Core CEI Data Set 20.3.4.4 Data Sets 30.3.4.4 Data Sets	<b>Comment Number</b>	CRM #155
<b>Comment Type</b>	Substantive, Administrative	<b>Disposition</b>	Deferred
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	155 These four sections all reference NOTE1 to Table 6-I-1 although the intent of the sections have two or three different meanings. Add additional NOTES to clarify the intent and meaning of the concepts referenced in the various sections. Rationale: Clarify system operation to support IOC and MOPS development		
<b>Government Response</b>	All changes categorized as CEI Parameter Notes have been deferred per the PNT LLB. <a href="#">A number of changes that respond to this CRM Item have already been proposed and saved for future use once these changes are cleared by GPS leadership for implementation.</a>		

## Specific Alarm Indications in IS-GPS-705

<b>DOORS ID</b>	IS705-1603		
<b>Paragraph</b>	6.4.5.1.2 Specific Alarm Indications	<b>Comment Number</b>	CRM #158
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	<p>For I5-code signal, clarify that any of the MT-10, 11, 3xs are all 0's or all 1's, then this is an alert. As written, it requires all of these to be all 0's or all 1's to be considered an alert.</p> <p>Suggests: (d) The transmitted bits (bits 39-276) in <u>one or more of</u> Message Types 10, 11 <del>and</del> <u>or</u> 30's are all set to 0's or all set to 1's.</p>		
<b>Government Response</b>	<p>This had not been considered as part of RFC-495A which was an oversight. This paragraph should closely match IS-GPS-200 <b>6.4.6.2.2 Specific Alarm Conditions</b></p> <p>To more closely match IS-GPS-200:</p> <ol style="list-style-type: none"> <li>1. "39-276" will be expanded to "39 through 276"</li> <li>2. the "30's" will be expanded to "30 through 37".</li> </ol> <p>Document production problems with IS-GPS-705J where the Notes aren't numbered will be fixed as well</p> <p><b>QUESTION DECISION</b></p> <p><del>Do</del> We will <del>want to</del> change "and" to "or" in the equivalent paragraph sub-item in IS-GPS-200?</p>		

## IS-GPS-705 Specific Alarm Indications - Redlines

Paragraph

IS705-1603

Proposed Redlines

The following alarm indications are specific to the code signals listed below.

I5-Code Signal

- (a) The failure of the CRC on 5 successive CNAV messages (30 seconds) (see paragraph 20.3.5).
- (b) The broadcast toe is not current (i.e. not within the current curve-fit) or does not match the broadcast toc (excluding normal data set cutovers, see paragraphs 20.3.3.1.1 and 20.3.4.4).
- (c) The broadcast  $t_{op}$  is not consistent across the Message Types 10, 11 and Type 30's messages which comprise the current (i.e. not within the current curve-fit) CEI data set (excluding normal data set cutovers, see paragraph 20.3.4.4).
- (d) The transmitted bits (bits 39-through 276) in one or more of Message Types 10, 11 and/or Type 30's through 37 are all set to 0's or all set to 1's.
- (e) The 8-bit preamble does not equal 100010112, decimal 139, or hexadecimal 8B (see paragraph 20.3.3).

Notes:

1. *A SIS alarm indication exists when the satellite is not trackable because it is not transmitting the standard PRN code modulation on the L-band carrier signal. These SIS alarm indications are specifically called out above because of their relatively high probability of occurrence.*
2. *The SIS alarm indications related to the CNAV message data are considered "weak" indications since receivers do not necessarily continuously read each satellite's CNAV message data either by design or by circumstance (e.g., radio-frequency interference [RFI] can prevent reading CNAV message data). These weak SIS alarm indications are assumed to have a five-minute lag time before receivers take notice of them for alerting purposes.*
3. *The SIS alarm indications related to the CNAV message data are indicative of a problem onboard the satellite. GPS receivers may perceive similar indications caused by local effects that are unrelated to the broadcast SIS.*
4. *In addition to SIS alarm indications, other conditions may also cause GPS signals to become temporarily untrackable, such as ionospheric signal fades, local signal masking, or local interference.*

# IS-GPS-200 Specific Alarm Indications - Matching Redlines

Paragraph

IS200-1760 (Repeated from Slide 41)

Proposed Redlines

The following alarm indications are specific to the code signals listed below.

#### C/A-Code or P(Y)-Code Signal

- (a) The failure of parity on 5 successive words of LNAV data (3 seconds) (see paragraphs 20.3.5 and 40.3.5). (See Note 5)
- (b) The broadcast IODE does not match the 8 LSBs of the broadcast IODC (excluding normal data set cutovers, see paragraph 20.3.3.4.1).
- (c) ~~The Bits transmitted~~ 61 bits through 298 transmitted in words 3-10 in subframe 1, 2, or 3 are all set to 0's or all set to 1's.
- (d) Default LNAV data is being transmitted in subframes 1, 2, or 3 (see paragraph 20.3.2).
- (e) The 8-bit preamble does not equal 100010112, decimal 139, or hexadecimal 8B (see paragraph 20.3.3).

#### CM-Code Signal

- (a) The failure of the cyclic redundancy check (CRC) on 5 successive CNAV messages (60 seconds) (see paragraph 30.3.5).
- (b) The broadcast time of ephemeris (toe) is not current (i.e. not within the current curve-fit) or does not match the broadcast time of clock (toc) (excluding normal data set cutovers, see paragraphs 30.3.3.1.1 and 30.3.4.4).
- (c) The broadcast top is not consistent across the Message Types 10, 11 and Type 30's messages which comprise the current (i.e. not within the current curve-fit) CEI data set (excluding normal data set cutovers, see paragraph 30.3.4.4).
- (d) The transmitted bits (bits 39- through 276) in one or more of Message Types 10, 11 ~~and Type or~~ 30's through 37 are all set to 0's or all set to 1's.
- (e) The 8-bit preamble does not equal 100010112, decimal 139, or hexadecimal 8B (see paragraph 30.3.3).

#### Notes:

1. *A SIS alarm indication exists when the satellite is not trackable because it is not transmitting the standard PRN code modulation on the L-band carrier signal. These SIS alarm indications are specifically called out above because of their relatively high probability of occurrence.*
2. *The SIS alarm indications related to the LNAV and CNAV message data are considered "weak" indications since receivers do not necessarily continuously read each satellite's LNAV or CNAV message data either by design or by circumstance (e.g., radio-frequency interference [RFI] can prevent reading LNAV or CNAV message data). These weak SIS alarm indications are assumed to have a five-minute lag time before receivers take notice of them for alerting purposes.*
3. *The SIS alarm indications related to the LNAV or CNAV message data are indicative of a problem onboard the satellite. GPS receivers may perceive similar indications caused by local effects that are unrelated to the broadcast SIS.*
4. *In addition to SIS alarm indications, other conditions may also cause GPS signals to become temporarily untrackable, such as ionospheric signal fades, local signal masking, or local interference.*
5. *An ~~alarm~~ Alarm indication (see C/A-Code or P(Y)-Code Signal (a)) does not apply to the default navigation data described in paragraph 20.3.2, when in subframes 4 or 5. Application of the user parity algorithm at paragraph 20.3.5.2 will result in failed parity checks for words 3-10 because the default LNAV data pattern is applied to bits 61- through 298. According to a) and d) default LNAV data broadcast in subframe 4 or in subframe 5 will not be considered as a do-not-use condition, and the user equipment may continue using the GPS L1 measurement as healthy so long as none of the other conditions leading to a GPS UNHEALTHY determination are present.*

## "Marginal" Indications

<b>DOORS ID</b>	IS705-1605		
<b>Paragraph</b>	6.4.5.2 "Marginal" Indications	<b>Comment Number</b>	CRM #159
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	Is there additional guidance on how to apply this marginal criteria? While receiver might be able to confirm a MT-0, it is difficult to determine that it replaced one of these message types, especially if the receiver fails to correctly decode some messages. Are there other cases where an MT-0 might replace a MT-31 to MT-39 due to lack of information other than clock information?		
<b>Government Response</b>	We had never considered changes to this requirement in any recent RFC, but after consideration, this request to rework list item 1 into the associated notes has been accepted as requested to improve clarity. Also, the list numbering missing from IS-GPS-705J will be restored.		



# "Marginal" Indications - Redlines



Paragraph	IS705-1605
Proposed Redlines	<p>The health of the I5-code and Q5-code signals is marginal when the signals would otherwise have been defined as healthy except that one or more of the following three warning conditions is or are present:</p> <ol style="list-style-type: none"> <li> <p><u>The satellite does not broadcast a current and consistent CEI data set within three times the maximum broadcast interval defined in paragraph 20.3.4.1.</u></p> <p><u>Note 1:</u> Default CNAV data (i.e., Message Type 0) <del>is</del> <u>may</u> <del>being</del> <u>be</u> transmitted <del>on</del> <u>in</u> <del>the</del> <u>lieu</u> <del>I5-code</del> <u>of</u> <del>signal</del> <u>any</u> <del>in</del> <u>message</u> <del>lieu</del> <u>type</u> <del>of</del> <u>when</u> <del>Message</del> <u>the</u> <del>Types</del> <u>correct</u> <del>10,</del> <u>data</u> <del>11</del> <u>for</u> <del>and/or</del> <u>the</u> <del>Type</del> <u>message</u> <del>30's</del> <u>type</u> (e.g., <del>is</del> <u>an</u> <del>unavailable</del> <u>current</u> <del>or</del> <u>and</u> <del>consistent</del> <u>when</u> <del>CEI</del> <u>no</u> <del>data</del> <u>other</u> <del>set</del> <u>message</u> <del>is</del> <u>not</u> <del>scheduled.</del> <u>available</u> <u>within</u></p> <p><u>Note 2:</u> <del>UE might be unable to confirm</del> <u>the</u> <del>maximum</del> <u>satellite</u> <del>broadcast</del> <u>interval</u> <del>of</del> <del>defined</del> <u>a</u> <del>in</del> <del>consistent</del> <u>paragraph</u> <del>data</del> <u>20.3.4.1).</u> <del>set</del> <u>when</u> <del>See</del> <u>local</u> <del>paragraph</del> <u>conditions</u> <u>20.3.3</u> <del>prevent</del> <u>correctly</u> <u>receiving</u> <u>and</u> <u>decoding</u> <u>a</u> <u>continuous</u> <u>set</u> <u>of</u> <u>messages.</u></p> </li> <li> <p>The URA alert flag is raised (i.e., bit 38 of each CNAV message is set to 1) and therefore the I5-code signal URA components do not apply to the I5-code and Q5-code signals. This means the I5-code and Q5-code signal URA may be worse than indicated by the URA index components transmitted in Message Type 10 and Type 30's. See paragraph 20.3.3.</p> </li> <li> <p>Either or both the <math>URA_{ED}</math> index in Message Type 10 and the <math>URA_{NED0}</math> index in Message Type 30's transmitted in the I5-code signal are equal to 15 or -16 ("N"=15 or "N"=-16). See paragraphs 20.3.3.1.1.4 and 20.3.3.2.4.</p> </li> </ol> <p>A more restrictive 'marginal indications' (e.g., the transmitted URA index in Subframe 1 greater than or equal to 8) may apply in the context of specified minimum performance standards such as are given in the GPS Standard Positioning Service Performance Standard (SPS PS).</p>

## "Marginal" Indications - IS:

## Paragraph

IS705-1605

Proposed  
IS: text

The health of the I5-code and Q5-code signals is marginal when the signals would otherwise have been defined as healthy except that one or more of the following three warning conditions is or are present:

1. The satellite does not broadcast a current and consistent CEI data set within three times the maximum broadcast interval defined in paragraph 20.3.4.1.

Note 1: Default CNAV data (i.e. Message Type 0) may be transmitted in lieu of any message type when the correct data for the message type is unavailable or when no other message is scheduled.

Note 2: UE might be unable to confirm the satellite broadcast of a consistent data set when local conditions prevent correctly receiving and decoding a continuous set of messages.

2. The URA alert flag is raised (i.e., bit 38 of each CNAV message is set to 1) and therefore the I5-code signal URA components do not apply to the I5-code and Q5-code signals. This means the I5-code and Q5-code signal URA may be worse than indicated by the URA index components transmitted in Message Type 10 and Type 30's. See paragraph 20.3.3.
3. Either or both the  $URA_{ED}$  index in Message Type 10 and the  $URA_{NED0}$  index in Message Type 30's transmitted in the I5-code signal are equal to 15 or -16 ("N"=15 or "N"=-16). See paragraphs 20.3.3.1.1.4 and 20.3.3.2.4.

A more restrictive 'marginal indications' (e.g., the transmitted URA index in Subframe 1 greater than or equal to 8) may apply in the context of specified minimum performance standards such as are given in the GPS Standard Positioning Service Performance Standard (SPS PS).



## Clock Correction and Accuracy Parameters – Reformat Request

<b>DOORS ID</b>	IS705-257		
<b>Paragraph</b>	Table 20-III. Clock Correction and Accuracy Parameters	<b>Comment Number</b>	CRM #160
<b>Comment Type</b>	Administrative	<b>Disposition</b>	Defer
<b>Comment Originator(s)</b>	FAA		
<b>Comment</b>	Table rows do not align in the pdf. Just correct so the that parameter names are on the same lines as the parameter values.		
<b>Government Response</b>	Below the current threshold for improving text alignment and formatting. <a href="#">We will fix this problem whenever the table is modified for another reason</a>		

## Deferred CEI Data Set Parameter Notes

<b>DOORS ID</b>	IS200-2140, IS705-1515, IS705-1524, IS705-1522, IS800-918, IS800-912, IS800-920		
<b>Paragraph</b>	Numerous	<b>Comment Number</b>	CRM #162, 166, 184
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Defer
<b>Comment Originator(s)</b>	FAA LM O&S		
<b>Comment</b>	<p>162 (ref IS-GPS-705 6.2.8, 6.2.8.1, and 20.3.4.4) These three sections all reference NOTE1 to Table 6-I-1 although the intent of the sections is for two or three different meanings. Add additional NOTES to clarify the intent and meaning of the concepts referenced in the various sections.</p> <p>166 (ref IS-GPS-800 3.5.5.2, 6.2.8, and 6.2.8.1) These four sections all reference NOTE1 to Table 6.2-18 although the intent of the sections is for two or three different meanings. Add additional NOTES to clarify the intent and meaning of the concepts referenced in the various sections.</p> <p>184 (ref IS-GPS-200 6.2.1.0-5) Add a 4th note to accommodate instantaneous URE bounding.</p> <p style="padding-left: 40px;">Suggested adding: "Note #4: The URA will only bound the instantaneous URE with the stated probability when the user applies all of the broadcast parameters in the same CEI data set as defined in IS-GPS-200 Section 20.3.4.4 Data Sets for LNAV or 30.3.4.4 Data Sets for CNAV.</p>		
<b>Government Response</b>	<p>162, 166, 184 All these paragraphs have been worked on as part of RFC-502 and all the CEI Data Set Parameter Notes work was deferred by the PNT LLB</p> <p>184 This was included in an earlier PCN and deferred by the PNT LLB. The specific misspelling has been corrected if this work ever comes back.</p> <p><a href="#">This change is likely to be accepted when the work for CEI notes is eventually approved to continue</a></p>		

# Correcting the Rule for Cutovers



<b>DOORS ID</b>	IS200-2090		
<b>Paragraph</b>	20.3.4.1. Paging and Cutovers 3 <sup>rd</sup> Paragraph	<b>Comment Number</b>	CRM #167, 171, 173, 180
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept, Accept with Comments
<b>Comment Originator(s)</b>	DOAN (Hutsell), LM O&S, Aerospace		
<b>Comment</b>	<p>167 The proposed added wording appears to exclude IIR, but include IIR-M (modernized) Block types, however to my understanding no difference exists between IIR-M and IIR Block types with respect to the requirement stated in the paragraph.</p> <p>171 If the intent is to provide "relief" to the IIR Block type from the cutover on 30 second boundries, then IIR-M should also be removed from the sentence.</p> <p>173 Remove IIR-M from the proposed redlines.</p> <p>180 Rephrase for consistency in GPS SV vehicle block name terms and avoid potential for misinterpretation by a hasty reader. Specific suggestion for lead-in is: "For Block IIR-M, Block IIF, Block III/IIIF, and all future GPS SVs, cutovers ..."</p>		
<b>Government Response</b>	<p>This was a recent addition because an RSAM related warning came up in a system that had implemented the cutover rule as an RSAM check. This prompted us to state which SVs will implement the rule correctly and specifically not include the offending SVs.</p> <p>167, 171, 173 all wanted Block IIR-M SVs to not be in the lead-in to the sentence because IIR-M does not execute the rule correctly all the time.</p> <p>180 Just wanted to rephrase the lead-in without dropping IIR-M.</p> <p>We will follow the lead from the CRM #167, #171 and #173. (see next slide)</p>		

# Correcting the Rule for Cutovers - Redlines



Paragraph	IS200-2090
July PCN Redlines	<p><del>Cutovers</del> <u>For Block IIF/IIR-M, GPS III/IIIF and all future SVs, cutovers</u> to newly updated data for subframes 1, 2, and 3 occur on frame boundaries (i.e., modulo 30 seconds relative to end/start of week). Newly updated data for subframes 4 and 5 may start to be transmitted with any of the 25 pages of these subframes.</p>
Current PCN Redlines	<p><del>Cutovers</del> <u>For Block IIF/<del>IIR-M</del>, GPS III/IIIF and all future SVs, cutovers</u> to newly updated data for subframes 1, 2, and 3 occur on frame boundaries (i.e., modulo 30 seconds relative to end/start of week). Newly updated data for subframes 4 and 5 may start to be transmitted with any of the 25 pages of these subframes.</p>

# Paging and Cutovers Administrative Correction



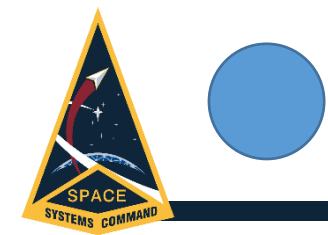
<b>DOORS ID</b>	IS200-669, IS705-370		
<b>Paragraph</b>	IS-GPS-200 30.3.4.1.0-1 Paging and Cutovers IS-GPS-705 20.3.4.1.0-1 Paging and Cutovers	<b>Comment Number</b>	CRM #178
<b>Comment Type</b>	Administrative	<b>Disposition</b>	Accept with Comments
<b>Comment Originator(s)</b>	Aerospace		
<b>Comment</b>	Should not preclude MT 30 from being broadcast more frequently.		
<b>Government Response</b>	178 Agreed that the suggested wording more exactly reflects what was meant. This comment was originally made against IS-GPS-705, but it applies equally to the corresponding paragraph in IS-GPS-200 (see next slide)		

# Substituting GGTO Type ID for GNSS Type ID

<b>DOORS ID</b>	IS800-655, IS800-236, IS200-663, IS705-364		
<b>Paragraph</b>	n.n.n or Table n or Figure n	<b>Comment Number</b>	CRM #174, 175
<b>Comment Type</b>	Administrative	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	Aerospace		
<b>Comment</b>	<p>174 GNSS Type ID was not changed consistently throughout section 3.5.4.2.1</p> <p>175 Table 3.5-4 should change "GNSS Type ID" to "GGTO ID" to be consistent with the redline for IS800-875.</p>		
<b>Government Response</b>	<p>Accept. A change was needed because the Public SiS documents had two different definitions for GNSS Type ID. One with 3-Bits and one with 4-Bits. It was decided that renaming the 3-Bit version to GGTO Type ID was the less disruptive choice.</p> <p>We failed to catch all the changes first time around. This oversight extends to other locations in IS-GPS-200 and IS-GPS-705.</p> <p><a href="#">There are ICD-GPS-801 and IS-GPS-901 need to perform corresponding changes to GGTO Type ID. These changes were delayed until other changes are made to these documents.</a></p>		



# Paging and Cutovers Administrative Correction - Redlines



Paragraph	IS200-669, IS705-370
<p data-bbox="0 328 338 492"><b>IS-GPS-200</b> <b>Current Redlines</b></p> <div data-bbox="0 492 338 782" style="background-color: yellow; padding: 5px;"> <p data-bbox="0 492 338 782"><b>Green text represents the recent CRM #178 change</b></p> </div>	<p data-bbox="338 328 2540 492"><u>The <del>system-B</del> broadcast schedule of <del>messages</del> CNAV message types is completely arbitrary, but sequenced to provide optimum user performance.- Message <del>Types</del> types 10, 11, and <del>11</del> a clock message shall be broadcast at least once every <u>60 seconds (with a nominal rate of 48 seconds) to provide system users the clock, ephemeris and integrity (CEI) data needed to access GPS.</u></u></p> <p data-bbox="338 492 2540 606"><u>Among the broadcast clock messages, an MT 30 message will be broadcast at least once every 300 seconds. Other message types may not be broadcast, but when they are scheduled for broadcast, they will be broadcast in between these CEI messages.</u></p> <p data-bbox="338 606 2540 782"><u>If a message type is scheduled for broadcast on L2C from a satellite, that satellite will broadcast that message type on L2C at least every 20 minutes, unless a message generation failure results in its replacement with a Message Type 0. CNAV message broadcast schedules may differ between satellites, and between L2C and L5I on the same satellite.</u></p>
<p data-bbox="0 782 338 946"><b>IS-GPS-705</b> <b>Current Redlines</b></p>	<p data-bbox="338 782 2540 946"><u>The <del>system-B</del> broadcast schedule of <del>messages</del> CNAV message types is completely arbitrary, but sequenced to provide optimum user performance.- Message types 10, 11, and <del>11</del> a clock message shall be broadcast at least once every <u>30 seconds (with a nominal rate of 24 seconds) to provide system users the clock, ephemeris and integrity (CEI) data needed to access GPS.</u></u></p> <p data-bbox="338 946 2540 1330"><u>Among the broadcast clock messages, an MT 30 message will be broadcast at least once <del>once</del> every 150 seconds. Other message types may not be broadcast, but when they are scheduled for broadcast, they will be broadcast in between these CEI messages. If a message type is scheduled for broadcast on L5I from a satellite, that satellite will broadcast that message type on L5I at least every 10 minutes, unless a message generation failure results in its replacement with a Message Type 0. Message types with constellation data (like almanac and differential corrections) will cycle through any allotted broadcast slots in these 10-minute intervals, and therefore, will take longer than 10 minutes to complete the broadcast of the entire data set. CNAV message broadcast schedules may differ between satellites, and between L2C and L5I on the same satellite.</u></p>

# IS-GPS-200 GGTO Type ID - Redlines



Paragraph  
IS-GPS-200  
Table 30-XI.  
GPS/GNSS Time  
Offset  
Parameters

IS200-663

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
$A_{0GGTO}$	16*	$2^{-35}$		seconds
$A_{1GGTO}$	13*	$2^{-51}$		sec/sec
$A_{2GGTO}$	7*	$2^{-68}$		sec/sec <sup>2</sup>
$t_{GGTO}$	16	$2^4$	0 to 604,784	seconds
$WN_{GGTO}$	13	$2^0$		weeks
<u>GGTO</u> <del>GNSS ID</del>	3			see text
<p>* Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;</p> <p>** See Figure 30-8 for complete bit allocation;</p> <p>*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.</p>				

## IS-GPS-705 GGTO Type ID - Redlines



Paragraph

IS705-364

IS-GPS-364  
Table 20-XI.  
GPS/GNSS Time  
Offset  
Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
$A_{0GGTO}$	16*	$2^{-35}$		seconds
$A_{1GGTO}$	13*	$2^{-51}$		sec/sec
$A_{2GGTO}$	7*	$2^{-68}$		sec/sec <sup>2</sup>
$t_{GGTO}$	16	$2^4$	0 to 604,784	seconds
$WN_{GGTO}$	13	$2^0$		weeks
<u>GGTO</u> GNSS ID	3			see text
* Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB				
** See Figure 20-8 for complete bit allocation				
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor				

## IS-GPS-800 GGTO Type ID - Redlines



## Paragraph

IS800-655, IS800-236

3.5.4.2.1 GGTO  
Parameter  
Content  
Redlines

Subframe 3, page 2 shall contain the parameters related to correlating GPS time with other GNSS time. Bits 15 through 17 of subframe 3, page 2 shall identify the other GPS-like navigation system to which the offset data applies. The three bits are defined as follows:

000 = no data available,

001 = Galileo,

010 = GLONASS,

011 through 111 = Reserved in order to preserve the use of these values in a future version of this IS. Until such a revision, a developer developing to this version of this IS should interpret these values as indicating that the GPS/GNSS Time Offset Parameter data, to which the ~~GNSS Type~~GGTO ID applies, is presently unusable.

IS-GPS-  
800Table 3.5-4.  
GPS/GNSS Time  
Offset  
Parameters  
Redlines

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
$A_{0GGTO}$	Bias coefficient of GPS time scale relative to GNSS time scale	16*	$2^{-35}$		seconds
$A_{1GGTO}$	Drift coefficient of GPS time scale relative to GNSS time scale	13*	$2^{-51}$		sec/sec
$A_{2GGTO}$	Drift rate correction coefficient of GPS time scale relative to GNSS time scale	7*	$2^{-68}$		sec/sec <sup>2</sup>
$t_{GGTO}$	Time data reference Time of Week	16	$2^4$	0 to 604,784	seconds
$WN_{GGTO}$	Time data reference Week Number	13	$2^0$		weeks
<del>GNSS ID</del> GGTO	<del>GNSS</del> GGTO Type ID	3			see text
<p>* Parameters so indicated shall be in two's complement notation;</p> <p>** See Figure 3.5-3 for complete bit allocation;</p> <p>*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.</p>					

## Core CEI Data Set Reference Correction

<b>DOORS ID</b>	IS200-1649, IS705-1524		
<b>Paragraph</b>	6.2.9.1 Core CEI Data Set 6.2.8.1 Core CEI Data Set	<b>Comment Number</b>	CRM #176, 177
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	Boeing		
<b>Comment</b>	<p>176 The deletion of Table 30-XII in IS-GPS-200 also affects IS-GPS-200 section 6.2.9.1 which references Table 30-XII. Section 6.2.9.1 must be updated to remove the table reference and possibly provide a difference reference for a user to ascertain the information.</p> <p>177 The deletion of Table 20-XII in IS-GPS-705 also affects IS-GPS-705 section 6.2.8.1 which references Table 20-XII. Section 6.2.8.1 must be updated to remove the table reference and possibly provide a difference reference for a user to ascertain the information.</p>		
<b>Government Response</b>	These changes were removed in response to the CEI Notes descoping from PNT LLB, but a portion of this particular change can be reconsidered for implementation as part of RFC-502. (see next slide)		

## Core CEI Data Set Reference Correction - Redlines



<b>Paragraph</b>	IS200-1649, IS705-1524
<b>IS-GPS-200 Redlines</b>	<p><b>6.2.9.1 Core CEI Data Set</b></p> <p>A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval <a href="#">for CNAV</a> -- see <del>Table 30</del> <a href="#">XII.3.4.1</a>. The <math>t_{op}</math> term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a NOTE1 in Table 6-I-1.</p>
<b>IS-GPS-705 Redlines</b>	<p><b>6.2.8.1 Core CEI Data Set</b></p> <p>A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval -- see <del>Table 20</del> <a href="#">XII.3.4.1</a>. The <math>t_{op}</math> term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a Note1 in Table 6-I-1.</p>

# Change in P-Code and C/A Code Upper PRN Rules



<b>DOORS ID</b>	IS200-25, IS200-29		
<b>Paragraph</b>	3.2.1.1 P-Code 3.2.1.3 C/A-Code	<b>Comment Number</b>	CRM #181, 182
<b>Comment Type</b>	Substantive	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	Aerospace		
<b>Comment</b>	<p>181 Intent of Original Text in relation to P(Y) Code is no longer needed</p> <p>182 Entire sense of the 2nd paragraph about C/A-Code is changed</p>		
<b>Government Response</b>	This is a recent comment about paragraphs in ICD-GPS-200 that have not been recently changed or proposed for change.		



## Paragraph

IS200-25

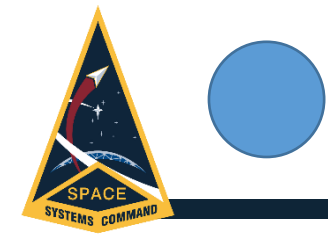
## Proposed Redlines

**3.2.1.1 P-Code**

The PRN P-code for SV ID number  $i$ , for  $i = 1$  to 37, is a ranging code,  $P_i(t)$ , of 7 days in length at a chipping rate of 10.23 Mbps. The 7 day sequence is the modulo-2 sum of two sub-sequences referred to as X1 and X2i; their lengths are 15,345,000 chips and 15,345,037 chips, respectively. The X2i sequence is an X2 sequence selectively delayed by 1 to 37 chips thereby allowing the basic code generation technique to produce a set of 37 mutually exclusive P-code sequences of 7 days in length. Assignment of these code phase segments by SV ID number is given in Table 3-Ia. (NOTE: previous versions of this document reserved PRNs 33 through 37 for other uses. Due to increased system capability, PRNs 33 through 37 are being redesignated to allow for use by SVs.)

~~An initial almanac collected from P(Y)-code in the upper PRNs must be obtained from PRNs 35, 36, or 38 through 63.~~





Paragraph	IS200-29
Proposed Redlines	<p><b>3.2.1.3 C/A-Code</b></p> <p>The PRN C/A-code for SV ID number <math>i</math> is a Gold code, <math>G_i(t)</math>, of 1 millisecond in length at a chipping rate of 1023 kbps. The <math>G_i(t)</math> sequence is a linear pattern generated by the modulo-2 addition of two sub-sequences, <math>G_1</math> and <math>G_{2i}</math>, each of which is a 1023 chip long linear pattern. The epochs of the Gold code are synchronized with the <math>X_1</math> epochs of the P-code. As shown in Table 3-Ia, the <math>G_{2i}</math> sequence is a <math>G_2</math> sequence selectively delayed by pre-assigned number of chips, thereby generating a set of different C/A-codes. Assignment of these by GPS PRN signal number are given in Table 3-Ia and Table 3-Ib.</p> <p><del>An initial almanac collected from C/A-code in the upper PRNs must be obtained from PRNs 35, 36, or 38 through 63.</del></p> <p>CS will prevent the simultaneous transmission of PRNs 34 and 37 of C/A-code: <u>to any point on the Earth's surface.</u></p> <p>Final decision outside the Public ICWG left the potential change in the last paragraph as is.</p>

# Open RFC-502 Discussion

*QUESTIONS &  
COMMENTS?*





# Action Item Review



**10 MINUTE BREAK**

# Positioning, Navigation and Timing Mission Public ICWG Slides

Template Version 16 .1a -Jan 2023



## ADJUDICATION WORKING GROUP

27-SEP-2023

## DOCUMENT CLASSIFICATION

UNCLASSIFIED

## REQUEST FOR CHANGE (RFC) NUMBER

RFC-477

## RFC TITLE

*OCX XML Products for Civil Users*

### GOVERNMENT POC

Capt. Rick Merchant, SSC/CGEP, 310.653.1871

### SE&I POC

Danny Froerer, SSC/CGEP, 310.414.2823

### CM POC

Jeff Thomas, SSC/CGEP, 310.353.6355



# Bottom Line Up Front

- The GPS Control Segment (CS) currently distributes four data products as defined in ICD-GPS-240 via the USCG Navigation Center. The 2nd Space Operations Squadron (2SOPS) also makes these products available as well as the Anti-Spoof (A-S) file.
- In the OCX era, all five data products will be consolidated into four schema-based XML Information Products defined in ICD-GPS-870 and distributed via the USCG Navigation Center.
- The OCX-era Information Products:
  - Were designed to conform with the National Information Exchange Model (NIEM)
  - Have an associated Information Exchange Package Documentation (IEPD)
  - Will be digitally signed using DoD PKI

# RFC-477: OCX XML Products for Civil Users



## RFC CHANGE TYPE: As-Built or As-Designed Baseline Update

### 1) PROBLEM STATEMENT:

1. The technical baseline does not reflect OCX as-built. The five GPS data products distributed in the AEP era are the Notice Advisory to Navstar Users (NANU), the Operational Advisory (OA), the Almanac (SEM & YUMA), the Satellite Outage File (SOF), and the Anti-Spoof (A-S) file. These data products are formatted in plain text and they:
  - a. Are being deprecated i.e., further updates and support are discontinued while ensuring backwards compatibility
  - b. Do not conform to the requisite National Information Exchange Model (NIEM) Naming and Design Rules
2. There is no communication mechanism to alert external stakeholders of changes happening due to the transition from AEP to OCX  
Linked Pre-RFCs. 1016: Namespace entries in XML files should look like government URLs and 1152: Public XML for ICD-GPS-870

### 2) SOLUTION:

1. Update the technical baseline to reflect OCX as-built. Consolidate the five, plain text data products into four, XML based data products for distribution. The four new data products are the GPS Advisory (NANU), GPS Advisory Collection (SOF), Ops Status (OA), and the Public Common Almanac (SEM, YUMA, and A-S)
  - a. Provide a Validate and Transform Utility (VATU), ensuring backwards compatibility
  - b. Baseline the NIEM Information Exchange Package Documentation (IEPD) specification which contains schemas, documentation, business rules, metadata, and samples
2. Notify the external stakeholders of the transition from AEP to OCX so they can implement the necessary changes



# RFC-477: OCX XML Products for Civil Users

**3) SPONSOR, DRIVER & IMPORTANT DATES:** **THIS RFC IS: ROUTINE**

Sponsor: SSC/CGCX				Lead Driver Event: OCX Constellation Transfer (CTX)				Lead Driver Event Date: 2024		
JCRB	TIM	Stakeholder Review	Comments Due	Resolve Comments	AWG	LL ERB	GPS ERB	Impact Assessment Period	LL CCB	CCB
19 Apr 21	17 Feb 22	15 Mar 22 (Non-Public) 7 Jul 23	14 Apr 22 (Non-Public) 11 Aug 23 & 22 Aug 23	28 Apr 22 (Non-Public) 25 Aug 23	12 May 22 (Non-Public) 27 Sep 23 P-ICWG	25 Oct 23	1 Nov 23	3 Nov 23 – 3 Jan 24	17 Jan 24	23 Jan 24

**4) APPROVAL AUTHORITY: (Select one)**

Enterprise	Proposed Change (or Variance) affects multiple Segments' Technical Baseline(s), prime contractor documentation or external agencies outside of the GPS Directorate
Lower Level	Proposed Change (or Variance) affects one Segment's Technical Baseline or prime contractor documentation



# RFC-477 Stakeholder Review Status



15) REVIEW STATUS											
Office	Response Required	No Impact	No Comments	Comments	No Response	EXTERNAL STAKEHOLDERS	Response Required	No Impact	No Comments	Comments	No Response
CGJA (PCA; GPA)			X			USSF, SpOC 2 SOPS (SPOC 2 SOPS)					
CGJC (ZACS-Civil; GPC)	RR		X			Space Delta 8 (was 50OG)	RR		X		
CGJG (ZACS-NGA; GPD)			X			SpOC/PNT-MAT (was SpOC/S5M)					
CGEP (ZACS-PNT; GPE)	RR		X			National Security Agency (NSA)					
CGEV (PCET; GPEV)						NGA					
CGCC OCX 3F (PCCC)	RR			X		PNT—PO (ADAP, MAGR, DAGR); EGI-M					
CGCC SMPS (PCCC; GPGC)	RR		X			AFLCMC/EBD					
CGCX (PCCX; GPGX)	RR			X		DHS USCG (NAVCEN)	RR				
CGL (PCL; GPL)		X	X			DOT/FAA	RR				
CGG (ECPG; GPL)	RR	X				<b>PRIME CONTRACTORS</b>					
CGJN (PCV; GPN; PCN)						GPS IIR/IIR-M/III/IIIF On Orbit Sust - LM					
CGX (PCT; GPT)						GPS IIF On-Orbit Sust - Boeing					
CGU (PCU; GPU)						GPS III - LM					
CGV3 (PCM3; GPV3)						GPS IIIIF - LM					
CGVF (PCMF; GPV4)						GCS II – Sust - LM	RR	X			
SNWN (PCCN; GPGN)						OCX 1/2 - RTX	RR				
SNPB						OCX 3F - RTX	RR				
AEROSPACE	RR			X		MGUE Inc 1 - KTR A					
MITRE	RR			X		MGUE Inc 1 - KTR B					
SE&I	RR			X		MGUE Inc 1 - KTR C					
<b>EXTERNAL STAKEHOLDERS</b>						MGUE Inc 2 MSI - BAE					
PM-PNT (Army)			See CGJA (PCA; GPA) Response			MGUE Inc 2 MSI - L3H					
NIWC PAC			See CGJN (PCV; GPN) Response			MGUE Inc 2 MSI - RTX					
USNO			See CGJN (PCV; GPN) Response			SMPS Development - BAH	RR				
USMC			See CGJN (PCV; GPN) Response			SMPS Sust - Lockheed Martin					
NAWCAD			See CGJN (PCV; GPN) Response			USNDS Ground 6 / ICADS 7 - Sandia					

# Stakeholder Review Comment Resolution Matrix (CRM) Status - at May 12<sup>th</sup>, 2022 Non-Public AWG



<b>16) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:</b>						
<b>Disposition/Type</b>	<b>Critical</b>	<b>Substantial</b>	<b>Administrative</b>	<b>Totals</b>	<b>Concurrence</b>	<b>Notes</b>
<b>Accept</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>5</b>	<b>5</b>	
<b>Accept with Comment</b>	<b>8</b>	<b>16</b>	<b>18</b>	<b>42</b>	<b>42</b>	
<b>Reject</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>4</b>	
<b>Defer</b>						
<b>Grand Totals:</b>	<b>10</b>	<b>21</b>	<b>20</b>	<b>51</b>	<b>51</b>	

# Stakeholder Review Comment Resolution Matrix (CRM) Status - for RFC-477 at This Review



16) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:						
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence	Notes
Accept			1	1	1	
Accept with Comment						
Reject						
Defer						
<b>Grand Totals:</b>			1	1	1	



# VATU .zip File Signature Error

<b>DOORS ID</b>	N/A		
<b>Paragraph</b>	N/A	<b>Comment Number</b>	CRM #52
<b>Comment Type</b>	Administrative	<b>Disposition</b>	Accept
<b>Comment Originator(s)</b>	Aerospace		
<b>Comment</b>	There was a minor problem with the ValidateTransformUtility.zip file that was initially provided with the RFC-477 artifacts.		
<b>Government Response</b>	<p>Accepted and repaired.</p> <p>With help from Michael Cole, the issue was identified and fixed. It wasn't with the software itself, but way the .zip file's directory structure was organized. The signature should now validate using the same product.pem file provided.</p> <p>Michael was able to verify the file validates (wrt the embedded digital signature) with the jarsigner tool, with the updated .pem file.</p>		



## *QUESTIONS & COMMENTS?*



# Action Item Review



# LUNCH BREAK



# Global Positioning System (GPS) Public Interface Control Working Group (ICWG) & Public Forum Special Topic Briefings

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September 27, 2023  
0830-1700 PDT

United States Space Force  
Positioning, Navigation, and Timing Mission Area





# Status Integrity Support Messages (ISM) Proposed Changes to the Requirements Baseline

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September 27, 2023

Capt. Rick Merchant



# Status of all ISM proposed changes to the Baseline

- The Government's Technical Baseline Change Management Process (TBCMP) requires funding for CCB Approval
- Here is the status of all ISM related changes to the baseline:

Proposed Tech Baseline Change	Status	Way Forward
RFC 413 – [CNAV] Integrity Support Messages (ISM)	CCB Approved, not implemented on any contract	Awaiting program to identify funding and contract for implementation.
RFC 495 – 2022 Public Docs (Contains CNAV ISM additions [495A])	ERB Approved, On-Hold pending Funding	Awaiting program to identify funding and contract for implementation.
Post 495 CNAV ISM additions [502B]	Redlines drafted, awaiting a future effort to incorporate in the baseline	These ISM additions are available for future RFC effort

- Government considering a future effort to combine all ISM proposed changes into one effort



# PNT TBCMP Funding References

- Excerpts from the TBCMP ([Link to GPS.gov](#)) for funding:
  - ROM & Impact Assessment (ROM/IA): “This letter possess a response due date, which is typically prior to the planned GPS CCB (with sufficient margin, so that if funding is required, availability may be determined prior to the GPS CCB).
  - IPT-PM: “Ensures funding is available upon receipt of the ROM/IA”
  - CCB: “Upon ROM/IA receipt, the LLB is held to determine funding availability and obtain LLB Chair concurrence to proceed to the GPS CCB”

**Per TBCMP: Funding Availability is a **requirement** for CCB approval**



# *QUESTIONS & COMMENTS?*



# Integrity Support Message CSOC IPT Recommendation

---

Public Interface Control Working Group Meeting  
27 September 2023

Andrew Hansen  
SSC/CGJC

# Background



## Integrity Support Message (ISM) Background

- Used to support Advanced Receiver Autonomous Integrity Monitoring (ARAIM)
- Introduced in RFC-413 and included in CNAV as Message Type 40 in IS-GPS-200 Revision M and in IS-GPS-705 Revision H, and in CNAV2 in Subframe 3, Page 8 in IS-GPS-800 Revision H
- Additional changes presented at PICWG in October 2022
  - Deferred resolution of several comments
  - Deferred implementation in IS documents
- This brief shows proposed update to ISM baseline
  - Where changes are marked, changes are from the RFC-413 baseline
  - Represents current ISM planning for update in a future revision cycle
  - Request any additional comments

# Summary of Major Updates



- 2022 PICWG briefed parameter changes from  $P_{const}$  to  $R_{const}$  and addition of  $MFD_{const}$
- Make this ISM format only applicable to GPS
  - Different constellations may use different values/format
- Additional modification of parameter values after 2022 PICWG
- Align ISM package sizes between CNAV and CNAV2
- Added elevation angle applicability
- Clarified action on receipt of Service Level 1

Briefing identifies IS-200, IS-705, and IS-800 sections for each content area

# Integrity Support Message



## 30.3.3.10 / 20.3.3.10 Message Type 40 ISM

- Figure 30-14a [20-14a] contains the structure of Message Type 40, Integrity Support Message (ISM). The contents of Message Type 40 are defined below, followed by material pertinent to the use of the ISM data. Users who implement Advanced Receiver Autonomous Integrity Monitoring (ARAIM) may use these parameters for the ARAIM algorithm as referenced in future TSO and MSO.

## 3.5.4.7 Subframe 3, Page 8 - ISM

- Figure 3.5-8a contains the structure of the Subframe 3, Page 8 message. The contents are defined below, followed by material pertinent to the use of the Integrity Support Message (ISM) data. Users who implement Advanced Receiver Autonomous Integrity Monitoring (ARAIM) may use these parameters for the ARAIM algorithm as referenced in future TSO and MSO.

No Change from RFC-413



# ISM Parameter Content



## 30.3.3.10 / 20.3.3.10

- Message Type 40 shall contain the parameters related to GNSS constellation and satellite integrity parameters used for ARAIM algorithms.
- The bit lengths, scale factors, ranges, and units of these parameters are given in Table 30-XIa [Table 20-XIa].
- The CS shall upload the current ISM parameters, when necessary, to the SVs.
- Users should use the ISM parameters with the most recent  $WN_{ISM}$  and  $TOW_{ISM}$  time stamp. All time stamps should be in the past.

## 3.5.4.7.1

- Same content, except message is Subframe 3, Page 8 and parameter definitions are given in Table 3.5-9

No Change from RFC-413

# Table 30-X1a / Table 20-X1a / Table 3.5-9

WAS: RFC-413 implementation

To: Current Planning

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
GNSS ID	4			
$WN_{ISM}$	13	1		weeks
$TOW_{ISM}$	6	4	0 to 164	hours
$t_{correl}$	4		0 to 12	hours
$b_{nom}$	4		0 to 2	meters
$Y_{nom}$	4		0 to 2	
$R_{sat}$	4		$1 \times 10^{-3}$ to $3.16 \times 10^{-10}$	/hours
$P_{const}$	4		$1 \times 10^{-3}$ to $3.16 \times 10^{-10}$	
MFD	4		0.25 to 24	hours
Service Level* Mask****	3 63			

\* See Table 30-X1b for Service Level Descriptions  
 \*\* See Figure 30-14a for complete bit allocation in Message Type 40  
 \*\*\* Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor  
 \*\*\*\* See Table 30-X1b for Mask bit mapping

Parameter	No. of Bits*	Scale Factor (LSB)	Valid Range**	Units
GNSS ID	4		See text	
$WN_{ISM}$	13	1	0 to 8191	weeks
$TOW_{ISM}$	6	4	0 to 164	hours
$t_{correl}$	4		See text	
$\beta_{nom}$	4	0.1	0 to 1.5	Meters
$\gamma_{nom}$	4	0.05	0 to 0.75	
$R_{sat}$	4		See text	
$MFD_{sat}$	4		See text	
$R_{const}$	4		See text	
$MFD_{const}$	4		See text	
Service Level***	3		See text	
PRN Inclusion Mask ****	63		See text	

\* See Figure 30-14a for complete bit allocation in Message Type 40  
 \*\* Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor  
 \*\*\* See Table 30-X1b for Service Level Descriptions  
 \*\*\*\* See Table 30-X1c for PRN Inclusion Mask bit mapping

- Change from  $P_{const}$  to  $R_{const}$ , added Mean Fault Durations ( $MFD_{sat}/MFD_{const}$ )
- New nomenclature for  $\beta_{nom}$
- Update parameter ranges, included in parameter definitions

# 30.3.3.10.1.1 [20.3.3.10.1.1] GNSS Constellation ID



- Bits 39 through 42 of Message Type 40 [Bits 15 through 18 of Subframe 3, Page 8] shall identify the GNSS service to which the associated ISM parameters apply.
- The four bits are defined as follows:
  - 0000 = No Data Available
  - 0001 = Reserved
  - 0010 = Reserved
  - 0011 = Reserved
  - 0100 = GPS
  - 0101 = Reserved
  - 0110 = Reserved
  - 0111 = Reserved
  - 1000 through 1111 = Reserved
- If users see four bits of '0000', users will ignore the entire ISM.

Described ISM format and bit allocations only applicable to GPS

If provide ISM information for other constellations, will need to add constellation, specific format

# ISM Effectivity Time Stamp



- **30.3.3.10.1.2 / 20.3.3.10.1.2 Week Number**
- Bits 43 through 55 of Message Type 40 shall provide the ISM Week Number ( $WN_{ISM}$ ) applicable to the start of the time of validity for a given ISM data issue.
- This parameter describes the time stamp, in terms of weeks, for the ISM parameters.
- **3.5.4.7.1.2**, Bits 19 through 31 of Subframe 3, Page 8 .....
  
- **30.3.3.10.1.2 / 20.3.3.10.1.2 Time of Week**
- Bits 56 through 61 of Message Type 40 shall provide the ISM Time of Week ( $TOW_{ISM}$ ) applicable to the start of the time of validity for a given ISM data issue.
- This parameter describes the time stamp, in terms of hours, for the ISM parameters.
- **3.5.4.7.1.3**, Bits 32 through 37 of Subframe 3, Page 8 .....

No Change from RFC-413

# Correlation Time Constant



## ■ 30.3.3.10.1.4 / 20.3.3.10.1.4

■ Bits 62 through 65 of Message Type 40 shall provide the assumed Correlation Time Constant ( $t_{\text{correl}}$ ) value for the ARAIM at the current time for the associated GNSS constellation.

■ The four bits are defined as follows:

- |                     |                      |
|---------------------|----------------------|
| ■ 0000 = 0.25 hours | ■ 1000 = 1.50 hours  |
| ■ 0001 = 0.33 hours | ■ 1001 = 2.10 hours  |
| ■ 0010 = 0.50 hours | ■ 1010 = 3.00 hours  |
| ■ 0011 = 0.67 hours | ■ 1011 = 4.20 hours  |
| ■ 0100 = 0.83 hours | ■ 1100 = 6.00 hours  |
| ■ 0101 = 1.00 hour  | ■ 1101 = 8.50 hour   |
| ■ 0110 = 1.17 hours | ■ 1110 = 12.00 hours |
| ■ 0111 = 1.33 hours | ■ 1111 = RESERVED    |

■ 3.5.4.7.1.4 Bits 38 through 41 of Subframe 3, Page 8 shall ....

No Change from RFC-413



# IAURA-Independent Additive Term for Nominal Pseudorange Error Bias



## ■ 30.3.3.10.1.5 / 20.3.3.10.1.5

■ Bits 66 through 69 of Message Type 40 shall provide the assumed IAURA-Independent Additive Term ( $\beta_{nom}$ ) value for ARAIM at the current time for the associated GPS GNSS satellites constellation indicated in the PRN Inclusion Mask. The IAURA-Independent Additive Term ( $\beta_{nom}$ ) bounds additive biases in the instantaneous URE that do not scale with IAURA, which is defined in section 30.3.3.1.1.

■ The four bits are defined as follows:

- |                      |                      |
|----------------------|----------------------|
| ■ 0000 = 0.00 meters | ■ 1000 = 0.80 meters |
| ■ 0001 = 0.10 meters | ■ 1001 = 0.90 meters |
| ■ 0010 = 0.20 meters | ■ 1010 = 1.00 meter  |
| ■ 0011 = 0.30 meters | ■ 1011 = 1.10 meters |
| ■ 0100 = 0.40 meters | ■ 1100 = 1.20 meters |
| ■ 0101 = 0.50 meters | ■ 1101 = 1.30 meters |
| ■ 0110 = 0.60 meters | ■ 1110 = 1.40 meters |
| ■ 0111 = 0.70 meters | ■ 1111 = 1.50 meters |

■ 3.5.4.7.1.5 Bits 42 through 45 of Subframe 3, Page 8 shall ....

Clarify definition and Parameter Values changed from RFC-413

# Scalar Term for Nominal Pseudorange Error Bias



## ■ 30.3.3.10.1.6 / 20.3.3.10.1.6

- Bits 70 through 73 of Message Type 40 shall provide the assumed Scalar Term ( $\gamma_{nom}$ )\_value for ARAIM at the current time for the associated GNSS-GPS satellites constellation indicated in the PRN Inclusion Mask. The Scalar Term ( $\gamma_{nom}$ ) bounds normalized additive biases in the instantaneous URE that scale with IAURA, which is defined in section 30.3.3.1.1.

- The four bits are defined as follows:

■ 0000 = 0.00	■ 1000 = 0.40
■ 0001 = 0.05	■ 1001 = 0.45
■ 0010 = 0.10	■ 1010 = 0.50
■ 0011 = 0.15	■ 1011 = 0.55
■ 0100 = 0.20	■ 1100 = 0.60
■ 0101 = 0.25	■ 1101 = 0.65
■ 0110 = 0.30	■ 1110 = 0.70
■ 0111 = 0.35	■ 1111 = 0.75

- **3.5.4.7.1.6** Bits 46 through 49 of Subframe 3, Page 8 shall ....

Clarify definition and Parameter Values changed from RFC-413

# Satellite Fault Rate



## ■ 30.3.3.10.1.7 / 20.3.3.10.1.7

- Bits 74 through 77 of Message Type 40 shall provide the assumed satellite fault rate ( $R_{sat}$ ) value for ARAIM at the current time *for the associated GNSS constellation*.
- $R_{sat}$  is the onset rate at which the instantaneous URE of any given satellite exceeds 4.42 times the IAURA (or 5.73 times the IAURA when the conveying signal is provided with an enhanced level of integrity assurance).

### ■ The four bits are defined as follows:

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| ■ 0000 = $1 \times 10^{-8}$ /hour     | ■ 1000 = $1 \times 10^{-4}$ /hour* |
| ■ 0001 = $3.16 \times 10^{-8}$ /hour  | ■ 1001 = RESERVED                  |
| ■ 0010 = $1 \times 10^{-7}$ /hour     | ■ 1010 = RESERVED                  |
| ■ 0011 = $3.16 \times 10^{-7}$ /hour  | ■ 1011 = RESERVED                  |
| ■ 0100 = $1 \times 10^{-6}$ /hour     | ■ 1100 = RESERVED                  |
| ■ 0101 = $3.16 \times 10^{-6}$ /hour  | ■ 1101 = RESERVED                  |
| ■ 0110 = $1 \times 10^{-5}$ /hour     | ■ 1110 = RESERVED                  |
| ■ 0111 = $3.16 \times 10^{-5}$ /hour* | ■ 1111 = RESERVED                  |

\* Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.

- **3.5.4.7.1.7** Bits 50 through 53 of Subframe 3, Page 8 shall ....

Clarify definition and Parameter Values changed from RFC-413



# Mean Duration of a Satellite Fault



## ■ 30.3.3.10.1.8 / 20.3.3.10.1.8

- Bits 78 through 81 of Message Type 40 shall provide the assumed mean duration of a satellite fault ( $MFD_{sat}$ ) value for ARAIM at the current time *for the associated constellation as per GNSS ID*.
- $MFD_{sat}$  is the mean time the instantaneous URE of any given satellite exceeds 4.42 times the IAURA (or 5.73 times the IAURA when the conveying signal is provided with an enhanced level of integrity assurance) without a timely notification issued to the user.
- The four bits are defined as follows:
 

■ 0000 = 0.25 hours	■ 1000 = RESERVED
■ 0001 = 0.50 hours	■ 1001 = RESERVED
■ 0010 = 1.00 hours	■ 1010 = RESERVED
■ 0011 = 2.00 hours*	■ 1011 = RESERVED
■ 0100 = 4.00 hours*	■ 1100 = RESERVED
■ 0101 = 6.00 hour*	■ 1101 = RESERVED
■ 0110 = 8.00 hours*	■ 1110 = RESERVED
■ 0111 = RESERVED	■ 1111 = RESERVED

\* Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.

- **3.5.4.7.1.8** Bits 54 through 57 of Subframe 3, Page 8 shall ....

Added  $MFD_{sat}$ , revised parameters after PICWG 2022



# Constellation Fault Rate



## ■ 30.3.3.10.1.9 / 20.3.3.10.1.9

■ Bits 82 through 85 of Message Type 40 shall provide the assumed constellation fault rate ( $R_{const}$ ) value for ARAIM at the current time for the associated GNSS constellation.

■  $R_{const}$  is the onset rate at which the instantaneous URE of two or more satellites exceed, due to a common cause, 4.42 times the IAURA (or 5.73 times the IAURA when the conveying signal is provided with an enhanced level of integrity assurance)..

■ The four bits are defined as follows:

- 0000 =  $3.16 \times 10^{-10}$  /hour
- 0001 =  $1 \times 10^{-9}$  /hour
- 0010 =  $3.16 \times 10^{-9}$  /hour
- 0011 =  $1 \times 10^{-8}$  /hour
- 0100 =  $3.16 \times 10^{-8}$  /hour\*
- 0101 =  $1 \times 10^{-7}$  /hour\*
- 0110 =  $3.16 \times 10^{-7}$  /hour\*
- 0111 =  $1 \times 10^{-6}$  /hour\*
- 1000 =  $3.16 \times 10^{-6}$  /hour\*
- 1001 = RESERVED
- 1010 = RESERVED
- 1011 = RESERVED
- 1100 = RESERVED
- 1101 = RESERVED
- 1110 = RESERVED
- 1111 = RESERVED

\* Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.

■ 3.5.4.7.1.9 Bits 58 through 61 of Subframe 3, Page 8 shall ....

Changed to Rconst, revised paramaters after PICWG 2022

# Mean Duration of a Constellation Fault



## ■ 30.3.3.10.1.10 / 20.3.3.10.1.10

- Bits 86 through 89 of Message Type 40 shall provide the assumed mean duration of a constellation fault ( $MFD_{const}$ ) value for ARAIM *at the current time for the associated GNSS constellation*.
- $MFD_{const}$  is the mean time the instantaneous URE of two or more satellites exceed, due to a common cause, 4.42 times the IAURA (or 5.73 times the IAURA when the conveying signal is provided with an enhanced level of integrity assurance) without a timely notification issued to the user.
- The four bits are defined as follows:
 

■ 0000 = 0.25 hours	■ 1000 = RESERVED
■ 0001 = 0.50 hours	■ 1001 = RESERVED
■ 0010 = 1.00 hours	■ 1010 = RESERVED
■ 0011 = 2.00 hours*	■ 1011 = RESERVED
■ 0100 = 4.00 hours*	■ 1100 = RESERVED
■ 0101 = 6.00 hour*	■ 1101 = RESERVED
■ 0110 = 8.00 hours*	■ 1110 = RESERVED
■ 0111 = RESERVED	■ 1111 = RESERVED

\* Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.

- **3.5.4.7.1.8** Bits 62 through 65 of Subframe 3, Page 8 shall ....

Added  $MFD_{const}$ , revised parameters after PICWG 2022

# Service Level



- **30.3.3.10.1.11 / 20.3.3.10.1.11**

- Bits 86 through 88 of Message Type 40 shall provide the Service Level, as described in Table 30-XIb, applicable to a given page of the ISM data issue.

- Three bits are allocated to the four identified service levels as follows:

- 000 = Level 1
- 001 = Level 2
- 010 = Level 3
- 011 = Level 4
- 100 = RESERVED
- 101 = RESERVED
- 110 = RESERVED
- 111 = RESERVED

- **3.5.4.7.1.8** Bits 66 through 68 of Subframe 3, Page 8 shall

....

Changed message bit location from RFC-413

# Service Level

[Table 30-XIb][Table 20-XIb][Table 3.5-10]



Service Level	Severity	Description	Notes/Applicability
Level 1	No Data Available	Service Level indicates that users may resort to the Performance Values for integrity solutions instead of this ISM. Users should not use this ISM	<a href="#">On receipt of Service Level 1, users should invalidate or clear any ISM parameter received for the associated GNSS ID with an effectivity time stamp earlier than the Service Level 1 effectivity time stamp (<math>WN_{ISM}</math> and <math>TOW_{ISM}</math>). The Service Level 1 applies to ISM parameters for all other Service Levels.</a>
Level 2	Non-Safety of Life Use	Service Level indicates that users may only use these parameters for non-safety of life (i.e., uncertified ARAIM) applications.	
Level 3	Safety of Life Use (Horizontal)	Service Level indicates that the user should only use these parameters for the applications requiring integrity less than or equivalent to H-ARAIM solutions.	<a href="#">ISM parameters for GPS for Service Level 3 are valid for use with elevation angles greater than or equal to 2 degrees</a>
Level 4	Safety of Life Use (Vertical)	Service Level indicates that the user should only use these parameters for the applications requiring integrity less than or equivalent to V-ARAIM solutions.	<a href="#">ISM parameters for GPS for Service Level 4 are valid for use with elevation angles greater than or equal to 5 degrees</a>

# PRN Inclusion Mask



■ **30.3.3.10.1.11 / 20.3.3.10.1.11**

- Bits 86 through 88 of Message Type 40 shall provide the Service Level, as described in Table 30-XIb, applicable to a given page of the ISM data issue.
- Three bits are allocated to the four identified service levels as follows:

■ Table 30-XIc

Bits	GPS
93	PRN 1
94	PRN 2
...	...
154	PRN 62
155	PRN 63

■ Table 3.5-11

Bits	GPS
69	PRN 1
70	PRN 2
...	...
130	PRN 62
131	PRN 63

- **3.5.4.7.1.12** Bits 69 through 131 of Subframe 3, Page 8 shall .... Refer to Table 3.5-11 ...

Only identify GPS PRNs and changed message bit numbers

# Reserved for ISM



- **30.3.3.10.1.12 / 20.3.3.10.1.12**
- Bits 156 through ~~244~~ 242 of Message Type 40 are reserved for future ISM use.
  
- **3.5.4.7.1.12**
- Bits 132 through 218 of Subframe 3, Page 8 are reserved for future ISM use.

Added placeholder for reserved bits and aligned ISM sizes between CNAV/CNAV2 reserved bits

# ISM Cyclic Redundancy Check



## ■ 30.3.3.10.1.14 / 20.3.3.10.1.14

- Bits 243 245 through 274 ~~276~~ of Message Type 40 are a 32-bit Cyclic Redundancy Check (CRC) specific to the ISM parameters. The ISM CRC will cover only the ISM parameters in Message Type 40 (bits 39 through 242 244).
- Bits 275 through 276 are reserved.

## ■ 3.5.4.7.1.14

- Bits 219 through 250 of Subframe 3, Page 8 are a 32-bit Cyclic Redundancy Check (CRC) specific to the ISM parameters. The ISM CRC will cover only the ISM parameters in Subframe 3, Page 8 (bits 15 through 218).

Updated assigned bits, removed reference to RTCA documents, and aligned ISM sizes between CNAV/CNAV2 reserved bits



# Use of ISM Data



## 30.3.3.10.2 / 20.3.3.10.2

- To calculate the nominal pseudorange error bias ( $b_{nom}$ ), use the following equation
  - $b_{nom} = \beta_{nom} + \gamma_{nom} * IAURA$
  - IAURA is defined in section 30.3.3.1.1 [section 20.3.3.1.1]

## 3.5.4.7.1

- To calculate the nominal pseudorange error bias ( $b_{nom}$ ), use the following equation
  - $b_{nom} = \beta_{nom} + \gamma_{nom} * IAURA$
  - IAURA is defined in section 6.2.1.

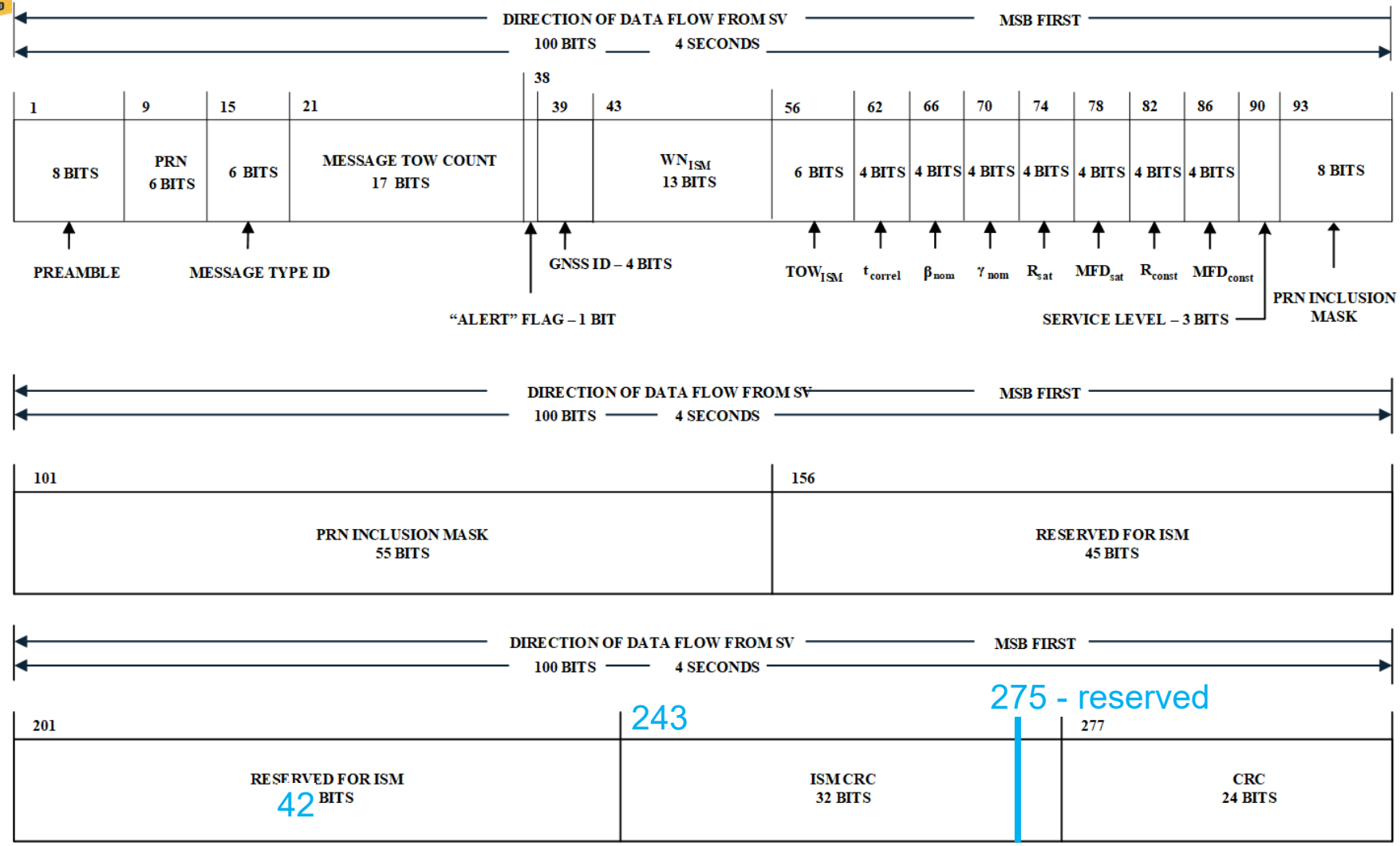
## 6.2.1

- The composite integrity assured URA (IAURA) value is the RSS of an elevation-dependent function of the upper bound value of the  $URA_{ED}$  component and the upper bound value of the  $URA_{NED}$  component.

Added equation for use of the data



# Figure 30-14-a [Figure 20-14a]





# *QUESTIONS & COMMENTS?*

# Next Generation GPS - OCX Public Release Data Products

## *Public Interface Configuration Working Group*

*27-SEP-2023*

### **Points of Contact**

*Danny Froerer*

*Science Applications International Corporation*

*Stephan M Hillman*

*The Aerospace Corporation*

*Kurk Erickson*

*The Raytheon Corporation*





- The materials for this review are contained within several zip archives as well as individual files:
  - 870-IEPDs.zip
    - Contains signed zip archives for each of the three ICD-GPS-870 IEPDs
    - The contents of each IEPD is described in detail later in this briefing
  - ValidateTransformUtility.zip
    - Contains Validate And Transform Utility (VATU) as well as the VATU User Guide
    - The VATU executable can be found within the ValidateAndTransformUtility sub-directory
      - “ValidateAndTransformUtility.exe”
    - The VATU is a stand-alone utility intended to function on Windows and Linux platforms per Section 3.3 of ICD-GPS-870
  - Cert\_PEM\_Files.zip
    - Contains the \*.pem files for two certificates
    - Both certs are provided to support validation of the signed files, either using the provided VATU or through independent means
      - “product.pem” - signing cert for the IEPD and Transform Utility zip archives as well as the sample GGA XML files provided within each IEPD
      - “productNegativeTest.pem” - provided so a failure can be observed when using the incorrect cert to attempt validation of the digital signatures



- **Review materials continued:**

- Sample products provided for this review are signed using a Raytheon generated certificate with a 10-year validity. In operations, these products will be signed using a standard DoD PKI certificate.
- In operations the IEPDs, VATU, and \*.pem files corresponding to the signing certificates will be made available to the public via the USCG Navigation Center (NAVCEN) web site
  - Details of the NAVEN distribution front-end are in work and will be made available in future.

# Background



- GPS Control Segment (CS) currently distributes four data products as defined in ICD-GPS-240 via the USCG Navigation Center:
  - Notice Advisory to Navstar Users (NANU)
  - Operational Advisory (OA)
  - Almanac (SEM & YUMA)
  - Satellite Outage File (SOF)
  - See: <https://www.navcen.uscg.gov/?pageName=gpsAlmanacs>
- The 2d Space Operations Squadron (2SOPS) also makes these products available as well as the Anti-Spoof (A-S) file.
  - See: <https://gps.afspc.af.mil/gps/conststatus.html>
- In the OCX era, all five data products will be consolidated into four schema-based XML Information Products defined in ICD-GPS-870 and distributed via the USCG Navigation Center:
  - GPS Advisory (equivalent NANU content)
  - GPS Advisory Collection (equivalent SOF content)
  - Ops Status (equivalent Ops Advisory content)
  - Public Common Almanac (equivalent SEM, YUMA, and A-S content)

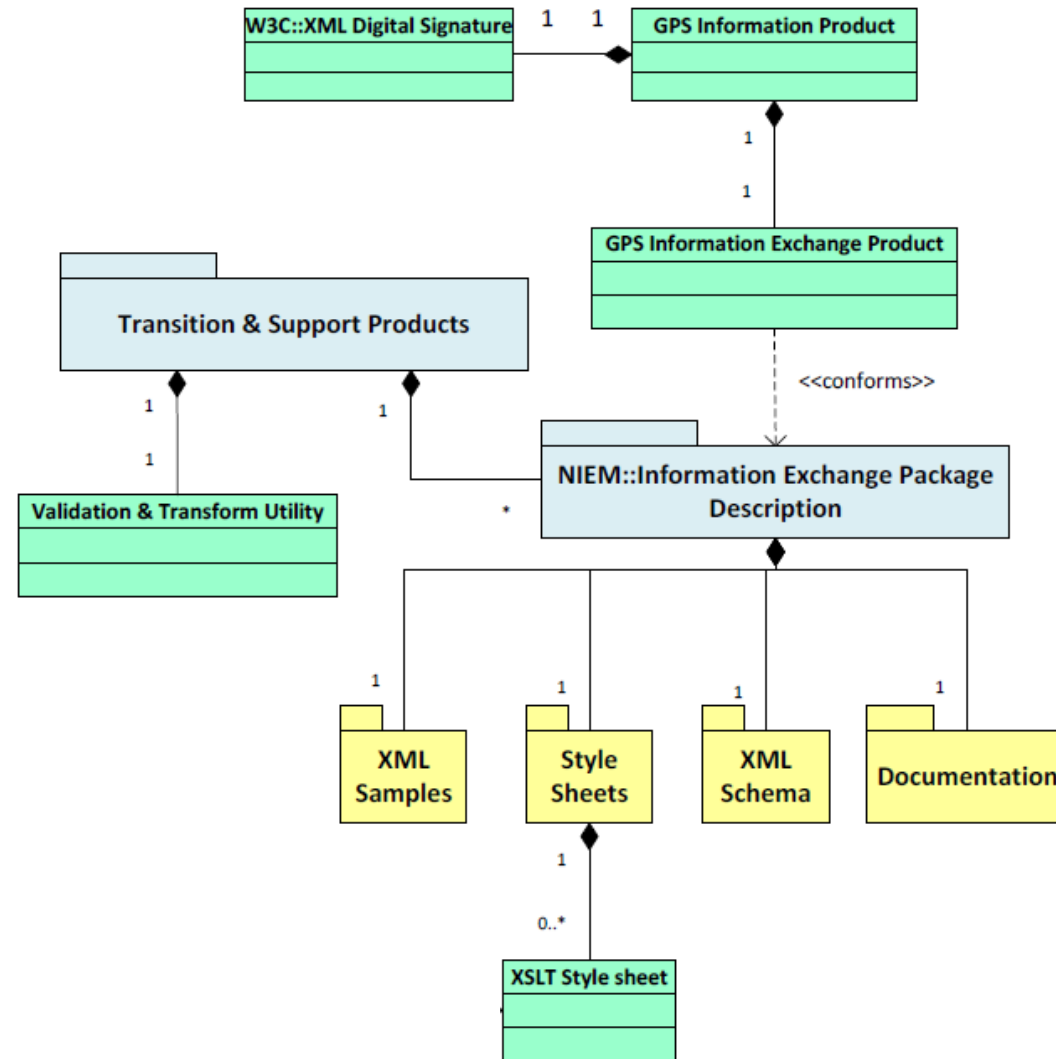


# OCX- Era Product Design

- The OCX-era Information Products were designed to conform with the National Information Exchange Model (NIEM)
  - “NIEM is a common vocabulary that enables efficient information exchange across diverse public and private organizations”
  - The OCX-era products are compliant with NIEM Version 2.1
  - See: <https://www.niem.gov/>
- IAW NIEM, each OCX-era product has an associated Information Exchange Package Documentation (IEPD)
  - “A NIEM IEPD is a package that describes the construction and content of a NIEM information exchange”
  - For the OCX-era products, each IEPD will be provided in the form of a digitally signed zip file containing a pre-defined directory structure with:
    - XML Schema
    - XML Sample Product/s
    - XSLT Stylesheet/s
    - Legacy (AEP-era) Sample Product/s
    - Documentation
- All OCX-era products will be digitally signed using DoD PKI



# OCX-Era Product High Level Ontology





# Data Integrity 1 of 2

- All OCX-era Information Products will contain a digital signature conforming to W3C standards to provide data integrity in transit and at rest
- The digital signature element of each product will include the x509 certificate corresponding to the digital signature
- See <https://www.w3.org/TR/xmlsig-core1/>
- Validation of digital signatures is not required to use the products, but it is strongly encouraged

```

<gpsocxmetadata:Header>
  <Signature xmlns="http://www.w3.org/2000/09/xmlsig#">
    <SignedInfo>
      <CanonicalizationMethod Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>
      <SignatureMethod Algorithm="http://www.w3.org/2001/04/xmlsig-more#rsa-sha256"/>
      <Reference URI="">
        <Transforms>
          <Transform Algorithm="http://www.w3.org/2000/09/xmlsig#enveloped-signature"/>
        </Transforms>
        <DigestMethod Algorithm="http://www.w3.org/2001/04/xmlenc#sha256"/>
        <DigestValue>digest value</DigestValue>
      </Reference>
    </SignedInfo>
    <SignatureValue>signature</SignatureValue>
    <KeyInfo><X509Data><X509Certificate>certificate</X509Certificate></X509Data></KeyInfo>
  </Signature>
</gpsocxmetadata:Header>

```



# Data Integrity 2 of 2

- The VATU and IEPD archives (zip files) are signed separately using Oracle's jarsigner
- See <https://docs.oracle.com/en/java/javase/13/docs/specs/man/jarsigner.html>
- See <https://docs.oracle.com/en/java/javase/13/docs/specs/jar/jar.html>
- Per the jarsigner standard, each archive contains a META-INF directory with the following files:
  - MANIFEST.MF
    - Contains two lines for each file found within the archive:
      - Line 1 - Filename
      - Line 2 - Name of the digest algorithm (ex SHA) followed by the digest (hash) of the binary data within the file
  - PRODUCT.SF
    - Contains two lines for each file found within the archive:
      - Line 1 - Filename
      - Line 2 - Name of the digest algorithm (ex SHA) followed by the digest (hash) value of the two lines for the corresponding source file in the manifest file
  - PRODUCT.RSA
    - Contains the signature of the PRODUCT.SF file
    - This file also contains, encoded inside it, the certificate or certificate chain from the keystore that authenticates the public key corresponding to the private key used for signing



# Backwards Compatibility Approach 1 of 7

For systems that will not be updated to process the directly-distributed XML files, XSLT Stylesheets are provided for each OCX-era product that has one or more corresponding AEP-era products

- Directly distributed products (Information Products) include the GPS Advisory, GPS Advisory Collection, Ops Status, and Public Common Almanac XML files
- The Stylesheets allow for transformation of the directly-distributed XML products into the AEP-era ASCII text formats (or legacy XML in the case of the SOF file)
  - Stylesheets conform to W3C standard XSL Transformations 2.0.

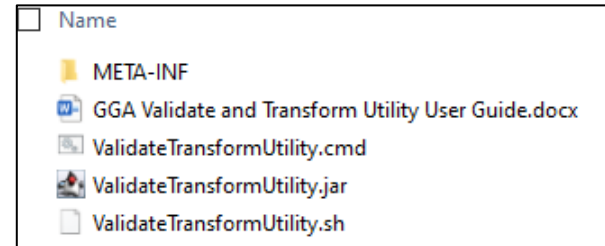
For those users without the knowledge or resources to directly utilize the XSLT Stylesheets, GPS will provide a downloadable utility which will ingest an XML product and relevant XSLT Stylesheet, and then output the desired AEP-era formatted file

- The Validate and Transform Utility (VATU) is a stand-alone application that can be installed and used on local workstations
- A User Guide is included with the VATU to provide instructions on the tool's use

*The VATU is provided with no warranty implied and is not intended as a long-term solution - users are encouraged to migrate to direct use of the XML and/or XSLT files as soon as practical*



Once the ValidateTransformUtility.zip file is extracted, you will see the following:



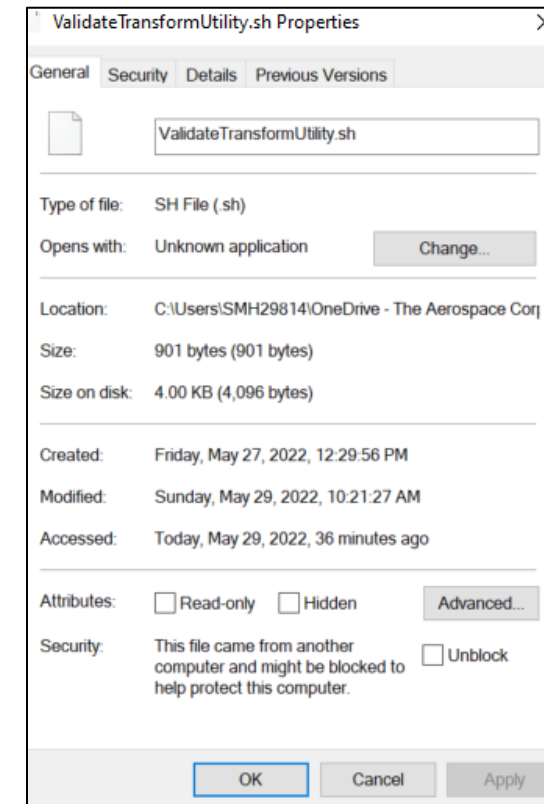
- As noted in Data Integrity, the META-INF folder contains digital signature information for the files contained in the ValidateTransformUtility.zip file
- The GGA Validate and Transform Utility User Guide.docx contains requirements and instructions for running the utility
- The ValidateTransformUtility.cmd and ValidateTransformUtility.sh files are scripts provided to assist with running the utility
- The ValidateTransformUtility.jar file is the utility itself and can be extracted in the same manner as a zip file in order to see additional information such as 3<sup>rd</sup> Party licenses and the government warranty statement
  - The utility may also be run by simply double-clicking on the jar file itself



There is a known issue with Windows Smartscreen blocking execution of the scripts depending on the configuration of the user's computer

The following fix action is one possible solution, but results may vary depending on user configuration

- Right-click on the file that will not execute and then select Properties to bring up the pop-up shown
- If available, select the Unblock check box on the bottom-right, select Apply, and then OK





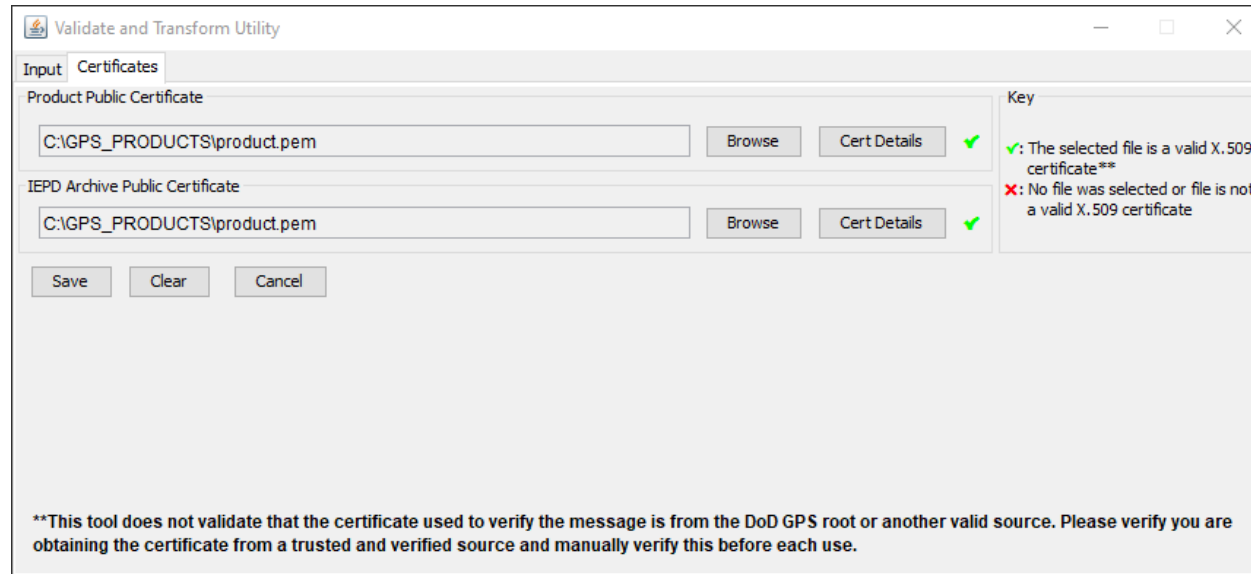
# Backwards Compatibility Approach 4 of 7

The Validate & Transform Utility (VATU) provides users with the option to validate a product's digital signature in addition to performing any transforms

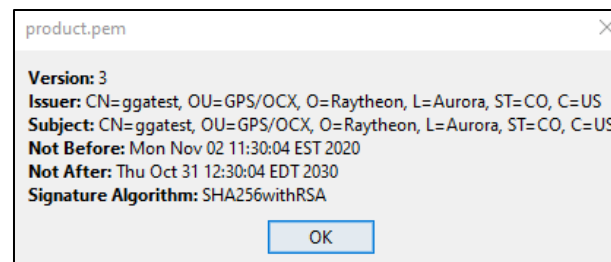
- The VATU ingests an Information Product and that Product's IEPD zip file



- If the \*.pem files for the certificates used to sign the Information Product & IEPD are provided, the VATU will attempt to validate their digital signatures

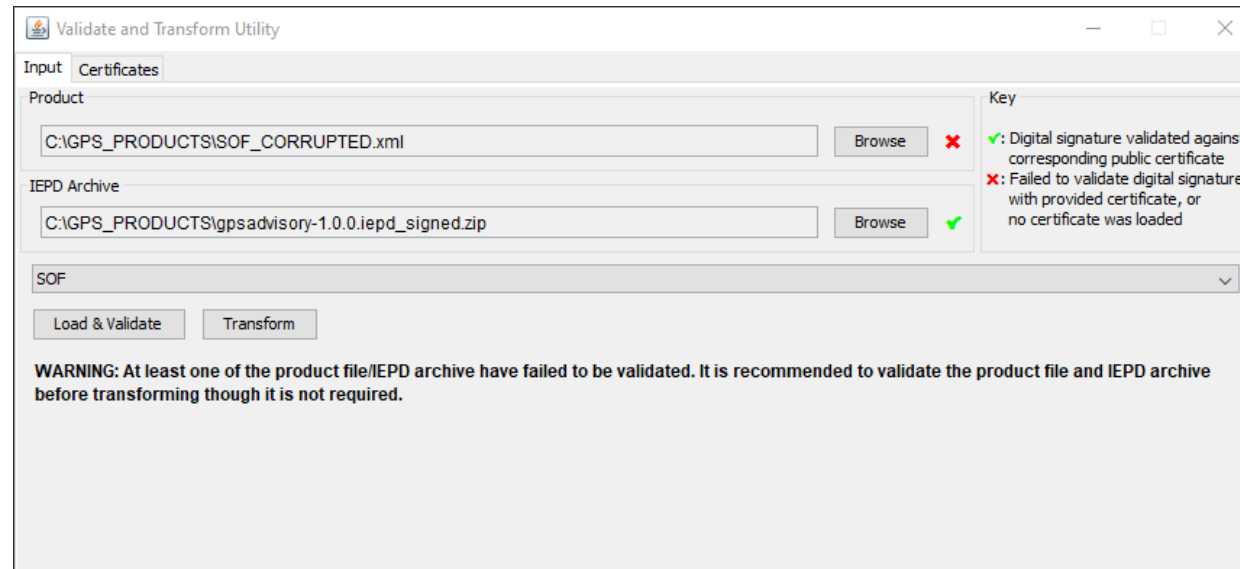


- The VATU also provides an ability for the user to examine details of the loaded certificate if desired





- Once the product, IEPD, and pem files are loaded, the tool will indicate whether the product and/or IEPD signatures validate and will present a dropdown of transformation options for the given product



*See GGA Validate and Transform Utility User Guide.docx for full details*



There is a known issue on some platforms where after entering the desired product and IEPD Archive – *with no certificates loaded* – the below may result:



The fix action is to click on the bottom border of the window and drag it down to increase its vertical size until you see the problem is corrected

The software developer has an action to correct this issue prior to the tool being posted for operational use

# IEPD Organization & Content 1 of 2

On the following slide is an example of the general organization and content of the IEPDs provided by GPS within the 870-IEPDs.zip file

- This example is based on the Ops Status Information Product IEPD, but all GPS IEPDs follow the same basic structure and conform to the same standards

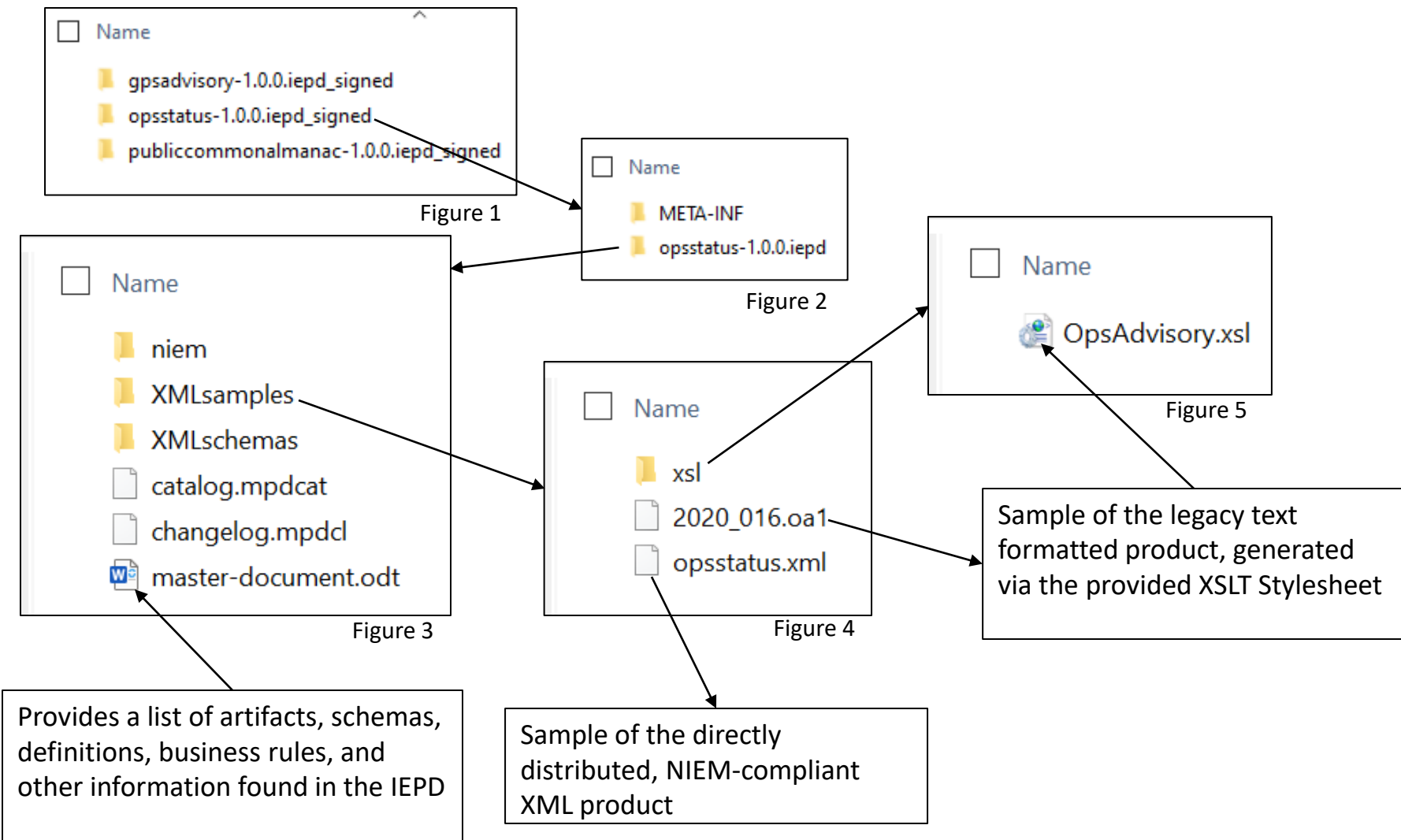
Schema is provided to simplify adoption of the NIEM-compliant XML products

Mapping from NIEM-compliant XML data elements to the legacy text product can be found in the XSLT Stylesheet

The GPS program acknowledges not all users will be familiar with schema or XSLT standards, so the previously mentioned Validate and Transform Utility (VATU) is provided

*Sample products provided for this review do not contain operationally realistic data*

# IEPD Organization & Content 2 of 2



# GPS vs UTC Time

Wherever a Date-Time Group (DTG) is displayed in the standard NIEM format as shown below, that DTG is referenced to UTC

```
<gpspub:CreateDate>2020-01-16T16:31:09.000Z</gpspub:CreateDate>
```

If the Legacy (AEP-era) product contained a DTG which is referenced to GPS rather than UTC, it is still shown in the NIEM format, but also includes the SourceGPSTime attribute

```
<gpspub:EffectiveDate gpspub:sourceGPSTime="1263228600" gpspub:timezoneCode="UTC">
  <nc:DateTime>2020-01-16T16:49:42.000Z</nc:DateTime>
</gpspub:EffectiveDate>
```

*Sample taken from Effective Date field of GPS Advisory Collection which corresponds to the SOF REFERENCE DTG*

This general format is used for any data element whose Legacy counterpart is referenced to the GPS Time Standard

- SourceGPSTime attribute provides seconds since GPS Epoch, 6 Jan 1980 0000Z
- The GPS time is then followed by a NIEM-standard DTG format, which is always in UTC
- If only the NIEM-standard DTG format is provided in an element, it will always be referenced to UTC

The Ops Status product provides the same information as found in the AEP-era Operational Advisory (OA) product, per the definition found in ICD-GPS-870 Rev E, Appendix 2

- Legacy Ops Advisory Header
  - This data is found within the opstatus:GPSMetadata element under opstatus:Constellation

Row 1 – Classification:

```
<gpspub:ICISMMetadata nism:ownerProducer="USA" nism:classification="U">  
<gpspub:NoticeList>  
<gpspub:Notice>  
<gpspub:NoticeText>DoD-Dist-A</gpspub:NoticeText>  
</gpspub:Notice>  
</gpspub:NoticeList>  
</gpspub:ICISMMetadata>
```

Rows 2 & 3 – Product Description & Date:

```
<gpspub:IdentifierValueText>2020_016.OA1</gpspub:IdentifierValueText>  
<gpspub:KeywordValueText>OpsStatus</gpspub:KeywordValueText>  
<gpspub:CreatedDate>2020-01-16T16:31:09.000Z</gpspub:CreatedDate>
```

- Legacy Ops Advisory Section 1 – Plane, Slot, & AFS Assignment
  - This data is grouped under opsstatus:Constellation within individual gpspub:SpaceVehicle elements for each PRN as follows

```
<gpspub:SpaceVehicle xsi:type="gpspub:GPSSpaceVehicleType" s:id="vehref27">
  <gpspub:PseudoRandomNoiseID>27</gpspub:PseudoRandomNoiseID>
  <gpspub:SlotNumeric>3</gpspub:SlotNumeric>
  <gpspub:PlaneText>F</gpspub:PlaneText>
  <gpspub:SVBlockCode>IIR</gpspub:SVBlockCode>
  <gpspub:NavigationPayload>
    <gpspub:Clock>
      <gpspub:AtomicClockKindCode>rubidium</gpspub:AtomicClockKindCode>
    </gpspub:Clock>
  </gpspub:NavigationPayload>
</gpspub:SpaceVehicle>
```



- Legacy Ops Advisory Section 2
  - Current and recent advisories, forecasts, and general text NANUs
  - This data is grouped within individual opsstatus:GPSSpaceEvent elements for each PRN as follows

```

<opsstatus:GPSSpaceEvent>
  <nc:ActivityDateRange>
    <nc:StartDate>
      <nc:DateTime>2009-01-01T09:15:00.000Z</nc:DateTime>
    </nc:StartDate>
    <nc:EndDate>
      <nc:DateTime>2009-01-01T16:20:00.000Z</nc:DateTime>
    </nc:EndDate>
  </nc:ActivityDateRange>
  <gpspub:SpaceEventKindCode>ForecastMaintenance</gpspub:SpaceEventKindCode>
  <gpspub:GPSSpaceVehicleReference s:ref="vehref15"/>
  <opsstatus:GPSSpaceEventMetadata>
    <nc:EffectiveDate>
      <nc:DateTime>2009-01-02T11:05:00.000Z</nc:DateTime>
    </nc:EffectiveDate>
    <nc:ReportedDate>
      <nc:DateTime>2009-01-02T11:05:00.000Z</nc:DateTime>
    </nc:ReportedDate>
    <gpspub:DESVersionNumeric>9</gpspub:DESVersionNumeric>
    <gpspub:NtkDESVersionNumeric>7</gpspub:NtkDESVersionNumeric>
    <gpspub:ResourceElementIndicator>>false</gpspub:ResourceElementIndicator>
    <gpspub:CreatedDate>2020-01-16T16:31:09.000Z</gpspub:CreatedDate>
    <gpspub:IdentifierValueText>2009001</gpspub:IdentifierValueText>
  </opsstatus:GPSSpaceEventMetadata>
</opsstatus:GPSSpaceEvent>

```





- Legacy Ops Advisory Section 2 – Continued
  - The following provides a basic mapping between key child elements within the opsstatus:GPSSpaceEvent element and the legacy Ops Advisory format:
    - **ActivityDate** – Event Start/Stop time as seen in the SUMMARY column
      - This is an optional element and may not be present if the NANU has no start/stop time information
      - **ActivityDateRange** will be used if the event has both start and stop DTG, with the start and stop DTG contained within the **StartDate** and **EndDate** elements
    - **SpaceEventKindCode** – NANU Type
      - Enumerations are fully spelled out rather than abbreviations
      - Ex, ForecastDeltaV instead of FCSTDV
    - **GPSSpaceVehicleReference** – PRN
    - **EffectiveDate** = **ReportedDate** – MSG DATE/TIME
    - **CreatedDate** – The creation DTG of the Ops Status product



- Legacy Ops Advisory Section 3 - Point of Contact Information
  - This data is found within the child elements of opsstatus:GPSMetadata under opsstatus:Constellation
    - Individual gpspub:PointOfContact records are provided for each POC as follows

```

<gpspub:PointOfContact>
  <nc:OrganizationName>NAVCEN</nc:OrganizationName>
  <nc:OrganizationPrimaryContactInformation>
    <nc:ContactTelephoneNumber>
      <nc:NANPTelephoneNumber>
        <nc:TelephoneAreaCodeID>703</nc:TelephoneAreaCodeID>
        <nc:TelephoneExchangeID>313</nc:TelephoneExchangeID>
        <nc:TelephoneLineID>5900</nc:TelephoneLineID>
        <nc:TelephoneSuffixID xsi:nil="true"/>
      </nc:NANPTelephoneNumber>
    </nc:ContactTelephoneNumber>
    <nc:ContactWebsiteURI> HTTPS://WWW.NAVCEN.USCG.GOV </nc:ContactWebsiteURI>
  </nc:OrganizationPrimaryContactInformation> <gpspub:PointOfContactCategoryCode> CIVIL NON-
  AVIATION </gpspub:PointOfContactCategoryCode>
</gpspub:PointOfContact>

```



The Public Common Almanac product provides the same information as found in the AEP-era SEM and YUMA almanacs as well as the Anti-Spoof and Extended Signals Health Status files, per the definitions found in ICD-GPS-870 Rev E, Appendix 2

The Public Common Almanac also contains classification and point of contact information as previously defined in for the Ops Status product

- The classification and point of contact data can be found within the pubcomalm:GPSMetadata element under pubcomalm:Constellation

Legacy Week Number & Time of Applicability are provided under the pubcomalm:TimeOfApplicabilityDateTime as follows

```
<pubcomalm:TimeOfApplicabilityDateTime>
```

```
<gpspub:GPSWeekNumeric>40</gpspub:GPSWeekNumeric>
```

```
<gpspub:GPSSecondsInWeekNumeric>18400</gpspub:GPSSecondsInWeekNumeric>
```

```
</pubcomalm:TimeOfApplicabilityDateTime>
```



The Almanac and Anti-Spoof data is grouped under pubcomalm:Constellation within individual gpspub:SpaceVehicle elements for each PRN as follows

```

<gpspub:SpaceVehicle xsi:type="gpspub:GPSSpaceVehicleType">

  <nc:ItemName>SVN: 68, PRN: 27</nc:ItemName>
  <nc:ItemStatus xsi:nil="true"/>

  <gpspub:OrbitalState xsi:type="gpspub:SupplementalOrbitStateInfoType">

    <gpspub:EccentricityMeasure>0.006045738566963673</gpspub:EccentricityMeasure>
    <gpspub:SquareRootSemiMajorAxisMeasure>5153.6763027527095</gpspub:SquareRootSemiMajorAxisMeasure>
    <gpspub:ArgumentOfPerigeeMeasure>-0.9401327840266962</gpspub:ArgumentOfPerigeeMeasure>
    <gpspub:MeanAnomalyMeasure>0.3921527776300167</gpspub:MeanAnomalyMeasure>
    <gpspub:GeographicLongitudeOfOrbitalPlaneMeasure>
-0.22369163821016966
  </gpspub:GeographicLongitudeOfOrbitalPlaneMeasure>
    <gpspub:InclinationOffsetMeasure>0.010640977589115507</gpspub:InclinationOffsetMeasure>
    <gpspub:RateOfRightAscensionMeasure>-2.454105210312804E-9</gpspub:RateOfRightAscensionMeasure>
    <gpspub:RightAscensionAngleMeasure>-7.709798899855139E-9</gpspub:RightAscensionAngleMeasure>

  </gpspub:OrbitalState>

  <gpspub:VehicleID>68</gpspub:VehicleID>
  <gpspub:PseudoRandomNoiseID>27</gpspub:PseudoRandomNoiseID>
  <gpspub:SVBlockCode>IIF</gpspub:SVBlockCode>

```

.....Continued on next slide



```

<gpspub:SpaceVehicle xsi:type="gpspub:GPSSpaceVehicleType">

  <gpspub:NavigationPayload xsi:type="gpscomalm:ModernizedNavigationPayloadType">

    <gpspub:AverageUserRangeAccuracyNumeric>0</gpspub:AverageUserRangeAccuracyNumeric>
    <gpspub:Anti-SpoofStatusCode>OFF</gpspub:Anti-SpoofStatusCode>
    <gpspub:SatelliteConfigurationNumeric>3</gpspub:SatelliteConfigurationNumeric>
    <gpspub:NAVHealthSummaryCode>all NAV data are OK</gpspub:NAVHealthSummaryCode>
    <gpspub:HealthOfSvSignalComponentsCode>All Signals OK</gpspub:HealthOfSvSignalComponentsCode>

    <gpspub:Clock>
      <gpspub:ClockBiasMeasure>1.3639616230718497E-4</gpspub:ClockBiasMeasure>
      <gpspub:ClockDriftMeasure>4.090584069820737E-12</gpspub:ClockDriftMeasure>
    </gpspub:Clock>

    <gpscomalm:L1>
      <gpspub:SignalCode>L1C</gpspub:SignalCode>
      <gpspub:SignalHealthCode>Signal bad or unavailable</gpspub:SignalHealthCode>
    </gpscomalm:L1>
    <gpscomalm:L2>
      <gpspub:SignalCode>L2C</gpspub:SignalCode>
      <gpspub:SignalHealthCode>Signal OK</gpspub:SignalHealthCode>
    </gpscomalm:L2>
    <gpscomalm:L5>
      <gpspub:SignalCode>L5</gpspub:SignalCode>
      <gpspub:SignalHealthCode>Signal OK</gpspub:SignalHealthCode>
    </gpscomalm:L5>

  </gpspub:NavigationPayload>

</gpspub:SpaceVehicle>

```

- NAVHealthSummaryCode per IS-GPS-200 section 20.3.3.3.1.4 SV Health
- HealthOfSvSignalComponentsCode per IS-GPS-200 Table 20-VIII
- SignalHealthCode per IS-GPS-200 section 30.3.3.1.1.2 Signal Health (L1/L2/L5).



There are two general types of GPS Advisory which can be differentiated based on the `gpsadvisory:GpsAdvisoryKindCode` element

- GPS Advisory – Corresponds to individual legacy NANUs
  - `<gpsadvisory:GpsAdvisoryKindCode>NoticeAdvisoryToNavstarUsers</gpsadvisory:GpsAdvisoryKindCode>`
- GPS Advisory Collection – Corresponds to the legacy Satellite Outage File
  - `<gpsadvisory:GpsAdvisoryKindCode>SatelliteOutageFile</gpsadvisory:GpsAdvisoryKindCode>`

Both types of GPS Advisory contain classification and point of contact information as previously defined in for the Ops Status product

- The classification and point of contact data can be found within the `gpsadvisory:GPSMetadata` element under `gpsadvisory:GpsAdvisory`

Similar to the Ops Status product, the GPS Advisory contains Created, Reported, and Effective date/time stamps within the `gpsadvisory:GPSMetadata` element under `gpsadvisory:GpsAdvisory`, though there is some difference between how `ReportedDate` is used between the GPS Advisory vs the GPS Advisory Collection

- **CreatedDate** – DTG of product creation
- **ReportedDate** –
  - GPS Advisory = NANU DTG (or REF NANU DTG as appropriate, see slide 3 of 4)
  - GPS Advisory Collection = DTG of product creation
- **EffectiveDate** – Internal system time to which the data is referenced, does not correlated to any DTG provided in the legacy NANUs



Data for the GPS Advisory can be found within the gpsadvisory:GPSSpaceEvent element under gpsadvisory:GpsAdvisory as well as within the gpsadvisory:GPSSpaceVehicle element

```
<gpsadvisory:GpsAdvisory>
```

```
  <gpsadvisory:GpsAdvisoryKindCode>NoticeAdvisoryToNavstarUsers</gpsadvisory:GpsAdvisoryKindCode>
```

```
  <gpsadvisory:GPSSpaceEvent>
```

```
    <nc:ActivityIdentification>
```

```
      <nc:IdentificationID>NANU2982127</nc:IdentificationID>
```

```
    </nc:ActivityIdentification>
```

```
    <nc:ActivityDateRange>
```

```
      <nc:StartDate>
```

```
        <nc:DateTime>2051-05-09T06:51:00.000Z</nc:DateTime>
```

```
      </nc:StartDate>
```

```
      <nc:EndDate>
```

```
        <nc:DateTime>2709-10-24T22:41:00.000Z</nc:DateTime>
```

```
      </nc:EndDate>
```

```
    </nc:ActivityDateRange>
```

```
    <gpspub:SpaceEventKindCode>ForecastMaintenance</gpspub:SpaceEventKindCode>
```

```
    <gpspub:GPSSpaceVehicleReference xmlns:s="http://niem.gov/niem/structures/2.0" s:ref="vehref72"/>
```

```
  </gpsadvisory:GPSSpaceEvent>
```

```
</gpsadvisory:GpsAdvisory>
```

```
<gpsadvisory:GPSSpaceVehicle xmlns:s="http://niem.gov/niem/structures/2.0" s:id="vehref72">
```

```
  <gpspub:VehicleID>72</gpspub:VehicleID>
```

```
  <gpspub:PseudoRandomNoiseID>45</gpspub:PseudoRandomNoiseID>
```

```
</gpsadvisory:GPSSpaceVehicle>
```



If the GPS Advisory references an earlier Advisory (ex, summary, cancel, extend, reschedule, etc), a second `gpsadvisory:GpsAdvisory` element with information on the referenced Advisory will be provided as follows

```
<gpsadvisory:GpsAdvisory xmlns:s="http://niem.gov/niem/structures/2.0" s:id="REF2982127">

  <gpsadvisory:GpsAdvisoryKindCode>NoticeAdvisoryToNavstarUsers</gpsadvisory:GpsAdvisoryKindCode>

  <gpsadvisory:GPSSpaceEvent>
    <nc:ActivityIdentification>
      <nc:IdentificationID>NANU2982127</nc:IdentificationID>
    </nc:ActivityIdentification>
  </gpsadvisory:GPSSpaceEvent>

  <gpsadvisory:GPSMetadata>
    <nc:ReportedDate>
      <nc:DateTime> 2323-01-13T04:26:00.000Z </nc:DateTime>
    </nc:ReportedDate>
    <gpspub:IdentifierValueText>NANU2982127</gpspub:IdentifierValueText>
    <gpspub:KeywordValueText>NoticeAdvisoryToNavstarUsers</gpspub:KeywordValueText>
  </gpsadvisory:GPSMetadata>

</gpsadvisory:GpsAdvisory>
```





The GPS Advisory Collection is constructed similarly to the GPS Advisory but it contains multiple `gpsadvisory:GPSSpaceEvent` elements, one for each NANU recorded in the Collection

The Collection also contains multiple `gpsadvisory:GPSSpaceVehicle` elements, one for each PRN/SVN pair referenced in the recorded NANUs

- Note, the primary key used for each NANU is `gpspub:GPSSpaceVehicleReference` within `gpsadvisory:GPSSpaceEvent`, which is the SVN
- `gpsadvisory:GPSSpaceVehicle` maps the SVN to the PRN

Otherwise, the structure of the data elements remains the same as shown previously for the GPS Advisory



# *QUESTIONS & COMMENTS?*



***BACKUP SLIDE***

# Map of Date/Time Fields from Modern to Legacy Product Types

GGA Product	GGA DateTime Element (UTC)	GGA xsd Type	Legacy Product	Legacy DateTime	Legacy Time Type
GPS Advisory	GpsAdvisory[not(@s:id)]/GPSMetadata/ReportedDate	gpspub:UTCDateTimeType	NANU	1. NANU DTG: <ddhhmmZ MMM yyyy>	UTC
GPS Advisory	GpsAdvisory[@s:id]/GPSMetadata/ReportedDate	gpspub:UTCDateTimeType	NANU	1. REF NANU DTG: 2. DTG <ddhhmmZ MMM yyyy>	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/StartDate	gpspub:UTCDateTimeType	NANU	UNUSABLE START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/EndDate	gpspub:UTCDateTimeType	NANU	DECOMMISSIONING START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDate	gpspub:UTCDateTimeType	NANU	LAUNCH TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDate (when no STOP)	gpspub:UTCDateTimeType	NANU	START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/StartDate	gpspub:UTCDateTimeType	NANU	START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/EndDate	gpspub:UTCDateTimeType	NANU	STOP TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDate	gpspub:UTCDateTimeType	NANU	COORDINATED UNIVERSAL TIME (UTC) WILL SEQUENCE AS FOLLOWS:	UTC
GPS Advisory Collection	GPSMetadata/CreatedDate	niem-xsd:dateTime	Satellite Outage File	CREATION / @ [YEAR   DOY   HR   MIN   SEC]	UTC
GPS Advisory Collection	GPSMetadata/EffectiveDate	gpspub:UTCDateTimeType	Satellite Outage File	REFERENCE / @ [YEAR   DOY   HR   MIN   SEC]	GPS
GPS Advisory Collection	ActivityDate	gpspub:UTCDateTimeType	Satellite Outage File	CURRENT / @ START [YEAR   DOY   HR   MIN   SEC]	UTC
GPS Advisory Collection	ActivityDateRange/StartDate	gpspub:UTCDateTimeType	Satellite Outage File	PREDICTED / @ START [YEAR   DOY   HR   MIN   SEC]	UTC
GPS Advisory Collection	ActivityDateRange/EndDate	gpspub:UTCDateTimeType	Satellite Outage File	PREDICTED / @ END [YEAR   DOY   HR   MIN   SEC]	UTC
GPS Advisory Collection	ActivityDateRange/StartDate	gpspub:UTCDateTimeType	Satellite Outage File	HISTORICAL / @ START [YEAR   DOY   HR   MIN   SEC]	UTC
GPS Advisory Collection	ActivityDateRange/EndDate	gpspub:UTCDateTimeType	Satellite Outage File	HISTORICAL / @ END [YEAR   DOY   HR   MIN   SEC]	UTC
Ops Status	Constellation/GPSMetadata/CreatedDate	niem-xsd:dateTime	Ops Advisory	SUBJ: GPS STATUS <dd MMM yyyy>	UTC
Ops Status	GPSSpaceEvent/ActivityDate (when no STOP)	gpspub:UTCDateTimeType	Ops Advisory	SUMMARY (JDAY/ZULU TIME START - STOP)	UTC
Ops Status	GPSSpaceEvent/ActivityDateRange/StartDate	gpspub:UTCDateTimeType	Ops Advisory	SUMMARY (JDAY/ZULU TIME START - STOP)	UTC
Ops Status	GPSSpaceEvent/ActivityDateRange/EndDate	gpspub:UTCDateTimeType	Ops Advisory	SUMMARY (JDAY/ZULU TIME START - STOP)	UTC
Ops Status	GPSSpaceEvent/GPSMetadata/ReportedDate	gpspub:UTCDateTimeType	Ops Advisory	MSG DATE/TIME <dd MMM yyyy>	UTC
Public Common Almanac	TimeOfApplicabilityDateTime/GPSWeekNumeric	gpspub:GPSWeekSimpleType	Almanac (Any Format)	Week Number (WN)	GPS
Public Common Almanac	TimeOfApplicabilityDateTime/GPSSecondsInWeekNumeric	gpspub:GPSSecondsInWeekSimpleType	Almanac (Any Format)	Time of Applicability (TOA)	GPS



# USCG Presentation

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September 27, 2023

**Not Presented**

USCG



**10 MINUTE BREAK**



# ***GPS PRN Expansion***

***Karl Kovach***  
***Principle Engineer***  
***The Aerospace Corporation***

***GPS PICWG***  
***27 September 2023***



# Grandfather's GPS

- **L1 P(Y), L2 P(Y), L1 C/A**
  - Originally scoped for up to 25 satellites
    - 25 pages for almanacs in Subframe 5
    - 37 PRN code triplets, 5 assigned to Ground Transmitters (GTs)
    - ICD MH08-00004-400 Rev. F in 1975
    - Broadcast from 1977 to 1983
  - Later expanded to allow up to 32 satellites
    - 32 pages for almanacs in Subframe 5 and Subframe 4
    - Still the same 37 PRN code triplets, still 5 assigned to Yuma GTs
    - ICD-GPS-200 Rev. NC in 1983
    - Broadcast from 1983 to present





# Father's GPS

- [L1 P(Y), L2 P(Y), L1 C/A] + L2C, L5
  - New signals developed/defined
    - Maintained the same 37 PRN code construct
      - 5 PRNs now generalized to “other uses” (not just GTs)
        - Satellites could be an “other use”
      - Almanac ‘messages’ (not ‘pages’) for PRNs in CNAV
        - Almanac messages for PRNs 33-37 directly in CNAV
    - Early milestones in GPS Modernization
      - IS-GPS-705 Rev. NC in 2003
      - IS-GPS-200 Rev. D in 2004
    - Never broadcast (used for future design planning)



# Current GPS

- **[L1 P(Y), L2 P(Y), L1 C/A, L2C, L5] + L1C**
  - One more new signal developed/defined = L1C
  - Expanded scope to include 63 PRN codes
    - 63 L1C PRN codes from the very beginning
    - Added 26 sets of GPS P(Y), C/A, L2C, and L5 PRN codes
  - LNAV almanac pages and CNAV almanac messages for PRNs 1-63
  - Still more milestones in GPS Modernization
    - IS-GPS-800 Rev. NC in 2008
    - IS-GPS-705 Rev. A in 2010
    - IS-GPS-200 Rev. F in 2011
  - Only broadcasting the lower PRNs (1-32) so far
    - Higher PRNs (33-63) for future design planning



# Segment Implementations

- **Space Segment**

- Blocks IIR, IIR-M, IIF — PRNs 1-37
- Blocks III, IIIF — PRNs 1-63

- **Control Segment**

- **AEP — PRNs 1-32**
- OCX — PRNs 1-63

- **User Segment**

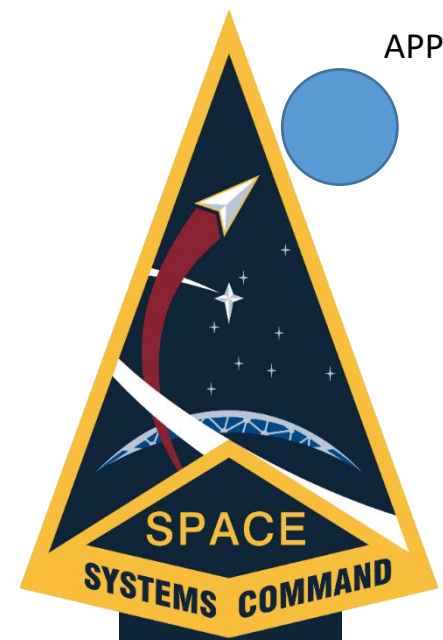
- Military
  - Legacy receivers — PRNs 1-32
  - MGUE receivers — PRNs 1-63
- Civil
  - All receivers — ad hoc manufacturer decisions



# *QUESTIONS & COMMENTS?*



# Action Item Review



# Walk-on Topics

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September 27, 2023

**None Presented**  
(In orange presentations, if any)

# Public Requirements Accountability Tool (PRAT)





- Status and Discussion of Closure of Existing Items 2014 through 2022
  - Total of 11 Open PRAT Items
- New PRAT Items for 2023
  - Only available after the 2023 Public ICWG



# Existing PRAT Items



# PRAT 2014-26 - Complete

<b>Yr</b>	2014	<b>Number</b>	26	<b>Status</b>	Complete
<b>Originator</b>	Karl Kovach (Aerospace)			<b>POC</b>	Karl Kovach (Aerospace)
<b>Description</b>	<i>Provide an informational briefing to remind the ICWG members that PRN expansion is coming.</i>				
<b>Livelihood</b>	<a href="https://smclivelihood.losangeles.af.mil/Livelihood/llisapi.dll?func=ll&amp;objaction=overview&amp;objid=53525283">https://smclivelihood.losangeles.af.mil/Livelihood/llisapi.dll?func=ll&amp;objaction=overview&amp;objid=53525283</a>				
<b>Notes</b>	<p>27 Sep 23: 2023 Public ICWG Presentatiion satisfies this PRAT Item. Closed at the Public ICWG.</p> <p>26 Oct 22: Explore presenting at the 2023 PICWG.</p> <p>23 Aug 18: PRN expansion is still in internal development. Specific questions related to this topic can be addressed to the GPS Public Forum or the GPS Directorate spectrum management team.</p> <p>6 Sep 17: Will remain deffered.</p> <p>28 Aug 17: Defer until we get a better answer from the PRN Expansion Group. Gov't Lead: Capt Duc Bui/Capt David Besson SME: Karl Kovach SE&amp;I: Steve Nance</p> <p>17 Apr 17: Combined action item 2014-45 with this item.</p> <p>10 Apr 17: Work in progress. KK presented twice at the 2015 and 2016 PICWGs. The PRN expansion working group has been started since Mid Jan 2017. Bi-weekly meeting- Will present the go-forward plan to Mr. Horejsi in June. Might need to represent the findings to the PICWG as a special topic. SPAWAR mentioned of some interpretations of the public documents. There might be some findings/clarifications to be made in public doc. At the time, we can submist a concern to take care of all. RFC-251 only addresses some specific "Classified" tables. Does not touch the IS-200.</p>				



# PRAT 2018-1- Complete Upon RFC-477 Approval

<b>Yr</b>	2018	<b>Number</b>	1	<b>Status</b>	In Progress
<b>Originator</b>	CWO Rebecca Ruch/ Rick Hamilton (USCG) POC			Stephan Hillman (Aerospace)	
<b>Description</b>	<i>Consider updating GPS products depicted in ICD-GPS-870 to reflect the modernized formats described in ICD-GPS-870, Table 3-I.</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: Closure is contingent on RFC-477 CCB approval.</p> <p>26 Oct 22: RFC 477 will hold an out-of-cycle PICWG in early 2023. US Gov working to gain PA approval on material, We will release to the Public as soon as possible.</p> <p>13-Jan-2022: Being solved as part of RFC-477</p> <p>17 Sep 20: Government plans to work XML changes or products in new RFC "2021 Public Document Proposed Changes". Scope was removed from RFC-395.</p> <p>5 Jun 19: Currently in-work under RFC-395 (2019 PICWG). Note: XML Schemas may be updated independent of the document to account for the modernized GPS products.</p> <p>12 Sept 18: This topic is documented in SE&amp;I internal concerns; to be worked in the 2019 Public RFC.</p>				



# PRAT 2020-3 - Not Addressed This Year - Still Open

<b>Yr</b>	2020	<b>Number</b>	3	<b>Status</b>	In Progress
<b>Originator</b>	Rhonda Slattery			<b>POC</b>	Tony Anthony (SE&I)
<b>Description</b>	<i>Make documents consistent between using the notation "x10^-1" and "1E-1". Choose one option and make all other occasions consistent.</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: This work item was not included in RFC-502 for the 2023 Public ICWG. Still Open.</p> <p>26 Oct 2022: Discussed at 2022 Public ICWG. Assess for feasibility with public documents 1st, then address the rest of the baseline. Give public documents priority.</p> <p>30 Sep 2020: Action derived from RFC 413 comment. Will explore how many objects are affected</p>				



# PRAT 2021-2 - In Progress - Still Open

<b>Yr</b>	2021	<b>Number</b>	2	<b>Status</b>	In Progress
<b>Originator</b>	Mr. Albert H. Hayden (SE&I)			<b>POC</b>	Bert Hayden (Aerospace)
<b>Description</b>	<i>Investigate the Almanac Ephemeris URE Table in IS-GPS-200 20.3.3.5.2.1 Almanac for RFC 467 and develop any requirements baseline changes needed to satisfy any consistency shortfalls or operational needs.</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: In Progress. Still Open. Will consider Pre-RFC-1202 for future Public Documents Update RFC.</p> <p>26 Oct 22: Assessment not complete. Will consider Pre-RFC-1202 for 2023 Public Documents Update RFC.</p> <p>29 Sep 21: Mr. Albert H. Hayden (SE&amp;I) accepted an action to investigate the information on Table 200-2078 for RFC 467.</p>				



# PRAT 2021-3 - In Progress - Still Open

<b>Yr</b>	2021	<b>Number</b>	3	<b>Status</b>	In Progress
<b>Originator</b>	Mr. Karl Kovach (Aerospace Corporation )			<b>POC</b>	Karl Kovach (Aerospace)
<b>Description</b>	<i>Investigate the removal of Inter Signal Corrections from the Core CEI Data in the public documents and develop any requirements baseline changes needed to satisfy any consistency shortfalls or operational needs</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: In Progress. Still Open.</p> <p>26 Oct 22: The Special Topic presentation advanced the subject, but had specific recommendations for baseline requirements changes. Will consider Pre-RFC-1201 for 2023 Public Documents Update RFC. Include Denis Bouvet, Rhonda Slattery and Jeff Stevens during investigation.</p> <p>Mr. Albert H. Hayden (SE&amp;I) accepted an action to create a concern regarding the removal of Inter Signal Corrections from the Core CEI Data in the public documents.</p>				



# PRAT 2021-4 Superseded by PRAT 2023-1

<b>Yr</b>	2021	<b>Number</b>	4	<b>Status</b>	Superseded
<b>Originator</b>	Dr. Andrew Hansen (DOT)			<b>POC</b>	Tony Anthony (SE&I)
<b>Description</b>	<i>Investigate converting from the use of Pconst to Rconst and MFDconst in the CNAV and CNAV2 Integrity Support Messages</i>				
<b>Livelihood</b>	<a href="https://smclivelihood.losangeles.af.mil/Livelihood/livelihood.exe?func=ll&amp;objId=71853781&amp;objAction=browse&amp;viewType=1">https://smclivelihood.losangeles.af.mil/Livelihood/livelihood.exe?func=ll&amp;objId=71853781&amp;objAction=browse&amp;viewType=1</a>				
<b>Notes</b>	<p>27 Sep 23: RFC-495A was not CCB approved as anticipated. At the 2023 Public ICWG it was agreed to not reopen this item and create a new PRAT 2023-1 which more clearly addresses the ISM work left to complete.</p> <p>26 Oct 22: A Concern was created and RFC 495 is satisfying this Action Item. 2022 PICWG closed this action.</p> <p>Mr. Albert H. Hayden (SE&amp;I) accepted an action to write a concern regarding the use of Pconst instead of Rconst and MFDconst in the CNAV and CNAV2 Integrity Support Messages</p>				



# PRAT 2021-5 Complete Upon RFC-502 Approval

<b>Yr</b>	2021	<b>Number</b>	5	<b>Status</b>	In Progress
<b>Originator</b>	Mr. Denis Bouvet (Thales Group)			<b>POC</b>	Karl Kovach (Aerospace)
<b>Description</b>	<i>Investigate the Data ID Issue and develop any requirements baseline changes needed to satisfy any consistency shortfalls or operational needs</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: Closure is contingent on RFC-502 CCB approval.</p> <p>26 Oct 22: Assessed to remain open, Karl provided special topic presentation for document changes in the 2023 PICWG.</p> <p>Mr. Albert H. Hayden (SE&amp;I) accepted an action to write a concern regarding the backward compatibility of transmitting a Data ID other than 2.</p>				




# PRAT 2022-1 - Contingent on ISM Completion

<b>Yr</b>	2022	<b>Number</b>	1	<b>Status</b>	In Progress
<b>Originator</b>	2022 PICWG Team			<b>POC</b>	Karl Kovach (Aerospace)
<b>Description</b>	<i>Reassess the relevance of the ISF 5.73 factor to the definition of MSF and develop any requirements baseline changes needed to satisfy any consistency shortfalls or operational needs</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: Closure of this PRAT item is conditioned on the resolution of pending changes to the definition of the ISM in the GPS technical baseline. Current definitions of Rsat and MFDsat need revision to reflect that an MSF is defined as <math>IURE &gt; 4.22 \times URA</math> for the computation of these parameters.</p> <p>26 Oct 22: Initiated at the 2022 Public ICWG. Consider developing a special topic presentation for the 2023 Public ICWG.</p>				





# PRAT 2022-2 Completed

<b>Yr</b>	2022	<b>Number</b>	2	<b>Status</b>	Complete
<b>Originator</b>	2022 PICWG Team			<b>POC</b>	Jason Bolger (SE&I)
<b>Description</b>	<i>Baseline search for Bnom to determine if there are other documents that may require an update.</i>				
<b>Livelihood</b>					
<b>Notes</b>	27 Sep 23: SE&I investigation shows there are no other documents that reference Bnom; therefore, no documents need to be updated regarding this parameter. It has been agreed to be complete at the Public ICWG.				




# PRAT 2022-3 Complete Upon RFC-502 Approval

<b>Yr</b>	2022	<b>Number</b>	3	<b>Status</b>	In Progress
<b>Originator</b>	2022 PICWG Team			<b>POC</b>	Bert Hayden (Aerospace)
<b>Description</b>	<i>Investigate CNAV Schedules Technical Baseline changes for future Public Documents Updates.</i>				

**Livelihood**

**Notes** 27 Sep 23: Closure is contingent on RFC-502 CCB approval.

A follow-on PRAT 2023-2 covers similar work for CNAV-2.

26 Oct 22: Include Jason Burns, CGJ (Army, Navy, Civils), SE&I (Straton), PNT-MAT during this investigation.



# PRAT 2022-4 No Note Needed - Complete

<b>Yr</b>	2022	<b>Number</b>	4	<b>Status</b>	Complete
<b>Originator</b>	Dan Godwin			<b>POC</b>	Bert Hayden (Aerospace)
<b>Description</b>	<i>Determine if a clarifying note is needed on equal applicability of the bnom computation for LNAV and CNAV</i>				
<b>Livelihood</b>					
<b>Notes</b>	<p>27 Sep 23: Actionee determined that the applicability of the bnom parameter should be left to the discretion of the ISM generator and MOPS since that applicability is determined by how the generator computes the bnom value. There was agreement on this at the Public ICWG and the PRAT item is closed</p> <p>Data analysis determined that there is no significant difference between the LNAV and CNAV clock/ephemeris solutions. Differences between the LNAV and CNAV data formats themselves should not drive any difference in the bnom parameter. A separate but related question concerns the applicability of a single bnom parameter to L1 C/A, L1C, L2C and L5 signals themselves. Though differences between these signals could in theory justify separate bnom, in practice the ISM generator can accommodate any such differences as part of the computation of bnom. A single bnom value is therefore potentially applicable to all signals and data formats as the current ISM design implies.</p> <p>26 Oct 22: Initiated at the Public ICWG. Originator specifically asked a Concern be created to implement this effort</p>				



# New 2023 PRAT Items



# PRAT 2023-1 ISM Final Engineering

<b>Yr</b>	2023	<b>Number</b>	1	<b>Status</b>	Not Started
<b>Originator</b>	Calvin Miles			<b>POC</b>	Capt. Merchant/Tony Anthony
<b>Description</b>	<i>Drive ISM to Final Engineering State</i>				
<b>Livelihood</b>					
<b>Notes</b>	27 Sep 23: Complete the system engineering for a PRN/IRN set and update the technical baseline. Refer to the 2023 Public ICWG Special Topic on the associated RFCs for the current state. This supersedes PRAT 2021-4 which never had its associated RFC-495A CCB approved. This PRAT Item will replace the ISM related changes from RFC-495A and the ISM related changes deferred from RFC-502.				



# PRAT 2023-2 CNAV-2 Schedules

<b>Yr</b>	2023	<b>Number</b>	2	<b>Status</b>	Not Started
<b>Originator</b>	Rhonda Slattery			<b>POC</b>	Bert Hayden
<b>Description</b>	<i>Investigate CNAV-2 Schedules Technical Baseline changes for future Public Documents Updates</i>				
<b>Livelihood</b>					
<b>Notes</b>	27 Sep 23: Prior item is PRAT 2022-3 but only for CNAV.				



# PRAT 2023-3 Other Deferrals from RFC-502

<b>Yr</b>	2023	<b>Number</b>	3	<b>Status</b>	Not Started
<b>Originator</b>	Rhonda Slattery			<b>POC</b>	Tony Anthony
<b>Description</b>	<i>Investigate the Inclusion of all Changes that have been Deferred from RFC-502</i>				
<b>Livelihood</b>					
<b>Notes</b>	27 Sep 23: CEI Data Set Parameter notes plus other items				



# PRAT 2023-4 RFC-495B “Text Message” Status

<b>Yr</b>	2023	<b>Number</b>	4	<b>Status</b>	Not Started
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<b>Originator</b>	Dr. Andrew Hansen (DOT)	<b>POC</b>	Jason Bolger
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**Description** *Status RFC-495B Text Message Changes for Completion*

## Livelihood

**Notes** 27 Sep 23: This small set of requirements changes greatly expands the printable character codes and will allow Text Messages to be treated as binary coded messages since all 256 8-bit character codes are allowed in all character code positions, regardless of their printability.





# PRAT 2023-5 PRN 34 and 37

<b>Yr</b>	2023	<b>Number</b>	5	<b>Status</b>	Not Started
<b>Originator</b>	Dr. Andrew Hansen (DOT)			<b>POC</b>	Bert Hayden
<b>Description</b>	<i>Investigate Impact of PRN 34 and 37 Rule</i>				
<b>Livelihood</b>					
<b>Notes</b>	27 Sep 23: Addresses changes anticipated to be approved in RFC-502				



# Action Item Review



# Closing Remarks

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# Backup Slides

# Acronyms

AFL	Available for Launch	IBR	Integrated Baseline Review
ASIC	Application Specific Integrated Circuit	IDR	Implementation Design Review
CDD	Capability Development Document	JTLV	Joint Light Tactical Vehicle
CDR	Critical Design Review	LCS	Launch and Checkout System
DAGR	Defense Advanced GPS Receiver	MGUE	Military GPS User Equipment
DDG	Arleigh Burke Guide Missile Destroyer	MSI	Miniature Serial Interface
DT	Developmental Testing	OCX	Operational Control System
FOT&E	Follow-on Operational Test and Evaluation	OT	Operational Testing
FQT	Formal Qualification Testing	PDR	Preliminary Design Review
FUE	Field User Evaluation	PNT	Positioning, Navigation, and Timing
GNST+	GPS IIF Non-flight Satellite Test Bed	SIS	Signal in Space
GRAM-S/M	GPS Receiver Application Module – Standard Elec Module/Modernized	TRV	Technical Requirements Verification
HH	Handheld	URE	User Range Error
HPE	Hewlett Packard Enterprise	USAF	United States Air Force
IBM	International Business Machines	USMC	United States Marine Corps
		USN	United States Navy