

### Global Positioning Systems (GPS) Public Interface Control Working Group and Public Forum

21-22 September 2016 0830 – 1630 hrs PST

United States Air Force GPS Directorate Phone Number: 1-310-653-2663 Meeting ID: 6272252 Passcode: 000001 DCS Website: https://conference.apps.mil/webconf/gpspublicmeeting





## **Colonel Gerard G. Gleckel**

Deputy Director, Global Positioning Systems (GPS) Directorate Space and Missile Systems Center



## **Roll Call**

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## Agenda – Day 1 (Public ICWG)

**Opening Remarks** 

Roll Call

Agenda Overview

Meeting Logistics / Rules of Engagement

Meeting Purpose ICWG Presentations

> - Request for Change (RFC) 308: Update Interface Control Document (ICD)-GPS-870 and Interface Control Document (ICD)-GPS-240

> - Request for Change (RFC) 312: Definition Clarification for Time of Predict

- Request for Change (RFC) 318: 2016 Public Document Clean-Up

- Review of 2015 Comment Resolution Matrix

Action Item Review

Adjourn

# 

## Agenda – Day 2 (Public Forum)

#### Reconvene

Roll Call

**Special Topic Presentations** 

- Appendix D to the Standard Positioning Service (SPS) Performance Standard (PS)

- Release of Receiver Independent Exchange Format (RINEX) Data from Control Segment to Civil Users

- Message Type 38
- Carrier Phase Noise via 3<sup>rd</sup> Order Jaffe-Rechtin Phase-locked loop (PLL)
- Operational Advisories
- How a Change in Interface Specification (IS)-GPS-705 and Interface Specification (IS)-GPS-800 Could Save Lives
- GPS Technical Baseline Overhaul (Tentative)

**Open Discussion Session** 

Action Item Review

Adjourn



## **GPS Requirements Team**

#### Air Force

James Horejsi, GPS Chief Engineer

Daniel Godwin, GPS Requirements Section Chief

Capt Robyn Anderson, User/Ground Requirements Engineer

Capt Jenny Ji, Space/Enterprise Requirements Engineer

Bruce Charest, Section Support Engineer

#### Aerospace

Karl Kovach

**Rhonda Slattery** 

#### Systems Engineering and Integration (SE&I)

Pauline Bennett Omar Menjivar Huey Nguyenhuu George Farmer

Christy Carter





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





## UNCLASSIFIED



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





- Please place your phones on mute when not speaking to minimize background noise
- Comments against the topics listed on the official agenda will get priority during discussion
- Topics that warrant additional discussion may be side-barred
- Ad-hoc topics may be discussed during the open discussion on 22 Sep 16
- Meeting minutes and final IRNs will be generated and distributed as a product of this meeting via GPS.gov
- Please announce your name and organization before addressing the group





• The purpose of the meeting is to:

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

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

Comments received will be vetted per the standard change management process



### **Change Management High Level Process Flow**





## 2016 PUBLIC INTERFACE CONTROL WORKING GROUP

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A STATUS CALLS

## **ICWG** Introduction



## **Ground Rules**

- Please begin each comment by stating your name and organization
- Keep your comments within the scope of the proposed changes
- Any additional, out-of-scope changes can be submitted to the GPS directorate via the provided pre-RFC submission forms
- The proposed changes reflect updates to the CCB-approved version of the public documents, which served as the baseline (i.e., WAS) for the reviewed materials
- These presentations contain all submitted comments that are:
  - Critical
  - Substantive
  - Administrative (Rejected Only)
- Additional concerns can be submitted via concern forms, GPS.gov, or emailed to smcgper@us.af.mil



## **Updates to the Change Review Process**

- The GPS Directorate has received numerous comments highlighting the cumbersome nature of reviewing proposed interface revision notices (PIRNs)
- The SE&I team is working tirelessly to update the process used to release PIRNs so materials are presented in an efficient, readable manner
- Periodic updates will be provided to technical baseline change review stakeholders on progress with this effort
- Any further discussions on this topic will be deferred and additional comments can be submitted to the GPS Directorate via smcgper@us.af.mil

# A CALL AND THE STATUS

## {TEMPLATE for CRM Status}

CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS					
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence
Accept	##	##	##	##	##
Accept with Comment	##	##	##	##	##
Reject	##	##	##	##	##
Defer	##	##	##	, ##	##
Grand Totals:	##	##	##	##	##

Affected Document(s)	{List document	t(s)}	DOORS ID	{DOORS ID}
Paragraph	{Insert text her	e}	Comment Number	{from CRM}
Comment Type	{Critical/Substa	antive/Admin}	Disposition	{Accept/Accept w/ Comment/Reject/Defer}
Comment Originator(s)	Commenter Na	ame (Commenter Organiza	tion)	
Comment	{what was sub	mitted by the commenter in	the CRM}	
Directorate Response	{Text describin	ng the rationale of the dispos	sition}	
BASELINE TEXT (	WAS)	PIRN TEX	T (IS)	PROPOSED TEXT
{Text shown in current ve CCB-approved interface notice}	Frevision	{Text from PIRN}	nment Ad	{Proposed text received by the commenter during the PIRN review}







## Update ICD-GPS-870 and ICD-GPS-240

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ICD: Interface Control Document

J. Ji G. Farmer



## RFC-308 Update ICDs 240 and 870

#### **Problem Statement:**

ICD-GPS-870 needs to be updated to describe the data format changes for the public users of the United States Coast Guard (USCG) data. This will also address numerous formatting errors in the publicly released version of ICD-GPS-870. ICD-GPS-870 and ICD-GPS-240 require updates to clarify Notice Advisory to NAVSTAR Users (NANU) outage codes.

#### **Proposed Solution:**

Update the descriptions of the data public users can access on the US Coast Guard server in ICD-GPS-870. Add a definition of "outage" for NANU messages to ICD-GPS-240 and to ICD-GPS-870.

Impacted Documents:

ICD-GPS-240 and ICD-GPS-870



## RFC 308 CRM Status

CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS					
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence
Accept	7	7	20	34	33
Accept with Comment	5	5	0	10	9
Reject	1	2	0	3	2
Defer	0	5	0	5	0
Grand Totals:	13	19	20	52	44





## **Critical Comments (13)**

## **Substantive Comments**

## **Rejected Administrative Comments**

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-88		
Paragraph	10.1	Comment Number	ARC_1, RTN_01		
Comment Type	Critical	Disposition	Reject		
Comment Originator(s)	John Lavrakas (Advanced Research Corp), Alex Snyder (Raytheon)				
Comment	JL: Add definition for outage AS: Please either delete new insert or edit with suggested change. Additional statement and reference to documents that describe "unhealthy" could imply new functionality on control segment (CS) to automatically send NANU when section 2.3.2 for an unhealthy satellite vehicle (SV) is met.				
Directorate Response	The outage definition was ok but reviewers objected to the sentence describing "unhealthy" and thought it added more confusion than clarity.				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Notice Advisory to NAVSTAR Users	Notice Advisory to NAVSTAR Users	Notice Advisory to NAVSTAR Users (NANUs)
(NANUs) are used to notify users of	(NANUs) are used to notify users of	are used to notify users of scheduled and
scheduled and unscheduled satellite	scheduled and unscheduled satellite	unscheduled satellite outages and general GPS
outages and general GPS information.	outages and general GPS information. An	information. <u>An outage is defined to be a period</u>
	outage is defined to be a period of time that	of time that the satellite is removed from
	<u>the satellite is removed from service and not</u>	<u>service and not available for use. This occurs</u>
	available for use. This occurs when the	when the satellite meets the conditions for
	satellite meets the conditions for	"unhealthy" provided in Section 2.3.2 of the
	"unhealthy" provided in Section 2.3.2 of the	Standard Positioning Service Performance
	Standard Positioning Service Performance	Standard.
	Standard.	
		Suggested wording: rejected
		Operators determine satellite meets the
		conditions for "unhealthy" provided in Section
		2.3.2 of the Standard Positioning Service
		Performance guide.

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-36		
Paragraph	3.1.1-17	Comment Number	RTN_02, Aero_3		
Comment Type	Critical	Disposition	Accept with Comments		
Comment Originator(s)	Walid Al-Masyabi (Raytheon), Rhonda Slattery (Aerospace)				
Comment	The RFC title and intent is to add Satellite Outage File (SOF) content to as part of the GPS advisory.				
Directorate Response	Contractor and SE&I to derive new wording. Needs to describe new terminology and transition plan from legacy SOF format to Next Generation Operational Control System (OCX) format. (See RTN-New11 for updated wording)				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
The GPS Advisory exchange information product includes a single advisory notification concerning a GPS space event and associated GPS space vehicle. See GPS Advisory IEPD for more details. Published on a periodic basis, based on operational events/needs.	(not in PIRN)	There are two types of the GPS Advisory exchange information product: 1) A GPS Advisory exchange that includes a single advisory notification concerning a GPS space event and associated GPS space vehicle. 2) A GPS Advisory exchange includes Collection a collection of advisory notifications of all available historical, current and predicted satellite outage space events. See GPS Advisory IEPD for more details. Published on a periodic basis, based on operational events/needs.

Affected Document(s)	ICD-GPS-870	)	DOORS ID	ICD870 General	
Paragraph	N/A		Comment Number	Aero_2	
Comment Type	Critical		Disposition	Accept with Comments	
Comment Originator(s)	Rhonda Slatte	ery (Aerospace)			
Comment	This is very difficult to review because the Dynamic Object Oriented Requirements System (DOORS) IDs are not in the published document. For public review, additional information is needed or the changes need to be placed in context. Also, you are deleting objects, like Table 3-III, and replacing them with a new DOORs ID as separate actions, making it almost impossible to understand what the final document is going to look like				
Directorate Response	SE&I to work with Rhonda to ensure that the public documents are updated in a way that is less confusing for the public reviewers. Not sure if that will be proposed interface revision notice (PIRNs) with paragraph numbers as well as object IDs or draft documents with object IDs distributed on the .gov web site.				
BASELINE TEXT (	WAS)	PIRN TEX	T (IS)	PROPOSED TEXT	
N/A		N/A		N/A	

Affected Document(s)	ICD-GPS-870	)	DOORS ID	ICD870 General
Paragraph	N/A		Comment Number	GPGX-08
Comment Type	Critical		Disposition	Accept with Comments
Comment Originator(s)	Stephan Hillm	nan (Aerospace)		
Comment	This proposed Has SE&I cor ICD?	d interface revision notice nducted a review to ensur	(PIRN) removes all re that these requirer	shall statements/requirements from this ICD. nents have been properly migrated to another
Directorate Response	SE&I has the	action to insure requirem	ents are covered in a	a more appropriate ICD.
BASELINE TEXT (	(WAS) PIRN TEXT		T (IS)	PROPOSED TEXT
N/A		N/A		√A

Affected Document(s)	ICD-GPS-870		DOORS ID	ICD870-673
Paragraph	3.1.1-12		Comment Number	RTN-NEW01
Comment Type	Critical		Disposition	Accept
Comment Originator(s)	Walid Al-Masy	abi (Raytheon)		
Comment	Need to add a requirement for the Validate and Transform utility to validate the Nation Exchange Model (NIEM) Information Exchange Package Documentation (IEPD) assoc information product prior to creating backward compatible products formats as describ appendices of ICD 870.			tility to validate the National Information ocumentation (IEPD) associated with the roducts formats as described in the
Directorate Response	None.			
BASELINE TEXT	(WAS)	PIRN TEX	(T (IS)	PROPOSED TEXT
Jsing the Information Produ provided Transformation Pro- shown in Table 3-III, the Val fransform Utility shall allow /alidate the digital signature Products.	icts and oducts as lidate and the user to of GPS	(not in PIRN)		Ising the Information Products and provided Transformation Products as shown in Table 3- I, the Validate and Transform Utility shall How the user to validate the digital signature of SPS Products. The Validate and Transform Utility will allow the ser to validate the digital signature of GPS information Products. and its associated NIEM EPD.

Affected Document(s)	ICD-GPS-870		DOORS ID	ICD870-698
Paragraph	N/A		Comment Number	RTN-NEW02
Comment Type	Critical		Disposition	Accept
Comment Originator(s)	Walid Al-Masyabi (	(Raytheon)	•	
Comment	Need to add a required with the informatio appendices of ICD	uirement for the Val n product prior to c 870.	date and Transform util reating backward compa	ity to validate the NIEM IEPD associated atible products formats as described in the
Directorate Response	None.			
BASELINE TEXT	ſ (WAS)	PIRN TEXT (IS)		PROPOSED TEXT
<ul> <li>As the Authoritative Source for GPS Products describinly digitally signed GPS Products to improve informest (i.e., resident on a storage device) within the GP signatures to ensure the integrity and proof of origin of normation Products originally from the CS could be unintentionally) during redistribution to the end user. corrupted GPS Information products varies between nformation Assurance critical applications (e.g. publishich the potential consequence are significant and user. Therefore; <ul> <li>a) The CS will only distribute GPS P are digitally signed XML documen for compliance with modern Net C standards for non-repudiation.</li> <li>b) The CS publishes Transformation downloadable Validate and Transvalidating then transforming Inform compatible ASCII formats.</li> <li>c) In order to maximize the benefit of recommends that End Users perfor as possible (just prior to ingesting)</li> <li>d) Validating the data integrity of GP responsibility of the user. End uses the criticality of the user. End uses the criticality of the responsibility of the integrity of GP responsibility of the is application in whether they can accept the risks signatures.</li> <li>e) Any US government user interested or products derived from GPS proto the GPS CS before doing so to un duplicative efforts are not being plant.</li> </ul></li></ul>	bed in this ICD, the CS publishes ation assurance for GPS data at S user community. Without digital of the GPS Products at rest, corrupted (intentionally or The potential consequence of end users. Some end users have ic utilities, safety of life systems) in therefore unacceptable to the end roducts (see section 3.1.1) which its per the published XML schema entric and Information Assurance Products and also provides a form Utility to assist users with first nation Products into backward f information assurance, the CS form the transformation step as late ). S products is optional and is the ers must apply their knowledge of making the determination of of ignoring CS provided digital ed in redistributing GPS Products ducts are advised to consult with iderstand the tradeoffs and verify anned by the GPS CS.		As the Authoritative Source for GP3 only digitally signed GPS Products t esident on a storage device) within the integrity and proof of origin of the S could be corrupted (intentionally botential consequence of corrupted users have Information Assurance of which the potential consequence and "herefore; a) The CS will only distribute GPS documents per the published X Information Assurance standar b) The CS publishes Transformatt signed IEPDS which include XS and Transform Utility to assist of Products into backward compa c) In order to maximize the benefit perform the transformation step (i) Validating the data integrity of users must apply their knowled of whether they can accept the Products are advised to consul tradeoffs and verify duplicative	S Information Products described in this ICD, the CS publishes o improve information assurance for GPS data at rest (i.e., the GPS user community. Without digital signatures to ensure e GPS Products at rest, Information Products originally from the or unintentionally) during redistribution to the end user. The GPS Information products varies between end users. Some end critical applications (e.g. public utilities, safety of life systems) in e significant and therefore unacceptable to the end user. S Products (see section 3.1.1) which are digitally signed XML (ML schema for compliance with modern Net Centric and ds for non-repudiation. ion Products and also provides GPS Community provides Digitally SLT stylesheets that can be used in conjunction with the Validate users with first validating then transforming GPS Information tible ASCII formats. it of information assurance, the CS recommends that End Users p as late as possible (just prior to ingesting). GPS products is optional and is the responsibility of the user. End dge of the criticality of their application in making the determination e risks of ignoring CS provided digital signatures. ested in redistributing GPS Products or products derived from GPS It with the GPS <u>CSCommunity</u> before doing so to understand the efforts are not being planned by the GPS <u>CSCommunity</u> .



## BASELINE TEXT (WAS) ICD870-698

As the Authoritative Source for GPS Products described in this ICD, the CS publishes only digitally signed GPS Products to improve information assurance for GPS data at rest (i.e., resident on a storage device) within the GPS user community. Without digital signatures to ensure the integrity and proof of origin of the GPS Products at rest, Information Products originally from the CS could be corrupted (intentionally or unintentionally) during redistribution to the end user. The potential consequence of corrupted GPS Information products varies between end users. Some end users have Information Assurance critical applications (e.g. public utilities, safety of life systems) in which the potential consequence are significant and therefore unacceptable to the end user. Therefore;

- a) The CS will only distribute GPS Products (see section 3.1.1) which are digitally signed XML documents per the published XML schema for compliance with modern Net Centric and Information Assurance standards for non-repudiation.
- b) The CS publishes Transformation Products and also provides a downloadable Validate and Transform Utility to assist users with first validating then transforming Information Products into backward compatible ASCII formats.
- c) In order to maximize the benefit of information assurance, the CS recommends that End Users perform the transformation step as late as possible (just prior to ingesting).
- d) Validating the data integrity of GPS products is optional and is the responsibility of the user. End users must apply their knowledge of the criticality of their application in making the determination of whether they can accept the risks of ignoring CS provided digital signatures.
- e) Any US government user interested in redistributing GPS Products or products derived from GPS Products are advised to consult with the GPS CS before doing so to understand the tradeoffs and verify duplicative efforts are not being planned by the GPS CS.



## **Proposed Text for ICD870-698**

As the Authoritative Source for GPS Information Products described in this ICD, the CS publishes only digitally signed GPS Products to improve information assurance for GPS data at rest (i.e., resident on a storage device) within the GPS user community. Without digital signatures to ensure the integrity and proof of origin of the GPS Products at rest, Information Products originally from the CS could be corrupted (intentionally or unintentionally) during redistribution to the end user. The potential consequence of corrupted GPS Information products varies between end users. Some end users have Information Assurance critical applications (e.g. public utilities, safety of life systems) in which the potential consequence are significant and therefore unacceptable to the end user. Therefore;

a) The CS will only distribute GPS Products (see section 3.1.1) which are digitally signed XML documents per the published XML schema for compliance with modern Net Centric and Information Assurance standards for non-repudiation.

b) The <u>CS publishes Transformation Products and also provides GPS Community provides Digitally</u> <u>signed IEPDS which include XSLT stylesheets that can be used in conjunction with</u> the Validate and Transform Utility to assist users with first validating then transforming <u>GPS</u> Information Products into backward compatible ASCII formats.

c) In order to maximize the benefit of information assurance, the CS recommends that End Users perform the transformation step as late as possible (just prior to ingesting).

d) Validating the data integrity of GPS products is optional and is the responsibility of the user. End users must apply their knowledge of the criticality of their application in making the determination of whether they can accept the risks of ignoring CS provided digital signatures.

e) Any US government user interested in redistributing GPS Products or products derived from GPS Products are advised to consult with the GPS <u>CSCommunity</u> before doing so to understand the tradeoffs and verify duplicative efforts are not being planned by the GPS <u>CSCommunity</u>.

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-664		
Paragraph	3.1.0-10	Comment Number	RTN-NEW04		
Comment Type	Critical	Disposition	Accept		
Comment Originator(s)	Walid Al-Masyabi (Raytheon)				
Comment	Need to update figure to include validation of NIEM IEPD				
Directorate Response	None.				



Affected Document(s)	ICD-GPS-870		DOORS ID	ICD870-701		
Paragraph	3.3.0-6		Comment Number	RTN-NEW06		
Comment Type	Critical		Disposition	Accept		
Comment Originator(s) Walid Al-Masyal		/abi (Raytheon)				
Comment	Need to upda	Need to update to include validation of signed IEPD containin		ig the stylesheet		
Directorate Response	None.	None.				
BASELINE TEXT (WAS)		PIRN TEXT (IS)		PROPOSED TEXT		
<b>BASELINE TEXT (WAS)</b> 1. Download the desired Information Product and Transform Product (see Table 3-III). Note: Because the XML schema for an Information Product will change very infrequently, a Transformation Product can be downloaded once for a new schema revision and then reused repeatedly without downloading again. 2. Just prior to use, validate the Digital Signature of Information Product and the Transform Product using a W3C XML Digital Signature Compliant standard COTS/Library (e.g., JDK 1.6/1.7) and the currently published CS public certificate. 3. If the signatures do not validate in Step 2, then either the Information Product or the Transformation Product is not authentic (not produced by the CS) or has been corrupted. Do not use. The user should return to step 1. 4. If the signatures validate in both Step 2 and Step 3, then extract XSLT from the Product Meta Data Body Element (see Figure 3-3) and apply the XSLT using standard COTS/Library to produce the desired ASCII file format.		PIRN TEXT (IS)  1. Download the desired Information Product and Transformassociated Product[EPD (see Table 3- III) from USCG NIS web site or an alternate redistribution site. Note: Because the XML schema[EPD for an Information Product will change very infrequently, a Transformationthis Productstep cancould be downloadedperformed once for a new schema[EPD revision and then reused repeatedly without downloading again. 2. Just prior to use, validate the Digital Signature of the Information Product and the Transform XSLT Productstylesheet signature file using a W3C XML Digital Signature Standard compliant standard COTS/Library (e.g., JDK 1.6/1.7) and the currently published CS public certificate. 3. If the signatures do not validate in Step 2, then either the Information Product or the Transform XSLT Productstylesheet is not authentic (not produced by the CS) or has been corrupted. Do not use. The user should return to step 1. 4. If the signatures validate in both Step 2 and Step 3, then extract XSLT from the Product Meta Data Body Element (see Figure 3-3) and apply the XSLT stylesheet using standard COTS/Library to		<ol> <li>Download the desired Information Product and associated IEPD (see Table 3-III) from USCG NIS web site or an alternate redistribution site. Note: Because the IEPD for an Information Product will change very infrequently, this step could be performed once for a new IEPD revision and then reused repeatedly without downloading again.</li> <li>Just prior to use, validate the Digital Signature of the Information Product and the signed IEPD containing the XSLT stylesheets signature file using a W3C XML Digital Signature Standard compliant standard COTS/Library and the currently published CS public certificate.</li> <li>If the signatures do not validate in Step 2, then either the Information Product or the signed IEPD is not authentic (not produced by the CS) or has been corrupted. Do not use. The user should return to step 1.</li> <li>If the signatures validate in both Step 2 and Step 3, then apply the XSLT stylesheet using standard COTS/Library to produce the desired ASCII file format.</li> </ol>		

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-702
Paragraph	3.3.0-7	Comment Number	RTN-NEW07
Comment Type	Critical	Disposition	Accept w/ Comments
Comment Originator(s)	Walid Al-Masyabi (Raytheon)		
Comment	Need to update to include validation of signed IEPD containing the stylesheet		
Directorate Response	Table reference should remain 3-III		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
1. Download the desired Information Product (see Table 3-III)	1. Download the desired Information Product (see Table 3-HI) from the USCG NIS web site.	1. Download the desired Information Product (see Table 3-III) from the USCG NIS web
2. Just prior to use, Validate the Digital Signature of Information Product using a W3C XML Digital Signature Compliant	2. Just prior to use, Validate the Digital Signature of Information Product using a W3C XML Digital Signature Compliant standard	site. 2. Just prior to use, Validate the Digital
standard COTS/Library (e.g. JDK 1.6/1.7) and the currently published CS public certificate.	COTS/Library (e.g. JDK 1.6/1.7) and the currently published CS public certificate.	W3C XML Digital Signature Compliant standard COTS/Library and the currently published CS public certificate.
3. If the signature does not validate in Step 2, then the Information product is either not authentic (not produced by the CS) or the information content has been corrupted. Do not use. The user should	3. If the signature does not validate in Step 2, then the Information product is either not authentic (not produced by the CS) or the information content has been corrupted. Do not use. The user should return to step 1.	3. If the signature does not validate in Step 2, then the Information product is either not authentic (not produced by the CS) or the information content has been corrupted. Do not use. The user should return to step 1.
4. If the signature validates in Step 2, then the GPS Product is authentic and the content has not been corrupted.	4. If the signature validates in Step 2, then the GPS <u>Information</u> Product is authentic and the content has not been corrupted.	4. If the signature validates in Step 2, then the GPS Information Product is authentic and the content has not been corrupted.

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-669
Paragraph	3.1.1-7	Comment Number	RTN-NEW09
Comment Type	Critical	Disposition	Accept
Comment Originator(s)	Walid Al-Masyabi (Raytheon)		
Comment	Need to update figure to include validation of NIEM IEPD		
Directorate Response	None		





## Baseline Text (WAS) ICD870-669



ALL AMISSILE OFFICIAS CRIME

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## PIRN Text (IS) ICD870-669



# ALL ALMASILE SUSTEME CONTROL

### Proposed Text ICD870-669


Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-new object	
Paragraph	Insert after 3.2.3	Comment Number	RTN-NEW10	
Comment Type	Critical	Disposition	Accept	
Comment Originator(s)	Walid Al-Masyabi (Raytheon)			
Comment	Add SOF Production rules			
Directorate Response	None.			

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	N/A	A new SOF will be provided each time one of the following NANU types is issued: FCSTDV, FCSTMX, FCSTEXTD, FCSTSUMM, FCSTCANC, FCSTRESCD, FCSTUUFN, UNUSUFN, UNUSABLE, UNUNOREF, LAUNCH, USABINIT, or DECOM

Allected Document(s)     ICD-GPS-S70     DOCKS ID     ICDS/GP2S       Paragraph     3.1.1-18.1     Comment Number     RTN-NEW12       Comment Type     Critical     Disposition     Accept       Comment Originator(s)     Walid Al-Masyabi (Raytheon)     Accept       Comment     Add legacy SOF backward compatibility to GPS-ICD-870 to be consistent with GPS-ICD-240 addition of SOF.       Directorate Response     Add appendix (notionally Appendix 2) to show legacy SOF format. This table then points to that appendix for the SOF format.     PIRN TEXT (IS)       Add shown row to table 3-III     Producerst     Data-Exchange: Identificationst     Information: Descriptionst     Security: Classification:st Stylesheet(s) is the secret stylesheet for.       Add shown row to table 3-III     GPS-Communityst     GPS-Advisory-IEPD     stylesheets,etc.)of artifacts-that: describe the: construction and: content (including: schemas,: transformation- stylesheet for.     Unclassified/- Format.       GPS-Communityst     GPS-Advisory-IEPD     stylesheets,etc.)of arGPS-Advisory-IEPD     Unclassified/- SoF.XSL:	Affected Decument(c)		C 070						
Paragraph     3.1.1-18.1     Comment Number     RTN-NEW12       Comment Type     Critical     Disposition     Accept       Comment Originator(s)     Walid Al-Masyabi (Raytheon)     Accept       Comment     Add legacy SOF backward compatibility to GPS-ICD-870 to be consistent with GPS-ICD-240 addition of SOF.       Directorate Response     Add appendix (notionally Appendix 2) to show legacy SOF format. This table then points to that appendix for the SOF format.     This table then points to that appendix for the SOF format.       BASELINE TEXT (WAS)     Producer#     Data-Exchange: Information     Information     Security-Classification-#     Included-       Add shown row to table 3-III     Producer#     Data-Exchange: Information     Information-Stylesheet(s)#     NANU.XSL:       Add shown row to table 3-III     GPS-Community#     GPS-Advisory+IEPD#     A-collection-of-artifacts-that-describethe-constructionand-content{including-stheet(s)#     NANU.XSL:       GPS-Community#     GPS-Advisory+IEPD#     stylesheets, etc., of-artifacts-that-describethe-stheet(s)#     Unclassified/-Stheet(s)#     Open/-Public     ¶       GPS-Community#     GPS-Advisory+IEPD#     stylesheets, etc., of-artifacts-that-stheet(s)#     Unclassified/-Stheet(s)#     Open/-Public     ¶       GPS-Community#     GPS-Advisory-IEPD#     stylesheets, etc., of-artifacts-that-stheet(s)#     GPS-Advisory-IEPD#     Stylesheetfor-stheet(s)#     GPS-Advisory-IEPD# <t< th=""><th>Affected Document(S)</th><th>ICD-GP</th><th>5-870</th><th></th><th>DOOR</th><th></th><th>GD870-723</th><th></th></t<>	Affected Document(S)	ICD-GP	5-870		DOOR		GD870-723		
Comment TypeCriticalDispositionAcceptComment Originator(s)Walid Al-Masyabi (Raytheon)CommentAdd legacy SOF backward compatibility to GPS-ICD-870 to be consistent with GPS-ICD-240 addition of SOF.Directorate ResponseAdd appendix (notionally Appendix 2) to show legacy SOF format.This table then points to that appendix for the SOF format.BASELINE TEXT (WAS)Producer#Data-Exchange- Identification#Information- Description#Security- Classification#Included- Transformation- Stylesheetfor format.Add shown row to table 3-IIIImage: Security- Identification#Information- Description#NANU.XSL: Stylesheetfor- producingASCII- formatted+CD- 870-Appendix1- NANUData- Format.¶NANU.XSL: Stylesheetfor- PorducingASCII- formation- stylesheets,etc.)of- aGPS-Advisory- information- stylesheets,etc.)of- aGPS-Advisory- information- Stylesheets,etc.)of- aGPS-Advisory- information- Stylesheets,etc.)of- aGPS-Advisory- information- Stylesheetfor- ProducingASCII- format.¶	Paragraph	3.1.1-18	3.1		Comment Number RTN		RTN-NEW12	TN-NEW12	
Comment Originator(s)       Walid Al-Masyabi (Raytheon)         Comment       Add legacy SOF backward compatibility to GPS-ICD-870 to be consistent with GPS-ICD-240 addition of SOF.         Directorate Response       Add appendix (notionally Appendix 2) to show legacy SOF format. This table then points to that appendix for the SOF format.       This table then points to that         BASELINE TEXT (WA>>       Producer#       Data-Exchange: Information-Description#       Security-Classification#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange: Information-Description#       Security-Classification#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange: Information-Description#       Security-Classification#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange: Information-Description#       Security-Classification#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange: Information-Description#       Security-Classification#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Bata-Exchange: Information+Description#       Security-Classification#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Bata-Exchange: Information-Stylesheet(s)#       Security-Classification# </th <th>Comment Type</th> <th>Critical</th> <th></th> <th></th> <th>Dispos</th> <th>sition</th> <th>Accept</th> <th></th>	Comment Type	Critical			Dispos	sition	Accept		
Comment       Add legacy SOF backward compatibility to GPS-ICD-870 to be consistent with GPS-ICD-240 addition of SOF.         Directorate Response       Add appendix (notionally Appendix 2) to show legacy SOF format. This table then points to that appendix for the SOF format.         BASELINE TEXT (WAS)       PIRN TEXT (IS)         Add shown row to table 3-III       Producerrit       Data-Exchange: Identification#       Information: Security: Classification#       Included: Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producerrit       Data-Exchange: Identification#       A-collection-of-artifacts-that: describe-the-iconstructionand-constructionand-iconstructiconstructiconand-iconstructionand-iconstructionand-ico	Comment Originator(s)	Walid Al	l-Masyabi (Raytheo	n)					
Directorate Response       Add appendix (notionally Appendix 2) to show legacy SOF format. This table then points to that appendix for the SOF format.         BASELINE TEXT (WAS)       Producer#       Data-Exchange-Identification#       Information-Description#       Security-Classification+#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange-Identification#       Information-Description#       Security-Classification+#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange-Identification#       Information-Description#       Security-Classification+#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange-Identification#       Information-Description#       Security-Classification+#       Included-Transformation-Stylesheet(s)#         Add shown row to table 3-III       Producer#       Data-Exchange-Identification#       Information-Stylesheet(s)#       NANU.XSL:         Add shown row to table       Identification#       A-collection-of-artification-sty       NANU.XSL:       Stylesheetfor-producingASCII-formation-Stylesheetfor-       Stylesheetfor-         Identification#       GPS-Community#       GPS-Advisory-IEPD#       Stylesheets,-etc.)of- a-GPS-Advisory-       Unclassified/-       Format.¶         Identification#       GPS-Advisory-       GPS-Advisory- <th>Comment</th> <th>Add lega SOF.</th> <th>acy SOF backward</th> <th>compatibilit</th> <th>y to GP</th> <th>S-ICD-870 to be</th> <th>consistent with GPS-</th> <th>ICD-240 addition of</th>	Comment	Add lega SOF.	acy SOF backward	compatibilit	y to GP	S-ICD-870 to be	consistent with GPS-	ICD-240 addition of	
BASELINE TEXT (WAS)       PIRN TEXT (IS)         Add shown row to table 3-III       Producerx       Data-Exchange· Identificationx       Information· Descriptionx       Security· Classification·x       Included· Transformation· Stylesheet(s)x         A-collection-of· artifacts-that· describe the· construction and· content{including- schemas,· transformation- stylesheets,retc.)of· a-GPS-Advisory-IEPDx       A-collection-of· artifacts-that· describe the· construction and· content{including- schemas,· transformation- stylesheets,retc.)of· a-GPS-Advisory- information-       Unclassified/· SOF.XSL:- Stylesheetfor- Stylesheetfor-	Directorate Response	Add app appendi	pendix (notionally A ix for the SOF form	ppendix 2) t at.	o show	legacy SOF form	at. This table then p	oints to that	
Add shown row to table 3-III       Producer#       Data-Exchange- Identification#       Information- Description#       Security- Classification-#       Included- Transformation- Stylesheet(s)#         A-collection-of- artifacts-that- describe-the- construction and- content{including- schemas,- transformation- stylesheets,etc.)of- a-GPS-Advisory-IEPD#       A-collection-of- artifacts-that- describe-the- construction and- content{including- schemas,- transformation- stylesheets,etc.)of- a-GPS-Advisory- information-       NANU.XSL:- Stylesheetfor- Producing-ASCII- format.¶	BASELINE TEXT (WA	S)				PIRN TEXT (IS			
exchange.¶ producing-ASCII- Published on a- periodic-bases with- each-new schema- Operational SOF-	Add shown row to table 3-III		GPSCommunity A GPS-Advisor		ge. n¤ yiEPD¤	Information- Description¤ A-collection-of- artifacts-that- describe-the- construction-and- content-(including schemas,- transformation- stylesheets,-etc.)- a-GPS-Advisory- information- exchange.¶ Published-on-a- periodic-bases-wite each-new-schema	Security· Classification·¤ Unclassified·/· Open·/·Public· Releasable¤	Included Transformation Stylesheet(s)¤ NANU.XSL: Stylesheetfor producing-ASCII- formatted-ICD- 870·Appendix:1· NANU-Data Format.¶ ¶ SOF.XSL: Stylesheetfor producing-ASCII- formatted-ICD- 870·Appendix:2- Operational-SOF-	

Affected Document(s)	ICD-GPS-2	240	DOORS ID	ICD240-292 (new object after ICD240-290)		
Paragraph	New appe	ndix for SOF	Comment Number	GPL_1		
Comment Type	Critical		Disposition	Accept with Comments		
Comment Originator(s)	William Co	William Connor (GPL)				
Comment	There is an impact to AEP depending on what is meant by the statements asking to place the SOF file onto the 2 SOPS and USCG NAVCEN websites. If the desire is to have GPS User Support System (GUSS) "in the loop" like it is in providing Almanac files to the websites (someone takes a file from the Almanac PC and places it on GUSS, GUSS then puts on NIPRNET), then there is an impact. If the desire is for 2 SOPS to manually obtain the SOF and put it on the various websites themselves, then no impact to AEP.					
Directorate Response	Need to resolve the final wording. Also, need to determine if there is, in fact, a need to update the GUSS tool (seems likely) to transfer the SOF to the USCG server. Regardless, include the SOF in 240 since it has been declassified. May need another update of 240 to describe how it is actually transferred to the USCG					
BASELINE TEXT (W	AS)	PIRN TE	EXT (IS)	PROPOSED TEXT		

Affected Document(s)	ICD-GPS-240	DOORS ID	ICD240-102, ICD870-111		
Paragraph	10.1.2.0-3	Comment Number	KK-2, KK-3, GPL_2		
Comment Type	Critical	Disposition	Defer		
Comment Originator(s)	Karl Kovach (GPE)				
Comment	Add SOF Production rules				
Directorate Response	Not clear when these new types would be used. 2SOPS will have to weigh in on impact to implement. Added as a 2016 Public Forum Special Topic.				

PIRN TEXT (IS)		PROPOSED TEXT				
N/A		Table 10-II Unscheduled Outages				
	NANU ACRONYM	NAME	DESCRIPTION			
	UNUSUFN	Unusable Until Further Notice	Notifies users that a satellite will be unusable to all users until further notice.			
	UNUSABLE	Unusable with reference NANU	Closes out an UNUSUFN NANU and gives the exact outage times; references the UNUSUFN NANU.			
	UNUNOREF	Unusable with no reference <u>NANU</u>	Gives times for outages that were resolved before an UNUSUFN NANU could be sent.			
	UNUSIFUEN	<u>Unusable Integrity</u> <u>Failure Until</u> <u>Further Notice</u>	Notifies users that a satellite will be unusable due to an integrity failure to all users until further notice.			
	UNUSIFABLE	<u>Unusable Integrity</u> Failure with reference NANU	<u>Closes out an UNUSIFUFN NANU and gives the exact outage</u> (malfunction) times; references the UNUSIFUFN NANU.			
	UNUIFNOREF	Unusable Integrity Failure with no reference NANU	Gives times for outages (malfunctions) that were resolved before an UNUSIFUFN NANU could be sent.			





### **Critical Comments**

## Substantive Comments (19)

### **Rejected Administrative Comments**

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-36	
Paragraph	3.1.1-17	Comment Number	RTN_NEW11	
Comment Type	Substantive	Disposition	Accept with Comments	
Comment Originator(s)	Walid Al-Masyabi (Raytheon)			
Comment	Updated wording for object			
Directorate Response	Column 2 of the new table format should show both the modern and the legacy names.			

BASELINE TEXT (WAS)		PIRN TEXT (IS)				PROPOSED TEXT		
								N/A
Producer	Data Exchange Identification	Information Description	Security	Producer	Nodern & Legacy Data	Description	Security Classification	
GPS CS	GPS Status Information	Information Product: NANU (see Table 3-III)	Unclassified Public Releasable Open Access	cs	Modern Identification: GPS Advisory Legacy Identification: Notice Advisory to Navstar Users (NANU)	The GPS Advisory exchange information product includes a single advisory notification concerning a GPS space event and associated GPS space vehicle. See GPS Advisory IEPD for more details. Published on a periodic basis, based on	Unclassified / Open / Public Releasable	
GPS CS	GPS Constellation Status Summary	Information Product: OA (See Table 3-III)	Unclassified Public Releasable Open Access	cs	Nodern Identification: Ops Status Legacy Identification: Operational Advisory (OA)	operational events/needs. The Ops Status Exchange information product includes an Ops Status notification concerning the GPS constellation and relevant GPS space events. See Ops Status IEPD for more	Unclassified / Open / Public Releasable	
GPS CS	GPS Constellation Orbital and Performance Parameters, and SV Signal Health Status GPS Constellation Anti-Spoofing Status	Information Product: Common Almanac (See Table 3-III)	Unclassified Public Releasable Open Access	cs	Modern Identification: Public Common Almanac Legacy Identification: (1) GPS Almanacs (SEM, YUNA) (2) Anti-Spoof Status (3) ESHS	detais. Nominally published once daily. The Public Common Almanac Exchange information product includes orbital state and health status of the GPS constellation. See Public Common Almanac IEPD for more details. Nominally published once daily.	Unclassified / Open / Public Releasable	
L	1	1	1	1				

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UNCLASSIFIED

### BASELINE TEXT (WAS) ICD870-36

Producer	Data Exchange Identification	Information Description	Security
GPS CS	GPS Status Information	Information Product: NANU (see Table 3-III)	Unclassified Public Releasable Open Access
GPS CS	GPS Constellation Status Summary	Information Product: OA (See Table 3-III)	Unclassified Public Releasable Open Access
GPS CS	GPS Constellation Orbital and Performance Parameters, and SV Signal Health Status GPS Constellation Anti- Spoofing Status	Information Product: Common Almanac (See Table 3-III)	Unclassified Public Releasable Open Access



### PIRN TEXT (IS) ICD870-36

Producer	Modern & Legacy Data Exchange Identification	Description	Security Classification
cs	Modern Identification: GPS Advisory Legacy Identification: Notice Advisory to Navstar Users (NANU)	The GPS Advisory exchange information product includes a single advisory notification concerning a GPS space event and associated GPS space vehicle. See GPS Advisory IEPD for more details. Published on a periodic basis, based on operational events/needs.	Unclassified / Open / Public Releasable
CS	Modern Identification: Ops Status Legacy Identification: Operational Advisory (OA)	The Ops Status Exchange information product includes an Ops Status notification concerning the GPS constellation and relevant GPS space events. See Ops Status IEPD for more details. Nominally published once daily.	Unclassified / Open / Public Releasable
CS	Modern Identification: Public Common Almanac Legacy Identification: (1) GPS Almanacs (SEM,YUMA) (2) Anti- Spoof Status (3) ESHS	The Public Common Almanac Exchange information product includes orbital state and health status of the GPS constellation. See Public Common Almanac IEPD for more details. Nominally published once daily.	Unclassified / Open / Public Releasable

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-662	
Paragraph	3.1.0-8	Comment Number	Aero_1	
Comment Type	Substantive	Disposition	Reject	
Comment Originator(s)	Rhonda Slattery (Aerospace)			
Comment	Why are you deleting "offered by the CS" This vocabulary does not apply to all GPS public products. If you are making a distinction between the CS and USCG, how about replacing with "discussed in this ICD"			
Directorate Response	Reviewer accepted rationale provided by author of the original change.			

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
In accordance with DODD 8320, Data	In accordance with DODD 8320, Data	N/A
Sharing in a Net Centric Department of	Sharing in a Net Centric Department of	
Defense, this ICD defines and then uses a	Defense, this This ICD defines and then	
GPS domain specific information	uses a GPS domain specific information	
exchange vocabulary which users should	exchange vocabulary which users should	
adopt when discussing the public GPS	adopt when discussing the public GPS	
products offered by the CS. Figure 3-3	products offered by the CS. Figure 3-3	
depicts a high level entity relationship	depicts a high level entity relationship	
diagram summarizing the GPS Product	diagram summarizing the GPS Product	
Ontology.	Ontology. This ontology captures the	
	modernized GPS Product relationships	
	including compliance with the latest	
	government standards for data sharing and	
	interoperability including National	
	Information Exchange Model (NIEM).	

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-679
Paragraph	3.1.1-20	Comment Number	Aero_2
Comment Type	Substantive	Disposition	Accept
Comment Originator(s)	Rhonda Slattery (Aerospace)		
Comment	This is deleting the header of Table 3-iii, but the actual table from the approved document doesn't seem to be deleted, but it was replaced with a new 723, leaving two table 3-iii's		
Directorate Response	Correct. Old Table 3-III should have been deleted.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Table 3-III Mapping Information Products & Transformation Products into Desired Output Format CS Effectivity: N/A SS Effectivity: N/A	Table 3-III Mapping Information Products & Transformation Products into Desired Output Format CS Effectivity: N/A SS Effectivity: N/A	<deleted object=""></deleted>

Affected Document(s)	ICD-GPS-870	DOORS ID	ICD870-141
Paragraph	10.2.0-3	Comment Number	Aero_6
Comment Type	Substantive	Disposition	Accept with Comments
Comment Originator(s)	Rhonda Slattery (Aerospace)		
Comment	Why was the 15 min objective removed? It adds no additional burden to OCX to have a goal that's better than their requirement.		
Directorate Response	15 minutes is arbitrary. If an objective is provided, it should now include separate allocations for processing time and operator time to declassify the data.		

BASELINE TEXT (WAS)

NANU Group	Nominal Notification Times	Objective	
Scheduled	48 hrs prior to outage start	96 hrs prior to outage start	
Unscheduled	Less than 1 hr after outage start	15 minutes after outage start	
General	No Nominal – Timing determined on a case-by-case basis		
Other	No Nominal – Timing determined on a case-by-case basis		

#### PIRN TEXT (IS)

NANU Group	Nominal Notification Times	Objective	
Scheduled	48 hrs prior to outage start	96 hrs prior to outage start	
Unscheduled	Less than 1 hr after outage start	15 minutes after outage start	
General	No Nominal – Timing determined on a case-by-case basis		
Other	No Nominal – Timing determined on a case-by-case basis		

ICD-GPS-240; ICD-GPS-870	DOORS ID	ICD240 and ICD870 Table 3-I
3.1.1.1-17	Comment Number	KK-1
Substantive	Disposition	Defer
Karl Kovach (GPE)		
Add description for Receiver Independent Exchange Format (RINEX) for nav data interchange		
Added as a 2016 PICWG Special Topic.		
	ICD-GPS-240; ICD-GPS-870 3.1.1.1-17 Substantive Karl Kovach (GPE) Add description for Receiver Independ Added as a 2016 PICWG Special Topic	ICD-GPS-240; ICD-GPS-870DOORS ID3.1.1.1-17Comment NumberSubstantiveDispositionKarl Kovach (GPE)Add description for Receiver Independent Exchange Format ( Added as a 2016 PICWG Special Topic.

PIRN TEXT (IS)	PROPOSED TEXT
I/A	N/A
	/A

Affected Document(s)	ICD-GPS-240; ICD-GPS-870	DOORS ID	ICD240 and ICD870
Paragraph	new	Comment Number	KK-4,5
Comment Type	Substantive	Disposition	Defer
Comment Originator(s)	Karl Kovach (GPE)		
Comment	Add description of Predict Ephemeris/State Vector Data		
Directorate Response	Added as a 2016 PICWG Special Topic.		

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

Affected Document(s)	ICD-GPS-240	DOORS ID	ICD240-294
Paragraph	21.1	Comment Number	TEDD_1
Comment Type	Substantive	Disposition	Accept
Comment Originator(s)	Ted Driver (Advanced Research Corp)		
Comment	At the top of page 12 of PIRN-240A-002, there is a statement that all times are GPS TIME unless otherwise specified. In the definitions for satellite outages, there is no other specification for time standards, so one must assume that the outage times in the SOF are GPS TIME. This is incorrect. Outage times in the SOF are identical to the outage times in the NANUS. NANU outages times are ZULU (UTC), defined by ICD-GPS-240A, paragraph 10.3.2.4.		
Directorate Response	*This comment is in the new wording describing the SOF message format and is several pages long. Text came from another GPS design document. SE&I will take an action to verify the time source for the SOF message. One alternative is to add information to each outage section description that the outage times are in UTC.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	<u>All times are GPS TIME unless otherwise</u> specified.	All times are GPS TIME <u>UTC</u> unless otherwise specified.

Affected Document(s)	ICD-GPS-240	DOORS ID	ICD240-294
Paragraph	21.1	Comment Number	TEDD_2
Comment Type	Substantive	Disposition	Accept with Comments
Comment Originator(s)	Ted Driver (Advanced Research Corp)		
Comment	At the bottom of page 13 of PIRN-240A-002, "Changes to the file formats are implemented as follows:" bullet number 3: "The old file format will be posted for four months, and then be removed". We'd like to request this be extended to 6 months to accommodate commercial development cycles.		
Directorate Response	Need concurrence from 2SOPS that this is acceptable. *This comment is in the new wording describing the SOF message format and is several pages long.		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	3. The old file format will be posted for four months, and then be removed.	3. The old file format will be posted for foursix months, and then be removed.

Affected Document(s)	ICD-GPS-240	DOORS ID	ICD240-294		
Paragraph	21.1	Comment Number	TEDD_3		
Comment Type	Substantive	Disposition	Accept with Comments		
Comment Originator(s)	Ted Driver (Advanced Research Corp)				
Comment	At the bottom of page 13 of PIRN-240A-002, "Changes to the file formats are implemented as follows:" add a bullet 4: Notifications of file format changes, with samples of the new format, will be published to www.GPS.gov when they are final.				
Directorate Response	This seems quite reasonable, just not sure who would be responsible for making the notification and how. Updating ICD-GPS-240 by itself can take a year.				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	3. The old file format will be posted for four months, and then be removed.	3. The old file format will be posted for four months, and then be removed.
		4. Notifications of file format changes, with samples of the new format, will be published to www.GPS.gov when they are final.





# DEFINITION CLARIFICATION FOR TIME OF PREDICT

J. Ji J. Buckley



### RFC-312 Definition Clarification for Time of Predict

### **Problem Statement:**

To remove ambiguity in contractor interpretation, the definition of the parameter Time of Predict (T\_op) and other timing parameters must be clarified in the GPS technical baseline documentation.

### **Proposed Solution:**

Process RFC via the proposed changes with the correct stakeholders and update the appropriate documentation for accurate implementation.

#### Impacted Documents:

(IS-GPS-200 Rev H, IS-GPS-705 Rev D, and IS-GPS-800 Rev D)



### RFC-312 CRM Status

CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS					
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence
Accept	0	0	54	54	0
Accept with Comment	1	20	2	23	5
Reject	0	1	0	1	0
Defer	4	0	0	4	0
Grand Totals:	5	21	56	82	0



RFC-312 Definition Clarification for Time of Predict

# **Critical Comments (5)**

### **Substantive Comments**

## **Rejected Administrative Comments**

Affected Document(s)	IS-GPS-200; IS-GPS-705; IS-GPS-800 <b>DOORS ID</b>		DOORS ID		IS200-1515; IS705-1517; IS800-914
Paragraph	200-6.2.10; 705-6.2.9; 800-6.2.9		Comment Nur	nber	18
Comment Type	Critical		Disposition		Accept w/ Comment
Comment Originator(s)	Rhonda Slatte	ery (Aerospace)			
Comment	This seems to about the vari CS/OCX/???	This seems to introduce OCX to IS-GPS-200 for the first time. If this is required, about the various Blocks of CSs is needed in section 6. Other additional discuss CS/OCX/??? May be needed also.			
Directorate Response	References to OCX will be removed. After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)". Aerospace subject matter experts concur that the verbiage "multiple segments of temporally continuous" would be more appropriate along with using term CEI rather than ICE.				rospace, acronym was updated to be rts concur that the verbiage "multiple ong with using term CEI rather than
BASELINE TEXT	(WAS) PIRN TEXT (IS)				PROPOSED TEXT
V/A		A related time-ordered seque data sets in which each succ set is a time projection of the data set. Special provisions users to discontinuities sepa data projection sequence fro data projection sequence (e. upload occurs). Before mod ICE data projection sequenc sometimes called an "upload Subframe 1-2-3 data sets". I the Next Generation Operation System (OCX), an upload ma multiple, disjoint but contigue projection sequences.	ence of ICE essive ICE data preceding ICE apply to alert rating one ICE m another ICE g., after an ernization, an e was ed sequence of Beginning with onal Control ay include bus ICE data	A relate data se data se ICE <u>CEI</u> alert us ICECEI Upload terms, a sometir Subfrar Next Ge (OCX), segmer contigu	ed time-ordered sequence of ICE_CEI ts in which each successive ICE_CEI t is a time projection of the preceding data set. Special provisions apply to ters to discontinuities separating one data projection sequence from another data projection sequence (e.g., after an occurs). Before modernization, in LNAV an ICE_CEI data projection sequence was mes called an "uploaded sequence of me 1-2-3 data sets". Beginning with the eneration Operational Control System An upload may include multiple ints of temporally continuous disjoint but ous ICE_CEI data projection sequences.

Affected Document(s)	IS-GPS-200; IS-GPS-705; IS- GPS-800		DOORS ID	IS200-3 IS800-1	63; IS200-550, IS705-239, 79	
Paragraph	200-20.3.3.4.2; 200- 705-20.3.3.1.3; 800-	-30.3.3.1.3; -3.5.3.6.1	Comment Number	47, 58,	76	
Comment Type	Critical		Disposition	Defer to	PICWG	
Comment Originator(s)	Mike Carroll (Raythe	eon)				
Comment	Using "projected ep "projected" has con another. Recommer void many of the pro	Using "projected ephemeris" instead of "predicted ephemeris" does not clarify the terminology, since "projected" has connotations other than temporal. E.g., it connote the projection of one vector onto another. Recommend leaving original text as is. Reverting to predicted nomenclature would render void many of the proposed changes.				
Directorate Response	Further discussion c as "n" projections.	on this topic is r	needed. Prediction occurs o	nce on th	e ground and then is uploaded	
BASELINE TEXT (WAS) PIRN TEXT (IS)			PROPOSED TEXT			
The user shall compute the E position for the phase center of utilizing a variation of the equ 20-IV. Subframes 2 and 3 pa Keplerian in appearance; the parameters, however, are pro (Block II/Block IIA/IIR/IIR-M/II via a least squares curve fit o ephemeris of the phase center antennas (time-position quad expressed in ECEF coordinat concerning the periods of the resultant accuracy, and the ap system are given in the follow	CEF coordinates of of the SVs' antennas ations shown in Table rameters are values of these duced by the CS F) and SS (GPS III) f the predicted er of the SVs' ruples; t, x, y, z es). Particulars curve fit, the oplicable coordinate ring subparagraphs.	The user shall position for the utilizing a varia 20-IV. Subfran Keplerian in ap parameters, ho (Block II/Block via a least squa <u>projected</u> ephe SVs' antennas expressed in E concerning the resultant accur system are giv	compute the ECEF coordin e phase center of the SVs' a ation of the equations shown nes 2 and 3 parameters are opearance; the values of the pwever, are produced by the IIA/IIR/IIR-M/IIF) and SS (C ares curve fit of the predicte emeris of the phase center of (time-position quadruples; ECEF coordinates). Particul e periods of the curve fit, the racy, and the applicable coo en in the following subparage	ates of ntennas n in Table ese e CS GPS III) of the t, x, y, z ars rdinate graphs.	N/A	

IS-GP	S-200; IS-GPS-705; IS-GPS-800	DOORS ID		IS200-1513, IS705-1515, IS800-912	
200-6.	2.9.1; 705-6.2.8.1; 800-6.2.8.1	Comment Number		28	
Critica		Disposition		Defer to PICWG	
Stever	n Brown (Lockheed Martin)				
Remov can ch exact µ param Consic	Remove "health flags" as an example of a related parameter within an ICE data set because health flags can change independent of ephemeris and clock values. Recommend providing an explicit list of the exact parameters that constitute the ICE data set to remove any ambiguity. It should be the collection of parameters within SF123 that get projected in time based on the propagation of the state vector. Consider further re-writes to explicitly list the parameters that are considered to be the ICE data set.				
NS)	PIRN TEXT (IS)			PROPOSED TEXT	
	An Integrity/Clock/Ephemeris (ICE) the collection of SV-specific URA pa- clock correction polynomial parame ephemeris parameters, and related (health flags, time tags, etc.) neede SV's broadcast signal(s) in the posi service. ICE data is sometimes als the user's 'hot start' data for the SV modernization, an ICE data set was called a "Subframe 1-2-3 data set".	data set is arameters, ters, parameters d to use the tioning o known as Before s sometimes	An Inter- Clock/ collect param time ta correc of qua indicat gravita rate co accura correc accura resulti neede positic also ki Before data s data s	egrity/Clock/Ephemeris (ICE) (Ephemeris/Integrity (CEI) data set is the tion of SV-specific URA parameters, clock tion polynomial parameters, ephemeris eters, and related parameters (health flags, ags, etc.) data fields for SV health, SV clock tion coefficients, reference time tags, a set si-Keplerian ephemeris elements, accuracy tors for clock-related data, a set of ational harmonic correction terms, rates and prections to quasi-Keplerian elements, an acy indicator for ephemeris-related data, and tion terms [and associated figures of acy] that compensate for inter-signal bias ng from SV group delay differential, that are ed to use the SV's broadcast signal(s) in the oning service. ICECEI data is sometimes nown as the user's 'hot start' data for the SV. e modernization, in LNAV terms, an ICECEI et was sometimes called a "Subframe 1-2-3 et".	
	UNCLASSIF	IED		60	
	IS-GPS 200-6. Critica Stever Remov can ch exact p param Consid	IS-GPS-200; IS-GPS-705; IS-GPS-800 200-6.2.9.1; 705-6.2.8.1; 800-6.2.8.1 Critical Steven Brown (Lockheed Martin) Remove "health flags" as an example of a can change independent of ephemeris and exact parameters that constitute the ICE of parameters within SF123 that get projecter Consider further re-writes to explicitly list t S) PIRN TEXT (IS) An Integrity/Clock/Ephemeris (ICE)) the collection of SV-specific URA particular and clock correction polynomial parameters, and related (health flags, time tags, etc.) needer SV's broadcast signal(s) in the posi- service. ICE data is sometimes also the user's 'hot start' data for the SV modernization, an ICE data set was called a "Subframe 1-2-3 data set". UNCLASSIF	IS-GPS-200; IS-GPS-705; IS-GPS-800       DOORS ID         200-6.2.9.1; 705-6.2.8.1; 800-6.2.8.1       Comment Number         Critical       Disposition         Steven Brown (Lockheed Martin)       Remove "health flags" as an example of a related parar can change independent of ephemeris and clock values exact parameters that constitute the ICE data set to remparameters within SF123 that get projected in time base consider further re-writes to explicitly list the parameter         S)       PIRN TEXT (IS)         An Integrity/Clock/Ephemeris (ICE) data set is the collection of SV-specific URA parameters, clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. ICE data is sometimes also known as the user's 'hot start' data for the SV. Before modernization, an ICE data set was sometimes called a "Subframe 1-2-3 data set".         UNCLASSIFIED	IS-GPS-200; IS-GPS-705; IS-GPS-800       DOORS ID         200-6.2.9.1; 705-6.2.8.1; 800-6.2.8.1       Comment Number         Critical       Disposition         Steven Brown (Lockheed Martin)       Steven Brown (Lockheed Martin)         Remove "health flags" as an example of a related parameter v can change independent of ephemeris and clock values. Rece exact parameters that constitute the ICE data set to remove a parameters within SF123 that get projected in time based on to Consider further re-writes to explicitly list the parameters that data the collection of SV-specific URA parameters, clock correction polynomial parameters, clock at signal(s) in the positioning service. ICE data is sometimes also known as the user's 'hot start' data for the SV. Before modernization, an ICE data set was sometimes called a "Subframe 1-2-3 data set".       An Integrity/ correction of quation also ku Before data set         UNCLASSIFIED       UNCLASSIFIED	



RFC-312 Definition Clarification for Time of Predict

### **Critical Comments**

# Substantive Comments (21)

### **Rejected Administrative Comments**

Affected Document(s)	IS-GPS-200; IS-GPS-705; IS-GPS-800	DOORS ID	Applies to all CEI updates	
Paragraph	Applies to all CEI updates	Comment Number	6	
Comment Type	Substantive	Disposition	Accept w/ Comment	
Comment Originator(s)	Rhonda Slattery (Aerospace)			
Comment	ICE has been a standard definition for Improved Clock and Ephemeris, and part of the M-code Improved Clock and Ephemeris (MICE) definitions for over 10 years (since 2004 in IS-GPS-200, 2003 for 705). Changing it now will cause years of briefings, papers, and other documentation to be confusing and misinterpreted. Come up with another acronym			
Directorate Response	After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)"			

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
N/A	Integrity/Clock/Ephemeris (ICE)	Integrity/Clock/Ephemeris (ICE) Clock/Ephemeris/Integrity (CEI)

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-468		
Paragraph	200-20.3.4.4 Table 20-XII	Comment Number	29		
Comment Type	Substantive	Disposition	Accept w/ Comment		
Comment Originator(s)	Steven Brown (Lockheed Martin)				
Comment	Note 5 (at a minimum) needs to be updated to refer to ICE data projection sequence. Perhaps also Note 2's "at least the first 14 days after upload"?				
Directorate Response	After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)". Update will be made.				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Note 2: IODC values for blocks with 1-, 2- or 4-hour transmission intervals (at least the first 14 days after upload) shall be any numbers in the range 0 to 1023 excluding those values of IODC that correspond to IODE values in the range 240-255, subject to the constraints on re-transmission given in paragraph 20.3.4.4. The CS can define the GPS III SV time of transition from the 4 hour curve fits into extended navigation (beyond 4 hour curve fits). Following the transition time, the SV will follow the timeframes defined in the table, including appropriately setting IODC values.  Note 5: The first data set of a new upload may be cut-in at any time and therefore the transmission interval may be less than the specified value.	N/A	Note 2: IODC values for blocks with 1-, 2- or 4-hour transmission intervals (at least the first 14 days after a new CEI data projection sequence upload) shall be any numbers in the range 0 to 1023 excluding those values of IODC that correspond to IODE values in the range 240-255, subject to the constraints on re-transmission given in paragraph 20.3.4.4. The CS can define the GPS III SV time of transition from the 4 hour curve fits into extended navigation (beyond 4 hour curve fits). Following the transition time, the SV will follow the timeframes defined in the table, including appropriately setting IODC values.

IS-GPS-800	DOORS ID	IS800-167		
800-3.5.3.3	Comment Number	68		
Substantive	Disposition	Accept w/ Comment		
Steven Brown (Lockheed Martin)				
Updated object text should specify the new definition of t <sub>op</sub> .				
After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)".				
	IS-GPS-800 800-3.5.3.3 Substantive Steven Brown (Lockheed Martin) Updated object text should specify the After discussion involving Aerospace, a	IS-GPS-800       DOORS ID         800-3.5.3.3       Comment Number         Substantive       Disposition         Steven Brown (Lockheed Martin)       Updated object text should specify the new definition of t <sub>op</sub> .         After discussion involving Aerospace, acronym was updated to		

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Bits 22 through 32 of subframe 2 shall contain the data predict time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state estimate utilized for the prediction of satellite quasi-Keplerian ephemeris parameters.	Bits 22 through 32 of subframe 2 shall contain the data predict time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state <u>data</u> estimate utilized for the <u>prediction projection</u> of satellite <u>ICE data</u> quasi-Keplerian ephemeris parameters. Users are cautioned to avoid using this parameter to compute age of data for any SV.	Bits 22 through 32 of subframe 2 shall contain the ICECEI data projection predict sequence time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state data utilized for the projection of satellite ICECEI data quasi- Keplerian ephemeris parameters. Users are cautioned to avoid using this parameter to compute age of data for any SV.

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-564			
Paragraph	200-30.3.3.2.1.2	Comment Number	81			
Comment Type	Substantive	Disposition	Accept w/ Comment			
Comment Originator(s)	Stephan Hillman (Aerospace)					
Comment	This object should contain the same warning text as in the last sentence of IS200-543.					
Directorate Response	After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)". The object will be updated to contain the same warning text as in the last sentence of object IS200-543.					

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Bits 39 through 49 of message types 30 through 37 shall contain the data predict time of week (t <sub>op</sub> ). The top term provides the epoch time of week of the state estimate utilized for the prediction of SV clock correction coefficients.	Bits 39 through 49 of message types 30 through 37 shall contain the ICE data projection predict time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state <u>data</u> estimate utilized for the prediction projecting the SV clock correction coefficients <u>forward in time</u> .	Bits 39 through 49 of message types 30 through 37 shall contain the ICECEI data projection time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state data utilized for projecting the SV clock correction coefficients forward in time. Users are cautioned to avoid using this parameter to compute age of data for any SV.

Affected Document(s)	IS-GPS-200; IS-GPS-705; IS-GPS-800	DOORS ID	IS200-1515, IS705-1517, IS800-914				
Paragraph	200-6.2.10; 705-6.2.9; 800-6.2.9	Comment Number	40				
Comment Type	Substantive	Disposition	Accept w/ Comment				
Comment Originator(s)	Roger Kirpes (Rockwell Collins)						
Comment	It is not clear what the phrase "multiple disjoint but contiguous" ICE data projection sequences implies for the user of such data. Clarify what is meant by "multiple disjoint but contiguous" ICE data projection sequences. Clarify what effect user equipment (UE) may experience if the broadcast ICE data changes from one data projection sequence to another. For example, clarify if the UE could compute SV positions, for the same time, using data sets which are both valid for that time, but result in SV positions which separated by more than the associated broadcast user range accuracy (URA) value.						
Directorate Response	Aerospace subject matter experts concur that the verbiage "multiple segments of temporally continuous" would be more appropriate along with using term CEI rather than ICE.						
BASELINE TEXT (WAS)	PIRN TEXT (IS)		PROPOSED TEXT				
N/A	A related time-ordered sequence of ICE dat in which each successive ICE data set is a t projection of the preceding ICE data set. Sp provisions apply to alert users to discontinuit separating one ICE data projection sequence another ICE data projection sequence (e.g., an upload occurs). Before modernization, a data projection sequence was sometimes ca an "uploaded sequence of Subframe 1-2-3 of sets". Beginning with the Next Generation Operational Control System (OCX), an uplo may include multiple, disjoint but contiguous data projection sequences.	a sets ime which each success projection of the provisions apple separating one after n ICE alled dataA related time-or which each success provisions apple anotherICE CE upload occurs) an ICECEI data called an ICECEI data sets". Beginnir ad sets". Beginnir control System segments of ter contiguous ICE	ordered sequence of ICECEI data sets in ccessive ICECEI data set is a time e preceding ICECEI data set. Special y to alert users to discontinuities ICECEI data projection sequence from I data projection sequence (e.g., after an Before modernization, in LNAV terms, a projection sequence was sometimes aded sequence of Subframe 1-2-3 data og with the Next Generation Operational (OCX), <u>A</u> n upload may include multiple mporally continuous disjoint but CEI data projection sequences.				

Affected Doc	ument(s)	IS-GPS-200; IS-GPS-705; IS-GPS-800	DOORS ID	IS200-1513, IS200-1515, IS705-1515, IS705-1517, IS800-912, IS800-914
Paragraph		200-6.2.9 and 200-6.2.10; 705-6.2.8 and 705-6.2.9; 800-6.2.8 and 800-6.2.9	Comment Number	4, 65
Comment Ty	ре	Substantive	Disposition	Accept w/ Comment
Comment Or	iginator(s)	Rhonda Slattery (Aerospace) and Steven	Brown (Lockheed Mar	tin)
<b>Comment</b> Since subframe 1-2-3 data set has never been in any of these documents, introducing it reduce any confusion. Delete the last sentence. Does this explanatory text make sense spec, when "Subframe 1-2-3" refers to the Legacy NAV Subframes 1-3? Subframes me different in CNAV-2.				
<b>Directorate Response</b> After speaking with Aerospace it was determined that the subframe reference was useful w context was made clear.				
BASELINE TEXT (WAS)		PIRN TEXT (IS)		PROPOSED TEXT
N/A	An Integrity/C SV-specific U parameters, e (health flags, signal(s) in th known as the modernization "Subframe 1-	Clock/Ephemeris (ICE) data set is the collection RA parameters, clock correction polynomial ephemeris parameters, and related parameters time tags, etc.) needed to use the SV's broadd e positioning service. ICE data is sometimes a user's 'hot start' data for the SV. Before n, an ICE data set was sometimes called a 2-3 data set".	of An Integrity/Clock/E (CEI) data set is the clock correction poly and related paramet use the SV's broadc ICECEI data is some data for the SV. Bet data set was someti	phemeris (ICE) Clock/Ephemeris/Integrity collection of SV-specific URA parameters, momial parameters, ephemeris parameters, ters (health flags, time tags, etc.) needed to cast signal(s) in the positioning service. etimes also known as the user's 'hot start' fore modernization, in LNAV terms, a ICECEI mes called a "Subframe 1-2-3 data set".
N/A	A related time successive IC data set. Spe discontinuities from another occurs). Befo was sometim 3 data sets". Control Syste but contiguou	e-ordered sequence of ICE data sets in which e CE data set is a time projection of the preceding ecial provisions apply to alert users to a separating one ICE data projection sequence ICE data projection sequence (e.g., after an up ore modernization, an ICE data projection sequence es called an "uploaded sequence of Subframe Beginning with the Next Generation Operation or (OCX), an upload may include multiple, disjustices is ICE data projection sequences.	ach A related time-order ICE each successive ICI preceding ICECEI d users to discontinuit load sequence from anot enceafter an upload occu 1-2- ICECEI data project al "uploaded sequence with the Next Gener upload may include	ed sequence of ICECEI data sets in which <u>CEI</u> data set is a time projection of the ata set. Special provisions apply to alert ies separating one ICECEI data projection her ICECEI data projection sequence (e.g., urs). Before modernization, in LNAV terms, an ion sequence was sometimes called an e of Subframe 1-2-3 data sets". Beginning ation Operational Control System (OCX), <u>A</u> n multiple segments of temporally continuous



**Proposed Text** IS-GPS-200 Rev H (IS200-1513, IS200-1515), IS-GPS-705 Rev D (IS705-1515, IS705-1517), IS-GPS-800 Rev D (IS800-912, IS800-914)

An Integrity/Clock/Ephemeris (ICE) Clock/Ephemeris/Integrity (CEI) data set is the collection of SV-specific URA parameters, clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. ICECEI data is sometimes also known as the user's 'hot start' data for the SV. Before modernization, in LNAV terms, a ICECEI data set was sometimes called a "Subframe 1-2-3 data set".

A related time-ordered sequence of ICECEI data sets in which each successive ICECEI data set is a time projection of the preceding ICECEI data set. Special provisions apply to alert users to discontinuities separating one ICECEI data projection sequence from another ICECEI data projection sequence (e.g., after an upload occurs). Before modernization, in LNAV terms, an ICECEI data projection sequence was sometimes called an "uploaded sequence of Subframe 1-2-3 data sets". Beginning with the Next Generation Operational Control System (OCX), An upload may include multiple segments of temporally continuous disjoint but contiguous ICECEI data projection sequences.

Affected Document(s)	IS-GPS-200; IS-GPS-705; IS-GPS-800	DOORS ID	Applies to all t <sub>op-D</sub> updates	
Paragraph	Applies to all t <sub>op-D</sub> updates	Comment Number	8	
Comment Type	Substantive	Disposition	Accept w/ Comment	
Comment Originator(s)	Rhonda Slattery (Aerospace)			
Comment	Changing the definition of a variable ( $t_{op-D}$ to $t_{ok-D}$ ) for no particular reason is confusing and liable to cause unneeded updates in people's documentation and possibly software. You can change the name e.g., in 200-640 without needing to change the variable.			
Directorate Response	After discussion involving Aerospace, chai $t_{op-D}$	nges to variable reverte	ed and the $t_{op-D}$ variable will remain as	

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
top-D	to <u>k</u> -D	to <mark>kp</mark> -D

Affected Document(s)	IS-GPS-200;	IS-GPS-705;	DOORS ID	IS	S200-654; IS705-354
Paragraph	200-30.3.3.7.	5; 705-20.3.3.7.5	Comment Numbe	r 5	51
Comment Type	Substantive		Disposition	R	≀eject w/ Comment
Comment Originator(s)	Steven Browr	n (Lockheed Martin)		•	
Comment	Should the U "prediction" to	DRA term also be update align with the t <sub>op-D</sub> vs. t <sub>ok</sub>	d to be referenced to <sub>-D</sub> change?	o the k	Kalman estimation rather than
Directorate Response	This item has remain t <sub>op-D</sub> .	been overcome by event	ts as the t <sub>ok-D</sub> change	e will r	no longer occur and the variable will
BASELINE TEXT (	WAS)	PIRN TEX	T (IS)		PROPOSED TEXT
differential user range accur It must be noted that the two provide estimated accuracy clock and ephemeris DC are UDRA <sub>op-D</sub> and UDRA indices two's complement integers i of +15 to -16 and have the for relationship:	acy for the SV. o parameters after both e applied. The s are signed, n the range ollowing			N/A	

Affected Document(s)	IS-GPS-200; IS-GPS-705; IS-GPS-800	DOORS ID	IS200-552, IS705-241, IS800-159		
Paragraph	200-30.3.3.1.3; 705-20.3.3.1.3; 800-3.5.3	Comment Number	3,24		
Comment Type	Substantive	Disposition	Accept /w Comment		
Comment Originator(s)	Roger Kirpes (Rockwell Collins)				
Comment	Tables do not contain parameter descriptions for $t_{op}$ and $t_{ok-D}$ . Please add the new time tag definitions/description to the Message types and parameters Table for $t_{ok-D}$ and $t_{op-D}$				
Directorate Response	After discussion involving Aerospace, changes to the variable will be reverted and the $t_{op-D}$ variable will remain as $t_{op-D}$ . The tables will be updated to reflect the updated name of the $t_{op}$ variable.				

						Table 30.1 Message Types 10 and 11 Parameters (1 of 2)											
		Table 30-I. Mess			Table 30-I. Messa	age Types 10 and 11 Parameters (1 of 2)				Table 50-1. Messag	ge Types 10 a	nu 11 Falamet	ers (1 01 2)				
	Table 30-I. Message Ty	pes 10 and 11	Parameters	(1 of 2)			Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units		Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
			Scale			WN	Week No.	13	(LSD)	Range	weeks	WN	Week No.	13	1		weeks
	Parameter	No. of Bits**	Factor (LSB)	Effective Range***	Units	URA <sub>ED</sub> Index	ED Accuracy Index	5*			(see text)	URA <sub>ED</sub> Index	ED Accuracy Index	5*			(see text)
WN	Week No.	13	1		weeks	Signal health (L1/L2/L5)		3	1		(see text)	Signal health (L1/L2/L5)		3	1		(see text)
Signal health (L1/L2/L5)	ED Accuracy mdex	3	1		(see text)	t <sub>op</sub>	ICE Data predict projection sequence of week	11	300	0 to 604,500	seconds	t <sub>op</sub>	<u>CEI ICE</u> Data projection sequence time of week	11	300	0 to 604,500	seconds
t <sub>op</sub>	Data predict time of week	11	300	604,500	seconds	ΔΑ ****	Semi-major axis difference at reference time	26*	2.9		meters	ΔΑ ****	Semi-major axis difference at reference time	26*	2-9		meters
ΔA ****	Semi-major axis difference at reference time	26*	2.9		meters	• A	Change rate in semi-major axis	25*	2.21		meters/sec	Å	Change rate in semi-major axis	25*	2-21		meters/sec
Å	Change rate in semi-major axis	25*	2.21		meters/sec	$\Delta n_0$	Mean Motion difference from computed value at	17*	2-44		semi-circles/sec	$\Delta n_0$	Mean Motion difference from computed value at reference time	17*	2-44		semi-circles/sec
$\Delta n_0$	Mean Motion difference from computed value at reference time	17*	2-44		semi-circles/sec	$\Delta \mathbf{n}_0$	reference time Rate of mean motion difference from computed	23*	2.57		semi-circles/sec <sup>2</sup>	$\Delta \hat{n}_0$	Rate of mean motion difference from computed	23*	2-57		semi-circles/sec <sup>2</sup>
$\Delta n_0$	Rate of mean motion difference from computed value	23*	2.57		semi-circles/sec <sup>2</sup>	M <sub>0-n</sub>	value Mean anomaly at reference time	33*	2.32		semi-circles	M <sub>0·n</sub>	Mean anomaly at reference time	33*	2-32		semi-circles
$M_{0 \cdot n}$	Mean anomaly at reference time	33*	2-32		semi-circles	en	Eccentricity	33	2 <sup>-34</sup>	0.0 to 0.03	dimensionless	en	Eccentricity	33	2-34	0.0 to 0.03	dimensionless
en	Eccentricity	33	2.34	0.03	dimensionless	ωn	Argument of perigee	33*	2-32		semi-circles	ω <sub>n</sub>	Argument of perigee	33*	2-32		semi-circles
ω <sub>n</sub>	Argument of perigee	33*	2-32		semi-circles	* Pa	rameters so indicated are two'	s complemen	t, with the sign	bit (+ or -) occup	ying the MSB;	* P	arameters so indicated are two's	s complement	, with the sign	bit (+ or -) occup	ying the MSB;
* Para	* Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB; * See Figure 30-1 for complete bit allocation in Message Type 10; * Unless otherwise indicated in this column, reflective range is the maximum range attainable with indicated bit allocation and scale factor. **** Relative to A <sub>REF</sub> = 26,559,710 meters. **** Relative to A <sub>REF</sub> = 26,559,710 meters.					dicated are two's complement, with the sign bit (+ or -) occupying the MSB;         ge Figure 30-1 for complete bit allocation in Message Type 10;         indicated in this column, effective range is the maximum range attainable with         indicated bit allocation and scale factor.         ***       Relative to A <sub>REF</sub> = 26,559,710 meters.			attainable with								

\*See next chart for enlarged table

A CALLER AND THE AND T

## Proposed Text

Table 30-I.   Message Types 10 and 11 Parameters (1 of 2)								
	Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units			
WN	Week No.	13	1		weeks			
URA <sub>ED</sub> Index	ED Accuracy Index	5*			(see text)			
Signal health (L1/L2/L5)		3	1		(see text)			
t <sub>op</sub>	CEI ICE Data projection sequence time of week	11	300	0 to 604,500	seconds			
ΔΑ ****	Semi-major axis difference at reference time	26*	2-9		meters			
Å	Change rate in semi-major axis	25*	2-21		meters/sec			
$\Delta n_0$	Mean Motion difference from computed value at reference time	17*	2-44		semi-circles/sec			
$\Delta \mathbf{n}_0^{ullet}$	Rate of mean motion difference from computed value	23*	2-57		semi-circles/sec <sup>2</sup>			
M <sub>0-n</sub>	Mean anomaly at reference time	33*	2 <sup>-32</sup>		semi-circles			
en	Eccentricity	33	2-34	0.0 to 0.03	dimensionless			
$\omega_n$	Argument of perigee	33*	2-32		semi-circles			
<ul> <li>Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB;</li> <li>** See Figure 30-1 for complete bit allocation in Message Type 10;</li> </ul>								
*** U	nless otherwise indicated in the	is column, va	lid range is the	maximum range a	attainable with			
	indica **** Relat	tive to $A_{\text{DEE}} =$	$26559710\mathrm{m}$	actor.				
Kelative to $A_{REF} = 26,559,710$ meters.								

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-475, IS200-476				
Paragraph	200-20.3.4.5	Comment Number	25,26				
Comment Type	Substantive	Disposition	Accept w/ Comment				
Comment Originator(s)	Steven Brown (Lockheed Martin)						
Comment	Missing ICE update	Missing ICE update					
Directorate Response	After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)". Update will be made.						

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT			
When the t <sub>oe</sub> , immediately prior to a new	N/A	When the t <sub>oe</sub> , immediately prior to a new CEI			
upload cutover, already reflects a small		data projection sequence upload cutover,			
deviation (i.e. a new upload cutover has		already reflects a small deviation (i.e. a new CE			
occurred in the recent past), then the CS		data projection sequence upload cutover has			
(Block II/IIA/IIR/IIR-M/IIF) and SS (GPS III)		occurred in the recent past), then the CS (Block			
shall introduce an additional deviation to		II/IIA/IIR/IIR-M/IIF) and SS (GPS III) shall			
the $t_{oe}$ when a new upload is cutover for		introduce an additional deviation to the t <sub>oe</sub> when			
transmission.		a new <u>CEI data projection sequence</u> upload is			
		cutover for transmission.			
A change from the broadcast reference		A change from the broadcast reference time			
time immediately prior to cutover is used		immediately prior to cutover is used to indicate			
to indicate a change of values in the data		a change of values in the data set. The user			
set. The user may use the following		may use the following example algorithm to			
example algorithm to detect the		detect the occurrence of a new <u>CEI data</u>			
occurrence of a new upload cutover:		projection sequence <mark>upload</mark> cutover:			
$DEV = t_{oe} [modulo 3600]$		$DEV = t_{oe} [modulo 3600]$			
If $DEV(\neq 0)$ there expressions		If $DEV \neq 0$ , then a new <u>CEI data</u>			
II $D \in V \neq 0$ , then a new upload		projection sequence upload cutover has			
cutover has occurred within past 4		occurred within past 4 hours.			
nours.					
Affected Document(s)	IS-GPS-200		DOORS ID	IS200-1496, IS200-1497, IS200-1498	
--	---	-------------------	--	---	--
Paragraph	200-30.3.4.5		Comment Number	30, 92	
Comment Type	Substantive		Disposition	Accept w/ Comment	
Comment Originator(s)	Steven Brown (Lockheed N	Aartin) and Deni	s Bouvet (Thales)		
Comment	Reference Times section for CNAV in Appendix III should also be updated (equivalent to the LNAV changes Could the ICE data set definition be complemented for CNAV data, as ISC and T <sub>gd</sub> parameters are also nec to use the SV in the positioning service? Or should we consider instead that they are implicitly included in th term of related parameters?				
Directorate Response	After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)". CEI can apply for CNAV as well. It's the equivalent information that is in MICE I, MICE II, and MT 12 in MNAV. Updat be made.				
BASELINE T	EXT (WAS)	PIRN TEXT (IS)		PROPOSED TEXT	
The CS (Block IIR-M/IIF) and SS $t_{oe}$ value, for at least the first data a new upload, is different from that cutover (see paragraph 30.3.4.4). Is cutover for transmission, the CS (GPS III) shall introduce a small d the t <sub>oe</sub> value that is offset from t hours into the fit interval (see T will be transmitted by an SV in the upload cutover and the second da set, may also continue to reflect th When the t <sub>oe</sub> , immediately prior to reflects a small deviation (i.e. a n occurred in the recent past), then SS (GPS III) shall introduce an a when a new upload is cutover the For CNAV data, the user may use algorithm to detect the occurrence DEV = t <sub>oe</sub> [modulo 7200] If DEV $\neq$ 5400, then a new within the past 4 hours.	(GPS III) shall assure that the set transmitted by an SV after at transmitted prior to the As such, when a new upload S (Block IIR-M/IIF) and SS eviation in the $t_{oe}$ resulting in the nominal location of 1.5 Table 30-XIII). This offset $t_{oe}$ e first data set after a new that set, following the first data he same offset in the $t_{oe}$ . a new upload cutover, already ew upload cutover has the CS (Block IIR-M/IIF) and additional deviation to the $t_{oe}$ for transmission.	N/A	The CS (Block IIR-M/IIF) a least the first data set trans <u>sequence upload</u> , is differed paragraph 30.3.4.4). As su is cutover for transmission introduce a small deviation the nominal location of $\sim$ This offset t <sub>oe</sub> will be transi- data projection sequence of first data set, may also cor When the t <sub>oe</sub> , immediately cutover, already reflects a <u>sequence upload</u> cutover H IIR-M/IIF) and SS (GPS III when a new <u>CEI data pro-</u> For CNAV data, the user m occurrence of a new <u>CEI of</u> DEV = t <sub>oe</sub> [modulo If DEV ≠ 5400, the has occurred within * <b>See next chart fo</b>	and SS (GPS III) shall assure that the $t_{oe}$ value, for at smitted by an SV after a new <u>CEI data projection</u> ant from that transmitted prior to the cutover (see uch, when a new <u>CEI data projection sequence upload</u> , the CS (Block IIR-M/IIF) and SS (GPS III) shall n in the $t_{oe}$ resulting in the $t_{oe}$ value that is offset from 1.5 hours into the fit interval (see Table 30-XIII). mitted by an SV in the first data set after a new <u>CEI</u> upload cutover and the second data set, following the ntinue to reflect the same offset in the $t_{oe}$ . prior to a new <u>CEI data projection sequence upload</u> small deviation (i.e. a new <u>CEI data projection</u> has occurred in the recent past), then the CS (Block ) shall introduce an additional deviation to the $t_{oe}$ <u>ojection sequence upload</u> is cutover for transmission. nay use the following example algorithm to detect the <u>data projection sequence upload</u> cutover: 0 7200] en a new <u>CEI data projection sequence upload</u> cutover in the past 4 hours.	



#### Proposed Text IS200-1496, IS200-1497, IS200-1498

The CS (Block IIR-M/IIF) and SS (GPS III) shall assure that the t<sub>oe</sub> value, for at least the first data set transmitted by an SV after a new <u>CEI data projection sequence upload</u>, is different from that transmitted prior to the cutover (see paragraph 30.3.4.4). As such, when a new <u>CEI data projection sequence upload</u> is cutover for transmission, the CS (Block IIR-M/IIF) and SS (GPS III) shall introduce a small deviation in the t<sub>oe</sub> resulting in the t<sub>oe</sub> value that is offset from the nominal location of 1.5 hours into the fit interval (see Table 30-XIII). This offset t<sub>oe</sub> will be transmitted by an SV in the first data set after a new <u>CEI data projection sequence upload</u> cutover and the second data set, following the first data set, may also continue to reflect the same offset in the t<sub>oe</sub>.

When the  $t_{oe}$ , immediately prior to a new <u>CEI data projection sequence upload</u> cutover, already reflects a small deviation (i.e. a new <u>CEI data projection sequence upload</u> cutover has occurred in the recent past), then the CS (Block IIR-M/IIF) and SS (GPS III) shall introduce an additional deviation to the  $t_{oe}$  when a new <u>CEI data projection sequence</u> upload is cutover for transmission.

For CNAV data, the user may use the following example algorithm to detect the occurrence of a new <u>CEI data projection sequence</u> upload cutover:

DEV =  $t_{oe}$  [modulo 7200] If DEV  $\neq$  5400, then a new <u>CEI data projection sequence upload</u> cutover has occurred within the past 4 hours.

Affected Document(s)	IS-GPS-200		DOOR	S ID	IS200-1399, IS705-1477
Paragraph	200-30.3.4.4; 705-20.3.4	.4	Comm	ent Number	32
Comment Type	Substantive		Dispos	sition	Accept w/ Comment
Comment Originator(s)	Steven Brown (Lockheed	l Martin)			
Comment	Text should be updated a	s well to refer	to ICE c	lata projection	sequences vs. uploads.
Directorate Response	After discussion involving Aerospace, acronym was updat Update will be made.			was updated t	o be "Clock/Ephemeris/Integrity (CEI)".
BASELINE T Includes RFC	EXT (WAS) 318 Updates	PIRN TEX	T (IS)		PROPOSED TEXT
Cutovers to new data sets w boundaries except for the fir upload. The first data set m paragraph 20.3.4.1) at any t therefore may be transmitter one hour. The start of the transmission corresponds to the beginnin for the data set. Each data duration of its transmission i also remains valid for the du interval. A data set is rende of its curve fit interval when cutting over to the first data Normal Operations. The me 30-37 data sets are transmit of two hours. The correspon three hours.	vill occur only on hour st data set of a new ay be cut-in (reference ime during the hour and d by the SV for less than interval for each data set g of the curve fit interval set remains valid for the nterval, and nominally tration of its curve fit red invalid before the end it is superseded by the SV set of a new upload. ssage type 10, 11, and ted by the SV for periods nding curve fit interval is	N/A		Cutovers to ne boundaries ex <u>projection seq</u> in (reference p hour and there than one hour The start of th corresponds to the data set. of its transmis valid for the du rendered inva when it is sup data set of a r Normal Opera data sets are hours. The co	ew data sets will occur only on hour cept for the first data set of a new <u>CEI data</u> <u>uence_upload</u> . The first data set may be cut- baragraph 20.3.4.1) at any time during the efore may be transmitted by the SV for less :

Affected Document(s)	IS-GPS-200		DOORS ID		IS200-543
Paragraph	200-30.3.3.1.	1.3	Comment Numbe	er	41
Comment Type	Substantive		Disposition		Accept w/ Comment
Comment Originator(s)	Roger Kirpes	(Rockwell Collins)			
Comment	It is not clear data will be in	that the epoch time of the time past relative to the ti	e state data (t <sub>op</sub> , WN me of broadcast of t	l <sub>op</sub> ) us that d	sed for the projection of the satellite ICE data.
Directorate Response	WN <sub>op</sub> and t <sub>op</sub> the paramete because it is	will be in the past relative r can be used to compute not relevant information fo	e to the time of broad e the age of the data or the receiver.	dcast . This	t of the data; however, this does not mean s information will not be stated in the text
BASELINE TEXT (	(WAS)	S) PIRN TEXT (IS) PROPOSED TEXT			
Bits 55 through 65 of messa shall contain the data predic (t <sub>op</sub> ). The t <sub>op</sub> term provides t of week of the state estimate the prediction of satellite qua ephemeris parameters.	ige type 10 it time of week the epoch time e utilized for asi-Keplerian	Bits 55 through 65 of mea contain the <u>ICE</u> data prece sequence time of week (t provides the epoch time of estimate data utilized for projection of satellite <u>ICE</u> Keplerian ephemeris para cautioned to avoid using compute age of data for a	ssage type 10 shall dict projection top). The top term of week of the state the prediction <u>data</u> quasi- ameters. <u>Users are</u> this parameter to any SV.	Bits & conta time epoc the p Keple cautio comp	55 through 65 of message type 10 shall ain the CEI ICE data projection sequence of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the the time of week of the state data utilized for projection of satellite CEI ICE data quasi- erian ephemeris parameters. Users are ioned to avoid using this parameter to pute age of data for any SV.

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-564		
Paragraph	200-30.3.3.2.1.2	Comment Number	42		
Comment Type	Substantive	Disposition	Accept w/ Comment		
Comment Originator(s)	Roger Kirpes (Rockwell Collins)				
Comment	It is not clear if clock and ephemeris data must have same $t_{op}$ , as well as same $t_{oe}/t_{oc}$ , in order to be utilized as an ICE data set. Clarify that clock and ephemeris data must have same $t_{op}$ , as well as same $t_{oe}/t_{oc}$ , in order to be utilized as an ICE data set.				
Directorate Response	After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)". $t_{oe}$ and $t_{oc}$ should always match for the CEI data set to be valid; that's the primary way to check. $t_{oe}$ and $t_{oc}$ are not required to match with $t_{op}$ . However, for a secondary check that's more or less redundant $t_{op}$ should match in MT10/11 and MT30.				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Bits 39 through 49 of message types 30 through 37 shall contain the data predict time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state estimate utilized for the prediction of SV clock correction coefficients.	Bits 39 through 49 of message types 30 through 37 shall contain the <u>ICE</u> data <u>projection</u> <del>predict</del> time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state <u>data</u> <del>estimate</del> utilized for the prediction of projecting the SV clock correction coefficients <u>forward in time</u> .	Bits 39 through 49 of message types 30 through 37 shall contain the <u>CEI</u> <del>ICE</del> data projection time of week (t <sub>op</sub> ). The t <sub>op</sub> term provides the epoch time of week of the state data utilized for projecting the SV clock correction coefficients forward in time.

Affected Document(s)	IS-GPS-800		DOORS ID	IS-GPS-800 Rev D (IS800-871)			
Paragraph	800-3.5.5.2		Comment Numbe	r 61, 64, 75			
Comment Type	Substantive		Disposition	Accept w/ Comment			
Comment Originator(s)	Rhonda Slatt	ery (Aerospace) and Stev	en Brown (Lockheed	d Martin)			
Comment	This paragraph was also modified by RFC 318. Those changes are not incorporated in your RFC. Sind your RFC is behind in schedule, be careful not to revert to pre-318 language when change is incorporated. Is the last paragraph being deleted from this object or was it intentionally left out of the IS text?						
Directorate Response	Object has be been address "Clock/Epher	Object has been updated to reflect the changes made by RFC 318. All other conflicting objects have been addressed and resolved. After discussion involving Aerospace, acronym was updated to be "Clock/Ephemeris/Integrity (CEI)".					
BASELINE TEXT (V	VAS)	PIRN TEXT	Г (IS)	PROPOSED TEXT			
The following rule governs the tra- tion different data sets: The trans- be different from any value trans- SV during the preceding seven of Cutovers to new data sets will of hour boundaries except for the finew upload. The first data set in the first data set in the first data set in the hour and therefore may be the the SV for less than one hour. The start of the transmission inter- data set corresponds to the beg curve fit interval for the data set. remains valid for the duration of interval, and nominally also rem- duration of its curve fit interval. rendered invalid before the end interval when it is superseded by over to the first data set of a new Normal Operations. The subfran- are transmitted by the SV for pe- hours. The corresponding curve three hours.	ransmission of nsmitted t <sub>oe</sub> will smitted by the days. ccur only on irst data set of a nay be cut-in any time during ransmitted by erval for each inning of the Each data set its transmission ains valid for the A data set is of its curve fit y the SV cutting v upload. ne 2 data sets riods of two e fit interval is	That t <sub>oe</sub> shall be equal to the t data set. The following rules transmission of t <sub>oe</sub> and t <sub>oc</sub> val sets: (1) The transmitted t <sub>oc</sub> val any value transmitted by the preceding seten days; (2) Th be different from any value tr during the preceding six hou Cutovers to new data sets with boundaries except for the first CEI data projection sequence may be cut-in (reference part time during the hour and the transmitted by the SV for less The start of the transmission set corresponds to the begin interval for the data set. Eact valid for the duration of its tra- and nominally also remains v of its curve fit interval. A data invalia before the end of its curve data set of a new CEI data p	t <sub>oc</sub> of the same CNAV a govern the lues in different data will be different from SV during the ne transmitted by the SV rs. illoccur only on hour st data set of a new e. The first data set agraph 3.5.5.1) at any refore may be st han one hour. interval for each data r ning of the curve fit ch data set remains ansmission interval, valid for the duration a set is rendered curve fit interval when tutting over to the first rojection sequence.	The following rule governs the transmission of t <sub>oe</sub> in different data sets: The transmitted t <sub>oe</sub> will be different rom any value transmitted by the SV during the preceding seven days. Cutovers to new data sets will occur only on hour boundaries except for the first data set of a new <u>CEI</u> data projection sequence upload. The first data set may be cut-in (reference paragraph 3.5.5.1) at any ime during the hour and therefore may be transmitted by the SV for less than one hour. The start of the transmission interval for each data set corresponds to the beginning of the curve fit interval or the data set. Each data set remains valid for the duration of its transmission interval, and nominally also emains valid for the duration of its curve fit interval. A data set is rendered invalid before the end of its curve it interval when it is superseded by the SV cutting over to the first data set of a new <u>CEI data projection</u> sequence upload. Normal Operations. The subframe 2 data sets are ransmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.			



#### Proposed Text IS800-871

The following rule governs the transmission of  $t_{oe}$  in different data sets: The transmitted  $t_{oe}$  will be different from any value transmitted by the SV during the preceding seven days.

Cutovers to new data sets will occur only on hour boundaries except for the first data set of a new <u>CEI</u> <u>data projection sequence upload</u>. The first data set may be cut-in (reference paragraph 3.5.5.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

The start of the transmission interval for each data set corresponds to the beginning of the curve fit interval for the data set. Each data set remains valid for the duration of its transmission interval, and nominally also remains valid for the duration of its curve fit interval. A data set is rendered invalid before the end of its curve fit interval when it is superseded by the SV cutting over to the first data set of a new <u>CEI data projection sequence</u> upload.

Normal Operations. The subframe 2 data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.





# 2016 PUBLIC DOCUMENT CLEANUP

B. Charest H. Nguyenhuu



#### RFC-318 2016 Public Document Clean-up

#### **Problem Statement:**

Extraneous, ambiguous, redundant, incorrect, or missing editorial and/or administrative information exists within the descriptive texts, phrases and/or references in the public documents (IS-GPS-200, IS-GPS-705, and IS-GPS-800) identified by the Users.

#### **Proposed Solution:**

Modify public documents to clarify extraneous, ambiguous, redundant, incorrect, or missing editorial and/or administrative information to enhance the public document quality (clear and concise communication) as suggested by Public Interface Control Working Group (ICWG) participants, stakeholders and key members.

Impacted Documents:

(IS-GPS-200, IS-GPS-705, and IS-GPS-800)



## RFC-318 CRM Status

Comment Resolution Matrix (CRM) – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS					
Disposition/Type	Critical	Substantial	Administrative	Totals	Concurrence
Accept	0	4	17	21	13
Accept with Comment	1	13	34	48	29
Reject	0	7	2	9	6
Defer	0	2	2	4	3
Grand Totals:	1	26	55	82	51



RFC-318 2016 Public Document Clean-up

# **Critical Comments (1)**

# **Substantive Comments**

# **Rejected Administrative Comments**

Affected Document(s)	IS-GPS-200		DOORS ID	IS200-1508	
Paragraph	6.2.7 :		Comment Numbe	er 75	
Comment Type	Critical		Disposition	Accept with Comments	
Comment Originator(s)	Steven Browr	n (GPS III/ LM)			
Comment	At the 1 June 2016 RFC-318 TIM, we had agreement to add statements to IS200, IS705, and IS800 to make it clear that it is possible for the system (in this case, a combination of CS and SS) to broadcast data that is outside the "valid range" but it still a value that fits in the available bits/scale factor. In this scenario, the user segment must be the one responsible for detecting the value and marking it invalid. Neither the CS nor the (space segment) SS will have logic to prevent the broadcast of a value outside of the "valid range." There appears to be no statement making this clear, despite the agreement at the 1 June 2016 TIM. Current definition is "Valid Range identifies the range of values used by GPS" but this isn't accurate because it is possible that GPS will broadcast a value that fits in the available bit allocation and scale factor that is outside the "valid range" and users need to know this. Direction provided in a procurement contracting officer letter (PCOL) for the RFC-288 impact assessment is not sufficient visibility to the users nor will it have sufficient longevity.				
Directorate Response	Revise wording to the proposed text.				
BASELINE TEXT	(WAS)	PIRN TEX	T (IS)	PROPOSED TEXT	
From RFC-288: Valid Range identifies the ra used by GPS. The Valid Rai PRNs 1-63.	nge of values nge is only for	(New change – This cha included in the original Pl review)	nge was not RN submitted for	Valid range identifies the range of values <del>used</del> <u>nominally broadcast</u> by GPS. The ¥valid <u>R</u> range <u>s</u> is are only for applicable to PRNs 1- through 63.	



RFC-318 2016 Public Document Clean-up

# **Critical Comments**

# **Substantive Comments (26)**

# **Rejected Administrative Comments**

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-115	
Paragraph	3.3.2.2 P-Code Generation	Comment Number	3	
Comment Type	Substantive	Disposition	Reject	
Comment Originator(s)	Willard Marquis (Lockheed Martin (LMSSC))			
Comment	Text insertion created a run-on sentence.			
Directorate Response	Understand the concern. However, the change requestor has withdrawn his comments. This proposed change is now Overcome by Events (OBE); therefore, the comment is no longer applicable and rejected. Remove the proposed changes.			

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
The X2A and X2B epochs are made to	The X2A and X2B epochs are made to	The X2A and X2B epochs are made to precess
precess with respect to the X1A and X1B	precess with respect to the X1A and X1B	with respect to the X1A and X1B epochs by
epochs by causing the X2 period to be 37	epochs by causing the X2 period to be 37	causing the X2 period to be 37 chips longer
chips longer than the X1 period. When the	chips longer than the X1 period. The When	than the X1 period. The 37 chip delay is done
X2A is in the last state of its 3750th cycle	37 chip delay is done by the X2A and X2B	by the X2A and X2B clock control functions. The
and X2B is in the last state of its 3749th	clock control functions. The X2A will halt the	X2A will halt the X2A shift register when it
cycle, their transitions to their respective	X2A shift register when it detects the 3750th	detects the 3750th X2A epoch. As with the X1B
initial states are delayed by 37 chip time	X2A epoch. Just like the X1B clock control	clock control function, the X2B clock control
durations.	function, the X2B clock control function	function holds the X2B register upon detection
	holds the X2B register upon detection of	of final state (chip 4093) of its 3749th cycle. or
	final state (chip 4093) of its 3749th cycle or	The X2B clock control also holds the register
	when the X2A is in the last state of its	when the X2A is in the last state of its 3750th
	3750th cycle and X2B is in the last state of	cycle and X2B is in the last state of its 3749th
	its 3749th cycle, their transitions to their	cycle,. Their transitions to their respective initial
	respective initial states are delayed by 37	states are delayed by 37 chip time durations.
	chip time durations.	
		(Note: This proposed change will not be
		implemented since the change requestor has
		withdrawn his comments. Text remains As Is in
		the baseline.)

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-115			
Paragraph	3.3.2.2 P-Code Generation	Comment Number	6			
Comment Type	Substantive	Disposition	Reject			
Comment Originator(s)	Mark E Dahle-Melsaether (Lockheed Martin (LMSSC))					
Comment	The "holding" of the process is measured in cycles not epochs. I believe the sentence should state "3750th cycle" and not "3750th epoch". 3750 epochs is ~94 mins. These registers get reset to initial conditions every X1 epoch (1.5 sec). Also, add "clock control function" to the second sentence to maintain consistency.					
Directorate Response	Understand the concern. However, the change requestor has withdrawn his comments. This proposed change is now Overcome by Events (OBE); therefore, the comment is no longer applicable and rejected. Remove the proposed changes.					

BASELINE TEXT (WAS)The X2A and X2B epochs are made to precess with respect to the X1A and X1B epochs by causing the X2 period to be 37 epoch chips longer than the X1 period. When the chip	PIRN TEXT (IS) ne X2A and X2B epochs are made to ecess with respect to the X1A and X1B pochs by causing the X2 period to be 37	<b>PROPOSED TEXT</b> The X2A and X2B epochs are made to precess with respect to the X1A and X1B epochs by
The X2A and X2B epochs are made to The precess with respect to the X1A and X1B precepochs by causing the X2 period to be 37 epochips longer than the X1 period. When the chip	ne X2A and X2B epochs are made to ecess with respect to the X1A and X1B bochs by causing the X2 period to be 37	The X2A and X2B epochs are made to precess with respect to the X1A and X1B epochs by
X2A is in the last state of its 3750th cycle and X2B is in the last state of its 3749th cycle, their transitions to their respective initial states are delayed by 37 chip time durations.	ips longer than the X1 period. The When Chip delay is done by the X2A and X2B ock control functions. The X2A will halt the A shift register when it detects the 3750th A epoch. Just like the X1B clock control inction, the X2B clock control function olds the X2B register upon detection of al state (chip 4093) of its 3749th cycle or nen the X2A is in the last state of its 750th cycle and X2B is in the last state of 3749th cycle, their transitions to their	causing the X2 period to be 37 chips longer than the X1 period. The 37 chip delay is done by the X2A and X2B clock control functions. The X2A clock control function will halt the X2A shift register when it detects the 3750th X2A epoch cycle (Note: This proposed change will not be implemented since the change requestor has withdrawn his comments. Text remains As Is in the baseline).

Affected Document(s)	IS-GPS-200		DOORS ID	IS200-108, IS200-115
Paragraph	3.3.2.2 P-Coo	de Generation	Comment Number	8
Comment Type	Substantive		Disposition	Reject
Comment Originator(s)	Jeff Harvey (I	Harris)		
Comment	Just wanted t adequate?	o ask the questionwhy o	does this text need to cl	nange after over 20 years of being
Directorate Response	Concur. In fac Overcome by proposed cha	ct, the change originator h Events (OBE); therefore inges.	nas withdrawn his comn , the comment is no lon	nents. This proposed change is now ger applicable and rejected. Remove the
BASELINE TEXT (	WAS)	PIRN T	EXT (IS)	PROPOSED TEXT
X1A cycles (15,345,000 chips) integer number of X1B cycles. accommodate this situation, th register is held in the final state its 3749th cycle. It remains in the X1A shift register complete cycle (343 additional chips). T of the 3750th X1A cycle establ X1 epoch which re-initializes b X1B shift registers starting a ne <b>115:</b> The X2A and X2B epochs precess with respect to the X12 epochs by causing the X2 period X2A is in the last state of its 37 X2B is in the last state of its 37 transitions to their respective ir delayed by 37 chip time duration	which is not an To e X1B shift e (chip 4093) of this state until is its 3750th he completion ishes the next oth the X1A and ew X1 cycle. s are made to A and X1B od to be 37 d. When the '50th cycle and '49th cycle, their nitial states are ons.	(15,345,000 chips) which is X1B cycles. To accommod shift clock register control is register in the final state (ch It remains in this state until completes its 3750th cycle completion of the 3750th X X1 epoch which re-initialize registers starting a new X1 <b>115:</b> The X2A and X2B epo with respect to the X1A and X2 period to be 37 chips lor When 37 chip delay is done control functions. The X2A when it detects the 3750th clock control function, the X holds the X2B register upor 4093) of its 3749th cycle or state of its 3750th cycle and 3749th cycle, their transition states are delayed by 37 ch	ed as the 3750 X IA Cycle a not an integer number of late this situation, the X1E <u>s function held holds the s</u> hip 4093) of its 3749th cyc the X1A shift register (343 additional chips). The 1A cycle establishes the r is both the X1A and X1B cycle. The South the X2A and X2B clo will halt the X2A and X2B clo will halt the X2A shift register (X2A epoch. Just like the X2A cycle. The South the So	<ul> <li>N/A</li> <li><u>hift</u> (Note: This proposed change will not be implemented since the change requestor has withdrawn his comments. Text remains As Is in the baseline).</li> <li>the he ck ster (1B) st f its I</li> </ul>



#### PIRN Text IS200-108, 115

**108:** The X1 period is defined as the 3750 X1A cycles (15,345,000 chips) which is not an integer number of X1B cycles. To accommodate this situation, the X1B shift clock register control is function held holds the shift register in the final state (chip 4093) of its 3749th cycle. It remains in this state until the X1A shift register completes its 3750th cycle (343 additional chips). The completion of the 3750th X1A cycle establishes the next X1 epoch which re-initializes both the X1A and X1B shift registers starting a new X1 cycle.

**115:** The X2A and X2B epochs are made to precess with respect to the X1A and X1B epochs by causing the X2 period to be 37 chips longer than the X1 period. The When 37 chip delay is done by the X2A and X2B clock control functions. The X2A will halt the X2A shift register when it detects the 3750th X2A epoch. Just like the X1B clock control function, the X2B clock control function holds the X2B register upon detection of final state (chip 4093) of its 3749th cycle or when the X2A is in the last state of its 3750th cycle and X2B is in the last state of its 3749th cycle, their transitions to their respective initial states are delayed by 37 chip time durations.

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-97			
Paragraph	3.3.2.1 Code Structure	Comment Number	10			
Comment Type	Substantive	Disposition	Accept with Comments			
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)					
Comment	While the WAS text has both superscripts and subscripts, they seem to have been converted to regular text in the IS section. For example, P sub i becomes Pi. Since the only substantive change appears to be changing from a minus sign to a plus sign, I assume these are inadvertent. It does significantly change the meaning of the formula with 1.023e7^-1. Also, there is still a minus sign in the first paragraph, should that also be a plus?					
Directorate Response	Subscripts and superscripts are in fact correctly shown in DOORS. The Diff function to generate red-lines from DOORS doesn't differentiate the subscripts and superscripts in the PIRNs. Review and Second peer review to ensure all subscripts and superscripts are corrected in the final documents. The (+) is correct. Section 3.3.2.1, Code Structure, bottom of page 19, the two formulas should be consistent. Change formula #1 from using "(t-T)" to read: Pi(t) = Pi-37(t+T) where T will equal 24 hours.					

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
For PRN codes 1 through 37, the $P_i(t)$ pattern (P-code) is	For PRN codes 1 through 37, the P <sub>i</sub> (t) pattern (P-code) is generated	N/A
generated by the modulo-2 summation of two PRN codes,	by the modulo-2 summation of two PRN codes, X1(t) and X2(t - iT),	
X1(t) and X2(t - iT), where T is the period of one P-code chip	where T is the period of one P-code chip and equals (1.023E7) <sup>-1</sup>	
and equals (1.023E7) <sup>-1</sup> seconds, while i is an integer from 1	seconds, while i is an integer from 1 through 37. This allows the	
through 37. This allows the generation of 37 unique P(t) code	generation of 37 unique P(t) code phases (identified in Table 3-Ia)	
phases (identified in Table 3-Ia) using the same basic code	using the same basic code generator.	
generator.		
	Expanded P-code PRN sequences, $P_i(t)$ where 38 ≤ i ≤ 63, are	
Expanded P-code PRN sequences, $P_i(t)$ where 38 ≤ i ≤ 63, are described as follows:	described as follows:	
	P <sub>i</sub> (t) = P <sub>i-37</sub> (t -+ T) where T will equal 24 hours)	
P <sub>i</sub> (t) = P <sub>i-37</sub> (t - T) where T will equal 24 hours)		
	therefore, the equation is	
therefore, the equation is		
	$P_{i}(t) = P_{i-37x}(t + i * 24 \text{ hours}),$	
P <sub>i</sub> (t) = P <sub>i-37x</sub> (t + i * 24 hours),		
	where i is an integer from 64 to 210, x is an integer portion of (i-1)/37.	
where i is an integer from 64 to 210, x is an integer portion of (i-1)/37.		



#### PIRN Text IS200-97

For PRN codes 1 through 37, the  $P_i(t)$  pattern (P-code) is generated by the modulo-2 summation of two PRN codes, X1(t) and X2(t - iT), where T is the period of one P-code chip and equals  $(1.023E7)^{-1}$  seconds, while i is an integer from 1 through 37. This allows the generation of 37 unique P(t) code phases (identified in Table 3-Ia) using the same basic code generator.

Expanded P-code PRN sequences,  $P_i(t)$  where  $38 \le i \le 63$ , are described as follows:

 $P_i(t) = P_{i-37}(t - t T)$  where T will equal 24 hours)

therefore, the equation is

 $P_i(t) = P_{i-37x}(t + i * 24 \text{ hours}),$ 

where i is an integer from 64 to 210, x is an integer portion of (i-1)/37.

Affected Document(s)	N/A	DOORS ID	N/A				
Paragraph	N/A	Comment Number	11				
Comment Type	Substantive	Disposition	Accept with Comments				
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)						
Comment	Since DOORS IDs are not published in the publicly releasable document, I thought these PIRNs used the paragraph and page numbering or complete redlines for public review?? This is very difficult to review in context. Also, the Word delivery has internal comments in the file from SE&I personnel, which are inappropriate in an official review copy.						
Directorate Response	Discussed with SE&I DOORS team about the limitation/concern. SE&I is looking into the way to generate PIRN/IRN with DOORS Ids and actual section/paragraph numbers to facilitate the PIRN/IRN review.						

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

Affected Document(s)	IS-GPS-200; IS-GPS-705	DOORS ID	IS200-338, IS705-332				
Paragraph	20.3.3.3.3.0-2 (IS200-338) 20.3.3.6.0-2 (IS705-332)	Comment Number	12				
Comment Type	Substantive	Disposition	Accept with Comments				
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)						
Comment	Not sure how this works, but RFC 288 changed the title of the column to valid range. This RFC should show the title as valid range in the WAS (or effective range in both, if expected to be approved before 288).						
Directorate Response	RFC-288 was approved 7/29/2016. We actually used the wording in RFC-288 as the "WAS". Since RFC-288 has been approved, it would be easier and clearer when we work on the IRN. Note: 20.3.3.3.3.0-2 (IS200-338) proposed change is OBE since the definition of "Valid Range" is covered in IS200-1505 (See Comment No. 52 for more details) Both RFC-288 and RFC-318 change the following DOORS IDs (tables) IS-GPS-200 Table: 338 IS-GPS-705 Tables:313, 332 Use RFC-288 wording as "WAS" for RFC-318						

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

Affected Document(s)	IS-GPS-200	DOORS ID	Applies to all tables				
Paragraph	<i>all tables</i> 20.3.3.3.3.0-2 (IS200-338- Table 20- I) is shown as an example	Comment Number	13				
Comment Type	Substantive	Disposition	Accept with Comments				
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)						
Comment	There are a large number of times where the valid range is given only as the max from RFC 288. Why is Table 20-I the only one being modified here?? Some examples are Tables 20-III, 20-VI, etc.						
Directorate Response	We were only modifying the first table (20-I) to include additional information in the notes below, but RFC 288 created a new section containing this information, so we are going to remove the proposed change from RFC 318. Additionally, all of the valid range values have been corrected in RFC 288. Note: 20.3.3.3.3.0-2 (IS200-338) proposed change is OBE since the definition of "Valid Range" is covered in IS200-1505 (See Comment No. 52 for more details)						

	BAS	SELINE	TEX	Г (WAS)			PIRN	TEXT	(IS)		PROPOSED TEXT
As	shown in	IRN- IS	6-200H	1-003 (R	FC-288)	As shown in A footnote w	PIRN-I /as add	IS-200 ed	H-005 (	RFC-318).	OBE – Removed the proposed changes.
IS :	Parameter	Table 20-I. No. of Bits**	Subfram e 1 Scale Factor (LSB)	Parameters Valid Range***	Units	Parameter	Table 20-I. No. of Bits**	Subframe 1 Scale Factor (LSB)	Parameters Valid Range***	Units	
	T at airets Code on L2 Week No. L2 P data flag SV accuracy SV health Top IODC toc ag ag	2 10 1 4 6 8* 10 16 8* 16*	(1.55) 1 1 1 1 2 <sup>-31</sup> 2 <sup>-4</sup> 2 <sup>-45</sup> 2 <sup>-46</sup>	0 to 604,784	(see text) week discrete (see text) discretes seconds (see text) seconds sec'sec <sup>2</sup> sec'sec	Code on L2 Week No. L2 P data flag SV accuracy SV health Top IODC toc ag ag	2 10 1 4 6 8* 10 16 8* 16*	(202) 1 1 1 2 <sup>31</sup> 2 <sup>4</sup> 2 <sup>45</sup> 2 <sup>48</sup>	0 to 604,784	discretes week discrete (see text) discretes seconds (see text) seconds sec/sec <sup>2</sup> sec/sec	
	ag Parameters so ind ** Unless otherwise ind	22* licated shall be two's See Figure 20-1 f dicated in this colum bit a	2 <sup>-51</sup> s complement, with for complete bit al nn, valid range is ti allocation and scal	h the sign bit (+ or -) oc location in subframe; he maximum range atta e factor.	seconds cupying the MSB; nable withindicated	an * Parameters so in *** Unless otherwise in bit allocation and sc circumstance	22* dicated shall be two's See Figure 20-1 f adicated in this colum la factor. I dentifies t is, invalid values may	2 <sup>-31</sup> s complement, with for complete bit all an, valid range is th the ordinary range y be broadcast. The	the sign bit (+ or -) o ocation in subframe; te maximum range att of values broadcast by valid ranges are only	seconds ccupying the MSB; imable with indicated GPS. In extraordinary for PRNs 1-63.	

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#### PIRN Text (IS) All Tables

	Table 20-I.	Subframe 1	Parameters						
Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units					
Code on L2	2	1		discretes					
Week No.	10	1		week					
L2 P data flag	1	1		discrete					
SV accuracy	4			(see text)					
SV health	6	1		discretes					
T <sub>GD</sub>	8*	2-31		seconds					
IODC	10			(see text)					
toc	16	24	0 to 604,784	seconds					
an	8*	2-55		sec/sec <sup>2</sup>					
afl	16*	2-43		sec/sec					
af0	22*	2 <sup>-31</sup>		seconds					
* Parameters so indic	* Parameters so indicated shall be two's complement, with the sign bit (+ or -) occupying the MSB;								
**	** See Figure 20-1 for complete bit allocation in subframe;								
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor. Identifies the ordinary range of values broadcast by GPS. In extraordinary circumstances, invalid values may be broadcast. The valid ranges are only for PRNs 1-63.									

**OBE** 96

Affected Document(s)	IS-GPS-705	DOORS ID	IS705-332					
Paragraph	20.3.3.6.2.0-2	Comment Number	15					
Comment Type	Substantive	Disposition	Accept with Comments					
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)							
Comment	After making the change to the range to read 0 to 604 in 200-338, you didn't make the change here? Be consistent.							
Directorate Response	The change was incorrectly put into DOORS. The correct change has now been updated in DOORS to say 0 to 604,784 (Valid Range). Given that RFC-288 has been CCB approved, we should be using those changes as our "WAS." The PIRN will be updated to reflect this change.							

BASELINE TEXT (WAS)					PIRN TEXT (IS)						PROPOSED TEXT	
As sl	hown in IRN-IS	-705	D-00	02 (RFC	C-288)							N/A
	Table 20-IX	UTC Para	ameters				Table 20-	IX. UTC Par	ameters			
Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units	Parameter	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units	
A <sub>0-n</sub>	Bias coefficient of GPS time scale relative to UTC time scale	16*	2-35		Seconds	A <sub>0-n</sub>	Bias coefficient of GPS time scale relative to UTC time scale	16*	2-35	range	Seconds	
A <sub>1-n</sub>	Drift coefficient of GPS time scale relative to UTC time scale	13*	2-51		sec/sec	A <sub>1-n</sub>	Drift coefficient of GPS time scale relative to UTC time scale	13*	2-51		sec/sec	
A <sub>2-n</sub>	Drift rate correction coefficient of GPS time scale relative of UTC time scale	7*	2-68		sec/sec <sup>2</sup>	A2-n	Drift rate correction coefficient of GPS time scale relative of UTC time scale	7*	2-68		sec/sec <sup>2</sup>	
ΔtLS	Current or past leap second count	8*	1		seconds	ΔtLs	Current or past leap second count	8*	1		seconds	
tot	Time data reference Time of Week	16	24	0 to 604,784	seconds	tot	Time data reference Time of Week	16	24	0 to 604,784	seconds	
WNet	Time data reference Week Number	13	1		weeks	WNet	Time data reference Week Number	13	1		weeks	
WNLSF	Leap second reference Week Number	8	1		weeks	WNLSF	Leap second reference Week	<mark>\$ 1</mark> 3	1		weeks	
DN	Leap second reference Day Number	4	1	1 to 7	days	DN	Lean second reference Day Number	4	1	1 to 7	days	
ΔtLSF	Current or future leap second count	8*	1		seconds	ΔtLSF	Current or future leap second count	8*	1		seconds	
* Pa ** Se *** Ui bi	rameters so indicated shall be two's compl F Figure 20-6 for complete bit allocation nless otherwise indicated in this column, v t allocation and scale factor.	ement with valid range	the sign bit (+	or -) occupying th	MSB;	* P4 ** S4 *** U; al	rameters so indicated shall be two's com te Figure 20-6 for complete bit allocation aless otherwise indicated in this column, location and scale factor;	pplement with 1 valid range is	the sign bit (+ or	r -) occupying th nge attainable w	e MSB; vith indicated bit	



### PIRN Text (IS) IS705-332

	Table 20-IX. UTC Parameters									
Parameter	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	TInite					
		16*	2-35	Teange	Sacarda					
A0-n	relative to UTC time scale	10*	2		Seconds					
A <sub>1-n</sub>	Drift coefficient of GPS time scale relative to UTC time scale	13*	2-51		sec/sec					
A <sub>2-n</sub>	Drift rate correction coefficient of GPS time scale relative of UTC time scale	7*	2-68		sec/sec <sup>2</sup>					
ΔtLS	Current or past leap second count	8*	1		seconds					
t <sub>ot</sub>	Time data reference Time of Week	16	24	0 to 604,784	seconds					
WNot	Time data reference Week Number	13	1		weeks					
WNLSF	Leap second reference Week Number	<mark>8</mark> 13	1		weeks					
DN	Leap second reference Day Number	4	1	1 to 7	days					
ΔtLSF	Current or future leap second count	8*	1		seconds					
* Pai ** See *** Un alle	rameters so indicated shall be two's com e Figure 20-6 for complete bit allocation less otherwise indicated in this column, ocation and scale factor;	nplement with n valid range is	the sign bit (+ or s the maximum ran	-) occupying th nge attainable w	e MSB; ith indicated bit					

Affected Document(s)	IS-GPS-800	DOORS ID	IS800-159					
Paragraph	3.5.3.0-7	Comment Number	16					
Comment Type	Substantive	Disposition Accept with Comments						
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)							
Comment	Why is only toe shown as 0 to And	not all time of weeks?						
Directorate Response	The change was incorrectly put into DOORS. The correct change has now been updated in DOORS and the values in question are now a range, rather than a single value. (Also reviewed proposed changes to other tables in IS-GPS-800, section 3.5-1, 3.5-3, 3.5-4, 3.5-5, 3.5-6, 3.5-7, 3.5-8)							

BASELINE TEXT (WAS)						PIRN TEXT (IS)						PROPOSED TEXT		
												N/A		
	Table 3.5-1. Subt	frame 2 Param	eters (1 of 3	5)			Table 3.5-1. Subf	rame 2 Param	eters (1 of	3)				
WN	Parameter Week No.	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units		Parameter	No. of Bits**	Scale Factor (LSB)	Efffective Range Valid	Units			
ITOW	Internal time of week			02	(real terrt)	WN	Week No	13	1	Range***	weeks			
	Interval time of week	°	200	63	(see text)	WIN I	Week IVO.	15	1	0.1.02	WEEKS			
Lop	Data predict time of week	11	500	604,500	seconds	now	Interval time of week	8		<u>0 to</u> 83	(see text)			
L1C health		1			(see text)	top	Data predict time of week	11	300	<u>0 to</u> 604,500	seconds			
URAED Index	ED accuracy index	5*			(see text)	L1C health		1			(see text)			
toe	Ephemeris/clock data	11	300	604,500	seconds	$\mathrm{URA}_{\mathrm{ED}}\mathrm{Index}$	ED accuracy index	5*			(see text)			
ΔA ****	Semi-major axis difference at	26*	2-9		meters	toe	Ephemeris/clock data reference time of week	11	300	<u>0 to</u> 604,500	seconds			
Å	Change rate in semi-major axis	25*	2-21		meters/sec	ΔA ****	Semi-major axis difference at reference time	26*	2-9		meters			
$\Delta n_0$	Mean Motion difference from computed value at reference time	17*	2-44		semi-circles/sec	Å	Change rate in semi-major axis	25*	2-21		meters/sec			
$\Delta \mathbf{n}_0$	Rate of mean motion difference from computed	23*	2-57		semi-circles/sec <sup>2</sup>	Δno	Mean Motion difference from computed value at reference time	17*	2-44		semi-circles/sec			
M <sub>0-n</sub>	value Mean anomaly at reference time	33*	2-32		semi-circles	Δno	Rate of mean motion difference from computed value	23*	2-57		semi- circles/sec <sup>2</sup>			
en	Eccentricity	33	2-34		dimensionless	M <sub>0-n</sub>	Mean anomaly at reference time	33*	2-32		semi-circles			
ωn	Argument of perigee	33*	2-32		semi-circles	en	Eccentricity	33	2-34	0.0 to 0.03				
* Param ** See Fi *** Unless	eters so indicated are in two's comp gure 3.5-1 for complete bit allocatic otherwise indicated in this column	plement notatio on in Subframe , effective rang	n; 2; te is the may	kimum range	attainable with	ωπ	ωn     Argument of perigee     33*     2 <sup>-32</sup> dimensionless       ωn     semi-circles				dimensionless semi-circles			
<ul> <li>Unless otherwise indicated in this column, effective range is the maximum range attainable with indicated bit allocation and scale factor.</li> <li>Relative to AREF = 26,559,710 meters.</li> </ul>						<ul> <li>Parameters so indicated are in two's complement notation;</li> <li>See Figure 3.5-1 for complete bit allocation in Subframe 2;</li> <li>Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.</li> <li>Relative to AREF = 26,559,710 meters.</li> </ul>					able with			

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### PIRN Text (IS) IS800-159

Table 3.5-1. Subframe 2 Parameters (1 of 3)								
	Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range Valid Range***	Units			
WN	Week No.	13	1		weeks			
ITOW	Interval time of week	8		<u>0 to</u> 83	(see text)			
top	Data predict time of week	11	300	<u>0 to</u> 604,500	seconds			
L1C health		1			(see text)			
URA <sub>ED</sub> Index	ED accuracy index	5*			(see text)			
toe	Ephemeris/clock data reference time of week	11	300	<u>0 to</u> 604,500	seconds			
ΔA ****	Semi-major axis difference at reference time	26*	2 <sup>-9</sup>		meters			
Å	Change rate in semi-major axis	25*	2-21		meters/sec			
$\Delta n_0$	Mean Motion difference from computed value at reference time	17*	2 <sup>-44</sup>		semi-circles/sec			
$\Delta n_0$	Rate of mean motion difference from computed value	23*	2-57		semi- circles/sec <sup>2</sup>			
M <sub>0-n</sub>	Mean anomaly at reference time	33*	2-32		semi-circles			
en	Eccentricity	33	2 <sup>-34</sup>	<u>0.0 to 0.03</u>	dimensionless			
ωn	Argument of perigee	33*	2-32		semi-circles			
* Paramete ** See Figu *** Unless of indicated **** Relative	ers so indicated are in two's comp ers 3.5-1 for complete bit allocatio therwise indicated in this column, d bit allocation and scale factor. to AREF = 26,559,710 meters.	lement notation n in Subframe valid range is	n; 2; the maxim	um range attaina	able with			

Affected Document(s)	IS-GPS-800	DOORS ID	IS800-159, IS800-160, IS800-161, IS800- 224, IS800-236, IS800-241, IS800-260, IS800-263, IS800-280					
Paragraph	N/A	<b>Comment Number</b>	17					
Comment Type	Substantive	Disposition	Accept with Comments					
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)							
Comment	Do these changes do not match the final agreed to RFC 288 changes? They do not match the PIRN and the (interface revision notice) IRN has not yet been published for comparison. If the 0-604 change is in the IRN for just one variable, the way you have it here, we should fix all the others in this RFC.							
Directorate Response	All of the changes to the 800 document were removed from 288 and are being addressed here in 318. RFC 288 did not modify the 800 document, but all occurrences of the "0 to 604,500" have been fixed in this RFC.							

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

Affected Document(s)	IS-GPS-800	DOORS ID	IS800-241							
Paragraph	3.5.4.2.3.0-2	Comment Number	18							
Comment Type	Substantive	Disposition	Defer							
Comment Originator(s)	Dr. Rhonda Slattery (Aerospace)									
Comment	Why are the given ranges on PM_X, etc removed? The goal of RFC 288 and this part of 318 should be to add clarification, not remove it.									
Directorate Response	The given ranges were removed (CCB approved 7/29/2016). Und parameters, that is more constrait technical change to the content of this RFC. Recommend to leave to 288, submit a concern in eGPS to	to be consistent with erstand the concern ned than the full ran f the document that the proposed chang o address the issue,	n the similar changes in RFC-288 that there IS a valid range for these oge that RFC 288 implies. This is a exceeds the administrative scope of e "As Is" to be consistent with RFC- and address in a separate RFC.							

	BASELI	NE	ТΕХ	KT (W	AS)			PIRN		PROPOSED TEXT								
	Table 3.5-5. Ear	th Orienta	tion Parame	ters				Table 3.5-5. Ear	th Orienta	tion Parame	ters			N/A				
	Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units		Parameter		Parameter		Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range Effective Range***	Units		
tEOP	EOP Data Reference Time	16	24	604,784	seconds	t	EOP	EOP Data Reference Time	16	24	<u>0 to</u> 604,784	seconds						
PM_X <sup>↑</sup>	X-Axis Polar Motion Value at Reference Time.	21*	2-20	1	arc-seconds	F	PM_X <sup>†</sup>	X-Axis Polar Motion Value at Reference Time.	21*	2-20	4	arc-seconds						
PM_X	X-Axis Polar Motion Drift at Reference Time.	15*	2-21	7.8125 x 10 <sup>-3</sup>	arc-seconds/day	F	PM_X	X-Axis Polar Motion Drift at Reference Time.	15*	2-21	<del>7.8125 x 10<sup>-3</sup></del>	arc-seconds/day						
PM_Y <sup>††</sup>	Y-Axis Polar Motion Value at Reference Time.	21*	2-20	1	arc-seconds	F	PM_Y <sup>††</sup>	Y-Axis Polar Motion Value at Reference Time.	21*	2-20	1	arc-seconds						
PM_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2-21	7.8125 x 10 <sup>-3</sup>	arc-seconds/day	F	PM_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2-21	7.8125 x 10 <sup>-3</sup>	arc-seconds/day						
AUT1	UT1-UTC Difference at Reference Time.	31*	2-24	64	seconds	4	∆UT1 <sup>III</sup>	UT1-UTC Difference at Reference Time.	31*	2-24	<del>6</del> 4	seconds						
ΔUT1 ***	Rate of UT1-UTC Difference at Reference Time	19*	2-25	7.8125 x 10 <sup>-3</sup>	seconds/day	2	∆UT1 <sup>†††</sup>	Rate of UT1-UTC Difference at Reference Time	19*	2-25	7.8125 x 10 <sup>-3</sup>	seconds/day						
<ul> <li>Parameter:</li> <li>See Figure</li> <li>Unless ofhindicated</li> <li>Representisemi-mino</li> <li>Representisemi-mino</li> <li>Representisemi-mino</li> <li>With zona</li> </ul>	so indicated are in two's comple 3.5.3 for complete bit allocation erwise indicated in this column, e is it allocation and scale factor. the predicted angular displaceme r axis of the reference ellipsoid al the predicted angular displaceme r axis of the reference ellipsoid or 1 tides restored.	ment notat in subfram ffective ra nt of insta ong Green nt of insta a line dir	ion; ae 3, page 2; age is the m ntaneous Ce wich meridi ntaneous Ce ected 90° w	aximum range atta elestial Ephemeris I an. elestial Ephemeris I est of Greenwich n	inable with Pole with respect to Pole with respect to seridian.	Parameters so indicated are in two's complement notation;     See Figure 3.5 for complete bit allocation in subframe 3, page 2;     With Unless otherwise indicated in this column, effective range is the maximum range attainable with     indicated bit allocation and scale factor.     Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to     semi-minor axis of the reference ellipsoid along Greenwich meridian.     Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to     semi-minor axis of the reference ellipsoid on a line directed 90° west of Greenwich meridian.     With zonal tides restored.												

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### PIRN Text (IS) IS800-241

	Table 3.5-5. Earth Orientation Parameters								
	I	Parameter	No. of Bits**	Scale Factor (LSB)	<u>Valid Range</u> Effective Range***	Units			
teop		EOP Data Reference Time	16	24	<u>0 to</u> 604,784	seconds			
PM_X <sup>↑</sup>		X-Axis Polar Motion Value at Reference Time.	21*	2-20	1	arc-seconds			
PM_X	• 4_X X-Axis Polar Motion Dri Reference Time.			2-21	7.8125 x 10 <sup>-3</sup>	arc-seconds/day			
PM_Y <sup>††</sup>	Y-Axis Polar Motion V at Reference Time.		21*	2 <sup>-20</sup>	4	arc-seconds			
PM_Y		Y-Axis Polar Motion Drift at Reference Time.	15*	2-21	<del>7.8125 x 10<sup>-3</sup></del>	arc-seconds/day			
∆UT1 <sup>III</sup>		UT1-UTC Difference at Reference Time.	31*	2-24	<del>6</del> 4	seconds			
∆UT1 ™		Rate of UT1-UTC Difference at Reference Time	19*	2-25	7 <u>.8125 x 10<sup>-3</sup></u>	seconds/day			
* Para ** See *** Unl- indi † Rep sem † Rep sem	<ul> <li>Parameters so indicated are in two's complement notation;</li> <li>** See Figure 3.5-3 for complete bit allocation in subframe 3, page 2;</li> <li>*** Unless otherwise indicated in this column, effective range is the maximum range attainable with indicated bit allocation and scale factor.</li> <li>† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.</li> <li>† Represents the predicted angular displacement of instantaneous Celestial Ephemeris Pole with respect to semi-minor axis of the reference ellipsoid along Greenwich meridian.</li> </ul>								
ttt Wit	h zonal ti	des restored.							

Affected Document(s)	IS-GPS-200	DOORS ID						IS200-1286
Paragraph	3.2.1.5.1.0-4				Com	Numbe	<b>er</b> 20	
Comment Type	Substantive				Disp	ositior	า	Accept with Comments
Comment Originator(s)	Bruce Chares	st (GPSV	V/EN)					
Comment	The "was" tak	ole is ide	ntical to	the "is"	table.			
Directorate Response	Understand th Table 3-1b, E SV-82's P-coo SV-85's P-coo	ne fonts xpanded de Relati de Relati	were sn I Code F ve Adva ve Adva	nall and Phase As ance fror ance fror	nard to signm n P13( n P16(	Howeve P13(t+ o P16(	rer, please note: +24) (t+24)	
BASELINE TEXT (WAS) PIRN TEXT (IS)						PROPOSED TEXT		
Table 2 Ib. Encoded Code Diseas Assistances (III and	undere annuelt blander, ander V							N/A
SV         Orss         Code Flast Selection         P-code           ID         Final Belay         Setting         Delay         Advance           No.         No.         (Chips)         (Octal)*         (Chips)         (Advance           70         38         67         0017         1         P1(t=24)           71         39         103         0541         2         P2(t=24)           72         40         91         1714         3         P3(t=24)           74         42         679         1651         5         P3(t=24)           76         44         625         0103         6         R4(t=24)           76         44         625         0543         7         P4(t=24)           78         46         638         1065         9         P4(t=24)           78         46         638         1065         9         P4(t=24)           78         46         638         1065         9         P4(t=24)           80         48         1001         1365         11         P1(t=24)           81         49         554         1541         12         P1(t=24) <th>Inst.         Prist.           10 Chips         12 Chips           0 ctal*         Octal*           0 Cotal*         Octal           130 Chips         12 Chips           0 Cotal*         Octal           130 Chips         12 Chips           0 126         3737           0 126         4402           1674         4023           1234         0233           071         2337           0712         3375           0123         3754           0412         3544           0236         7440           0450         1402           0661         6423           0142         1033           0175         2637           0111         5674           1600         0514           0424         6064           1351         1210           1550         6726           1271         1171           1441         6656           he initial settings as shown in this           y, for the first chip and the last           of the remaining 9 chips           sembly No. 38 are: 111110000).           N hou</th> <th colspan="5">Table 3-1b. Expanded Code Phase Assignments (III and subsequent blocks only)           SV         GPS         Code Phase Selection         P-code         First         First           No.         Gips         Code Phase Selection         P-code         First         First         First         Pirst           No.         Chips         Q(Cata)*         Q(Cata)*         Q(Chips)         (Hours)**         C/A         P           70         38         67         0017         Pi(t+24)         1236         3737           71         39         103         O(AI         Pi(t+24)         1746         440         911511         Pi(t+24)         0126         4402           75         43         225         0103         6         Pi(t+24)         02711         2337           78         46         636         9         Pi(t+24)         0271         &lt;td colspan="&lt;/th&gt;<th>First 12 Chips Octal P 3373 3757 7545 5440 4402 4023 2337 3754 3757 3755 3754 3667 0514 6064 1210 6726 1105 6660 those tho</th><th></th></th>	Inst.         Prist.           10 Chips         12 Chips           0 ctal*         Octal*           0 Cotal*         Octal           130 Chips         12 Chips           0 Cotal*         Octal           130 Chips         12 Chips           0 126         3737           0 126         4402           1674         4023           1234         0233           071         2337           0712         3375           0123         3754           0412         3544           0236         7440           0450         1402           0661         6423           0142         1033           0175         2637           0111         5674           1600         0514           0424         6064           1351         1210           1550         6726           1271         1171           1441         6656           he initial settings as shown in this           y, for the first chip and the last           of the remaining 9 chips           sembly No. 38 are: 111110000).           N hou	Table 3-1b. Expanded Code Phase Assignments (III and subsequent blocks only)           SV         GPS         Code Phase Selection         P-code         First         First           No.         Gips         Code Phase Selection         P-code         First         First         First         Pirst           No.         Chips         Q(Cata)*         Q(Cata)*         Q(Chips)         (Hours)**         C/A         P           70         38         67         0017         Pi(t+24)         1236         3737           71         39         103         O(AI         Pi(t+24)         1746         440         911511         Pi(t+24)         0126         4402           75         43         225         0103         6         Pi(t+24)         02711         2337           78         46         636         9         Pi(t+24)         0271         <td colspan="</th> <th>First 12 Chips Octal P 3373 3757 7545 5440 4402 4023 2337 3754 3757 3755 3754 3667 0514 6064 1210 6726 1105 6660 those tho</th> <th></th>					First 12 Chips Octal P 3373 3757 7545 5440 4402 4023 2337 3754 3757 3755 3754 3667 0514 6064 1210 6726 1105 6660 those tho	
NOTE #2: PRNs 38-63 are required per this Table if a manufacturer chooses to include these PRNs in their receiver design.					<del></del>			



#### PIRN Text (IS)

P-code Relative Advance (Hours) \*\*

 $P_1(t+24)$ P<sub>2</sub>(t+24) P<sub>3</sub>(t+24) P4(t+24) P<sub>5</sub>(t+24) P6(t+24) P7(t+24) P<sub>8</sub>(t+24) Pg(t+24) P10(t+24) Pn(t+24) P12(t+24) P13(t+24) P14(t+24) P15(t+24) P16(t+24) P17(t+24)

	Table 3-	Ib. Expand	led Code Pha	se Assignm	ents (III and sub	sequent blocks or	nly)
SV	GPS	Cod	e Phase Selec	tion	P-code	First	First
5V ID	PRN	G2	Initial G2	X2	Relative	10 Chips	12 Chips
No	Signal	Delay	Setting	Delay	Advance	Octal*	Octal
INO.	No.	(Chips)	(Octal)*	(Chips)	(Hours) **	C/A	Р
70	38	67	0017	1	P1(t+24)	1760	3373
71	39	103	0541	2	P2(t+24)	1236	3757
72	40	91	1714	3	P3(t+24)	0063	7545
73	41	19	1151	4	P4(t+24)	0626	5440
74	42	679	1651	5	P5(t+24)	0126	4402
75	43	225	0103	6	P6(t+24)	1674	4023
76	44	625	0543	7	P7(t+24)	1234	0233
77	45	946	1506	8	P <sub>8</sub> (t+24)	0271	2337
78	46	638	1065	9	P9(t+24)	0712	3375
79	47	161	1564	10	P10(t+24)	0213	3754
80	48	1001	1365	11	P11(t+24)	0412	3544
81	49	554	1541	12	P12(t+24)	0236	7440
82	50	280	1327	13	P13(t+24)	0450	1402
83	51	710	1716	14	P14(t+24)	0061	6423
84	52	709	1635	15	P15(t+24)	0142	1033
85	53	775	1002	16	P16(t+24)	0775	2637
86	54	864	1015	17	P17(t+24)	0762	7135
87	55	558	1666	18	P18(t+24)	0111	5674
88	56	220	0177	19	P19(t+24)	1600	0514
89	57	397	1353	20	P <sub>20</sub> (t+24)	0424	6064
90	58	55	0426	21	P <sub>21</sub> (t+24)	1351	1210
91	59	898	0227	22	P <sub>22</sub> (t+24)	1550	6726
92	60	759	0506	23	P <sub>23</sub> (t+24)	1271	1171
93	61	367	0336	24	P <sub>24</sub> (t+24)	1441	6656
94	62	299	1333	25	P <sub>25</sub> (t+24)	0444	1105
95	63	1018	1745	26	P <sub>26</sub> (t+24)	0032	6660
*Ir	the octal n	otation for	the first 10 ch	ups of the O	C/A-code or the i	nitial settings as s	shown in this
	table, the fi	rst digit (1/	0) represents	a "1" or "0	", respectively,	for the first chip :	and the last
	thre	e digits are	the conventio	nal octal re	epresentation of	the remaining 9 c	hips
(E		Emplo die	C/A	and for DT	DN Cimal Accord	ale remaining y c	1111110000
(For ex	ample, the	first 10 chij	ps of the C/A	code for Pl	CN Signal Assen	101y No. 38 are:	
*	<ul> <li>Pi(t+1</li> </ul>	N): P-code	sequence of I	KN numbe	er i shifted by N I	nours. See Sectio	n 5.3.2.1.
NOT	E #1: The	code phase	assignments	constitute i	nseparable pairs,	each consisting of	of a specific
		C/A	and a specifi	ic P code pl	hase, as shown al	bove.	

NOTE #2: PRNs 38-63 are required per this Table if a manufacturer chooses to include these PRNs in their receiver design.



Affected Document(s)	IS-GPS-800	DOORS ID	IS800-655					
Paragraph	3.5.4.2.1	Comment Number	28					
Comment Type	Substantive	Disposition	Accept with Comments					
Comment Originator(s)	Bruce Charest (GPSW/EN)							
Comment	Verbose and consequently confusing.	Verbose and consequently confusing.						
Directorate Response	Updated proposed text to reflect group consensus on 24 Aug 16.							

BASELINE TEXT (WAS)	PIRN TEXT (IS) (in the initial PIRN)	PROPOSED TEXT
000 = no data available,	000 = no data available,	By Mr. Bruce Charest:
001 = Galileo,	001 = Galileo,	Reserved in order to preserve the use of these
010 = GLONASS,	010 = GLONASS,	values in a future version of this IS. Until such a
011 through 111 = reserved for other	011 through 111 = <u>R</u> reserved <del>for other</del>	revision, the user segment developing to this
systems.	systems in order to preserve the use of	version of this IS should interpret these values
	these values in a future version of this IS.	as indicating that the GPS/GNSS Time Offset
	Until such a revision, the user segment	Parameter data, to which the GNSS Type ID
	developing to this version of this IS should	applies, is for future GNSS systems. These
	interpret these values as indicating that the	values are presently unusable.
	GPS/GNSS Time Offset Parameter data, to	
	which the GNSS Type ID applies, is	By discussion consensus (8/24/2016):
	presently unusable.	Reserved in order to preserve the use of these
		values in a future version of this IS. Until such a
		revision, <del>the user segment</del> <u>a developer</u>
		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 ID applies, is presently
		unusable.

Affected Document(s)	IS-GPS-705	DOORS ID	IS705-313		
Paragraph	20.3.3.4.6.2.1.0-3	Comment Number	30		
Comment Type	Substantive	Disposition	Accept with Comments		
Comment Originator(s)	Bruce Charest (GPSW/EN)				
Comment	Changes to table not clearly identified.				
Directorate Response	Just the 5 *****. Understand the frustration but the DIFF function in DOORS doesn't work for changes in a figure or table. This is a DOORS limitation. Thank you for your understanding.				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
Table 20-VI. Reduced Almanac Parameters         Parameter******       No. of Bits       Scale Factor (LSB)       Effective Range **       Units $\delta A^{***}$ $8^{*}$ $2^{-9}$ **       meters $\Omega 0$ $7^{*}$ $2^{-6}$ **       semi-circles $\Phi 0^{****}$ $7^{*}$ $2^{-6}$ **       semi-circles $\Phi 0^{****}$ $7^{*}$ $2^{-6}$ **       semi-circles         *       Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;       **       Effective range is the maximum range attainable with indicated bit allocation and scale factor;         **       Relative to $A_{ref} = 26,559,710$ meters;       ** $\Phi 0 = Argument of Latitude at Reference Time = M_0 + \omega;$ ******       Relative to following reference values: $e = 0$ $\delta_1 = +0.0056$ semi-circles (i = 55 degrees) $\dot{\Omega} = -2.6 \times 10^{-9}$ semi-circles/second	Table 20-VI. Reduced Almanac Parameters*****         Parameter       No. of Bits       Scale Factor (LSB)       Valid Range **       Units $\delta A$ ***       8 *       2**       **       meters $\Omega_0$ 7 *       2*6       **       semi-circles $\Phi_0$ ****       7 *       2*6       **       semi-circles $\Phi_0$ ****       7 *       2*6       **       semi-circles         *       Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;       **       Valid range is the maximum range attainable with indicated bit allocation and scale factor;         ***       Relative to $A_{rd} = 26,559,710$ meters;       *** $\Phi_0 = Argument of Latitude at Reference Time = M_0 + \omega;$ *****       Relative to following reference values: $e = 0$ $\delta_i = +0.0056$ semi-circles (i = 55 degrees) $\hat{\Delta} = -2.6 \times 10^{-9}$ semi-circles/second	N/A



PIRN	Tex	t (	S)	IS	7(	)5	-3	31	3

Table 20-VI. Reduced Almanac Parameters****							
Parat	neter <del>****</del>	No. of Bits	Scale Factor (LSB)	Valid Range **	Units		
	δα ***	8 *	2+9	**	meters		
	Ωο	7*	2-6	**	semi-circles		
	Φ0 ****	7 *	2-6	**	semi-circles		
<ul> <li>Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;</li> </ul>							
**	** Valid range is the maximum range attainable with indicated bit allocation and scale factor;						
***	*** Relative to A <sub>ref</sub> = 26,559,710 meters;						
**** $\Phi_0$ = Argument of Latitude at Reference Time = $M_0 + \omega$ ;							
****	***** Relative to following reference values:						
e = 0							
$\delta_i = +0.0056$ semi-circles (i = 55 degrees)							
$\dot{\Omega}$ =-2.6 x 10 <sup>-9</sup> semi-circles/second							

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-118		
Paragraph	3.3.2.2 (Figure 3-6)	Comment Number	50		
Comment Type	Substantive	Disposition	Accept		
Comment Originator(s)	Ron Dixon (Boeing IIF LOOS)				
Comment	Figure still needs cleaning up: - Text cut off in 'X1B CLOCK CONTROL', 'X2A CLOCK CONTROL' and 'X2B CLOCK CONTROL' boxes - Text overlays box boundary in 'X1A REGISTER' box (see 'X1B REGISTER' box for how it should look)				
Directorate Response	For clarity. Produce a new figure.				


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### PIRN Text (IS) IS200-118



Affected Document(s)	IS-GPS-200	DOORS ID	IS200-338		
Paragraph	20.3.3.3.3.0-2	Comment Number	52		
Comment Type	Substantive	Disposition	Accept with Comments		
Comment Originator(s)	Ron Dixon (Boeing IIF LOOS)				
Comment	The phrase 'extraordinary circumstances' was added to the footnote of the table and is undefined in this context. This makes it impossible to determine when invalid values may be broadcast. Suggest rejecting the change. If some SF1 parameters can indeed contain invalid values, the conditions that would cause this should be fully presented in the text of the document; not in a table footnote.				
Directorate Response	The original proposed change (additional footnote) to this DOORS ID is now OBE. The newly proposed change (clarification of the Valid Range definition) is now in IS200-1508.				

BASELINE TEXT (WAS)			PIRN TEXT (IS) (in the original PIRN)			original	PROPOSED TEXT			
	Table 20-I.	Subfram e 1	Parameters			Table 20-I.	Subframe 1	Parameters		OBE for IS200-338.
Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units	Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units	New proposed change is made as
Code on L2	2	1		(see text)	Code on L2	2	1		discretes	
Week No.	10	1		week	Week No.	10	1		week	IS200-1508 as noted in Comment 75.
L2P data flag	1	1		discrete	L2 P data flag	1	1		discrete	
SV accuracy	4			(see text)	SV accuracy	4			(see text)	
SV health	6	1		discretes	SV health	6	1		discretes	
T	*	2-31		uscietes	Tgp	8*	2-31		seconds	
1œ		2		seconds	IODC	10			(see text)	
TODC	10			(see text)	toc	16	24	0 to 604,784	seconds	
toc	16	24	0 to 604,784	seconds	an	8*	2-55		sec/sec <sup>2</sup>	
a₂	8*	2-55		sec/sec <sup>2</sup>	an	16*	2-43		sec/sec	
an	16*	2 <sup>-48</sup>		sec/sec	an	22*	2-31		seconds	
a <sub>iD</sub>	22*	2-31		seconds						
* Paramaters so india	ated shall be two's	complement wit	h the sign bit (+ or ) og	comping the MSP -	* Parameters so indi	icated shall be two's	complement, with	n the sign bit (+ or -) oc	cupying the MSB;	
1 ataliete s so filde		s comprement, wit	in the sign bit (+ of -) of	cupying the MSD,	**	See Figure 20-1	for complete bit al	location in subframe;		
** *** Unless otherwise indi	See Figure 20-1 f cated in this colum bit a	for complete bit al in, valid range is t allocation and scal	llocation in subframe; the maximum range atta le factor.	inable with indicated	*** Unless otherwise ind bit allocation and scal circumstances,	licated in this colun e factor. Identifies , invalid values may	in, valid range is t he ordinary range be broadcast. The	ne maximum range atta of values broadcast by valid ranges are only f	inable with indicated GPS. In extraordinary for PRNs 1-63.	

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#### PIRN Text IS200-338

	Table 20-I.	Subframe 1	Parameters	
Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
Code on L2	2	1		discretes
Week No.	10	1		week
L2 P data flag	1	1		discrete
SV accuracy	4			(see text)
SV health	6	1		discretes
T <sub>GD</sub>	8*	2-31		seconds
IODC	10			(see text)
toc	16	2 <sup>4</sup>	0 to 604,784	seconds
a <u>f</u> 2	8*	2-55		sec/sec <sup>2</sup>
afl	16*	2 <sup>-43</sup>		sec/sec
an	22*	2-31		seconds
* Parameters so indicated shall be two's complement, with the sign bit (+ or -) occupying the MSB:				

Parameters so indicated shall be two's complement, with the sign bit (+ or -) occupying the MSB

\*\* See Figure 20-1 for complete bit allocation in subframe;

\*\*\* Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor. Identifies the ordinary range of values broadcast by GPS. In extraordinary circumstances, invalid values may be broadcast. The valid ranges are only for PRNs 1-63.

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-1491		
Paragraph	30.3.3.4.6.1	Comment Number	53		
Comment Type	Substantive	Disposition	Reject		
Comment Originator(s)	Ron Dixon (Boeing IIF LOOS)				
Comment	The IS wording is not much better than the WAS wording. It is ambiguous. The Reduced Almanac Packets are 31 bits. Therefore, when the new IS wording states that all subsequent bits to the end of the message shall be filler bits, is this on a packet basis or an entire message basis? The former would have each packet begin with a one bit. The latter would have packets alternating between beginning with a one bit and a zero bit. I think each packet should begin with a one bit (not for any technical reason, I just think it's cleaner).				
Directorate Response	Consensus at the Non-Government Public ICWG on 24 August, 2016.				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
A 6-bit value of "000000" in the PRN <sub>a</sub> field shall indicate that no further Status Words are contained in the remainder of the data block. In this event, all subsequent bits in the data block field shall be filler bits, i.e., alternating ones and zeros beginning with one.	A 6-bit value of "000000" in the PRN <sub>a</sub> field shall indicate that no further Status <u>there</u> Words is are <u>no</u> contained <u>data</u> in the remainder of the <u>reduced</u> data <u>almanac</u> block packet. In this event, all subsequent bits in to the data <u>end</u> block of field the message that contains the packet shall be filler bits, i.e., alternating ones and zeros beginning with one.	A 6-bit value of "000000" in the PRNa field shall indicate that there is no data in the reduced almanac packet. In this event, all subsequent bits to the end of the message that contains the packet shall be filler bits, i.e., alternating ones and zeros beginning with one. Further, the entirety of each subsequent reduced almanac packet in the message shall also contain filler bits.

Affected Document(s)	IS-GPS-200	DOORS ID	N/A		
Paragraph	N/A	Comment Number	63		
Comment Type	Substantive	Disposition	Reject		
Comment Originator(s)	Brent Renfro (ARL:UT)				
Comment	Add a Table 3-VIa that illustrates the P-code Reset Timing for the same period, but for a sample PRN. For example, PRN 5. The purpose is to illustrate how the reset timing works with the PRN delay included. As presented, NO PRN delay is included (PRN 0, if you will)				
Directorate Response	Proposed changes are now OBE.				

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

Affected Document(s)	IS-GPS-200	DOORS ID	N/A		
Paragraph	N/A	Comment Number	64		
Comment Type	Substantive	Disposition	Reject		
Comment Originator(s)	Brent Renfro (ARL:UT)				
Comment	Add a Table 3-VIIa that illustrates the final code vector states including a PRN delay. This allows a multi- chip verification that a given implementation is correctly handling the X2 register delays associated with the PRN delay in addition to those associated with the X1/X2 precession.				
Directorate Response	Proposed changes are now OBE.				

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

Affected Document(s)	IS-GPS-200	DOORS ID	IS200-422		
Paragraph	20.3.3.5.1.9	Comment Number	66		
Comment Type	Substantive	Disposition	Defer		
Comment Originator(s)	Rockwell Collins				
Comment	Contents of Navigation Message Correction Table (NMCT) data broadcast in Subframe 4 Page 13 by PRN 32 are not defined. NMCT data contains slots for estimated range deviations (ERDs) for 30 SVs all SVs except for the transmitting PRN and for PRN 32. Current broadcast appears to indicate that alternating ones and zeros are broadcast by PRN 32. Clarify that NMCT data broadcast by PRN 32 in Subframe 4 Page 13 is filled with alternating ones and zeros, and the availability indicator is set to '10', indicating "no correction table available"				
Directorate Response	This comment is not directly against RFC-318's proposed changes. We will track this comment and submit a formal concern against it in eGPS to be resolved during the 2017 Public ICWG.				

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

Affected Document(s)	IS-GPS-800	DOORS ID	IS800-159, 160, 161		
Paragraph	3.5.3 Subframe 2 (Table 3.5-1 page 1, 2 & 3)	Comment Number	68		
Comment Type	Substantive	Disposition	Reject		
Comment Originator(s)	Steven Brown (GPS III/ LM)				
Comment	To align with the change from "effective range" to "valid range", suggest updating the *** note as well to not state "maximum".				
Directorate Response	The term "maximum" is not incorrect for the intended definition of valid range. (If we decide to remove the word maximum, 30+ tables in three public documents will be affected. The scope of the change doesn't warrant the amount of work required to implement this change)				

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
(N/A: This change was not included in the original PIRN submitted for review)	(N/A: This change was not included in the original PIRN submitted for review)	*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.		OR: *** Unless otherwise indicated in this column, valid range is the maximum <u>full</u> range attainable with indicated bit allocation and scale factor.

Affected Document(s)	IS-GPS-800	DOORS ID	IS800-894				
Paragraph	3.5.4.3.5.1.1, Reduced Almanac	Comment Number	69				
Comment Type	Substantive	Accept					
Comment Originator(s)	Steven Brown (GPS III/ LM)						
Comment	Proposed text slightly confusingpleas Resolution.	se rephrase, something	along the lines of the Recommended				
Directorate Response	Updated text to be more specific.						

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
A 8-bit value of "000000" in the PRN <sub>a</sub> field shall indicate that no further Status Words are contained in the remainder of the data block. In this event, all subsequent bits in the data block field shall be filler bits, i.e., alternating ones and zeros beginning with one.	A 8-bit value of "000000" in the PRN <sub>a</sub> field shall indicate that no further Status there Words is are no contained data in the remainder of the reduced data almanac block packet. In this event, all subsequent bits in to the data end block of field the message that contains the packet shall be filler bits, i.e., alternating ones and zeros beginning with one.	An 8-bit value of "00000000" in the PRNa field shall indicate that there is no data in the reduced almanac packet. In this event, all subsequent bits following the zero PRNa field to the end of the message that contains the packet Subframe 3 Page 3 message shall be filler bits, i.e., alternating ones and zeros, beginning with one.

Affected Document(s)	IS-GPS-800		DOORS ID	IS800-872			
Paragraph	3.5.5.3 (IS-GP	S-800)	Comment Number	70			
Comment Type	Substantive		Disposition	Accept with Comments			
Comment Originator(s)	Steven Brown	(GPS III/ LM)					
Comment	Why is CNAV being reference in IS800 and not CNAV2?						
Directorate Response	Section 3.5.5. CNAV-2 reference Recommend WAS: 3.5.5.3 Reference The CNAV reference S: 3.5.5.3 Reference The CNAV-2 reference CNAV reference	3 in IS-GPS-800 referred ence time information is s that we add the statemer ence Times: ference time information ence Times: reference time informatio ace time information may	to Section 30.3.4.5 similar to that of the at above for clarificat may be found in para n is similar to that of be found in paragra	in IS-GPS-200 but failed to specify that the CNAV excluding the toc reference. ion. agraph 30.3.4.5 in IS-GPS-200. the CNAV excluding the toc reference. The oh 30.3.4.5 in IS-GPS-200.			
BASELINE TEXT (	WAS)	PIRN TEXT (IS) PROPOSED TEXT					

PIRN TEXT (IS)	PROPOSED TEXT
(N/A: This change was not included in the original PIRN submitted for review)	Recommend to change to:
	3.5.5.3 Reference Times:
	similar to that of the CNAV excluding the toc
	reference.
	The CNAV reference time information may be found in paragraph 30.3.4.5 in IS-GPS-200.
	PIRN TEXT (IS) (N/A: This change was not included in the original PIRN submitted for review)

Affected Document(s)	IS-GPS-705	DOORS ID	IS705-332				
Paragraph	Table 20-IX UTC Parameters	Comment Number	71				
Comment Type	Substantive	Disposition	Accept				
Comment Originator(s)	Steven Brown (GPS III/ LM)						
Comment	RFC-318 fails to build on top of RFC-2 agreed upon changes. The only differe of this table should be the number of b other RFC-288 changes need to be ad	88 version of table so y ence between RFC-288 its for the WN_LSF par ded into the RFC-318 "	ou are going to lose/regress previously- version of this table and RFC-318 version ameter going from 8 bits to 13 bits. All is" text to ensure nothing gets dropped.				
Directorate Response	RFC-288 was CCB approved 7/29/2016. We used the wording in RFC-288 as the "WAS" and make changes to these applicable texts as the proposed "IS". Revisited the other tables which were impacted by both RFC-288 and RFC-318						

BASELINE TEXT (WAS)				PIRN TEXT (IS)				PROPOSED TEXT									
	Table 20-IX. UTC Parameters							Table 20.IX	UTC Paramete	ers							
	Table 20-IX	UTC Par	ameters					N6	Scale	17-114		<u> </u>					
		N	Scale	11-41-4		Parameter Symbol	Parameter Description	No. of Bits**	(LSB)	Valid Range***	Units	Parameter		No. of	Scale Factor	Valid	
Parameter Symbol	Parameter Description	Bits**	(LSB)	Range***	Units	A <sub>0-n</sub>	Bias coefficient of GPS time scale relative to UTC time scale	16*	2-35		Seconds	Symbol	Parameter Description	Bits**	(LSB)	Range***	Units
Aon	Bias coefficient of GPS time scale relative to UTC time scale	16*	2-35		Seconds	A <sub>1-n</sub>	Drift coefficient of GPS time scale	13*	2-51		sec/sec	Alo-n	relative to UTC time scale	10	2		Seconds
Alm	Drift coefficient of GPS time scale relative to UTC time scale	13*	2-51		sec/sec	A <sub>2-n</sub>	Drift rate correction coefficient of	7*	2.68		sec/sec <sup>2</sup>	A <sub>1-n</sub>	Drift coefficient of GPS time scale relative to UTC time scale	13*	2-51		sec/sec
A <sub>2-n</sub>	Drift rate correction coefficient of GPS time scale relative of UTC time.	7*	2-68		sec/sec <sup>2</sup>		GPS time scale relative of UTC time scale					A <sub>2-n</sub>	Drift rate correction coefficient of GPS time scale relative of UTC time scale	7*	2-68		sec/sec <sup>2</sup>
	scale					ΔtLs	Current or past leap second count	8*	1		seconds	ΔtLs	Current or past leap second count	8*	1		seconds
$\Delta t_{LS}$	Current or past leap second count	8*	1		seconds	tot	Time data reference Time of Week	16	24	604,784	seconds	tot	Time data reference Time of Week	16	24	0 to 604,784	seconds
tor	Time data reference Time of Week	16	24	0 to 604,784	seconds	WNet	Time data reference Week Number	13	1		weeks	WNet	Time data reference Week Number	13	1		weeks
WNα	Time data reference Week Number	13	1		weeks	WNLSF	Leap second reference Week	<mark>8-13</mark>	1		weeks	WNLSF	Leap second reference Week Number	<del>8</del> -13	1		weeks
WNLSF	Leap second reference Week Number	8	1		weeks	DN	Lean second reference Day Number	4****	1		days	DN	Leap second reference Day Number	4	1	1 to 7	days
DN	Leap second reference Day Number	4	1	1 to 7	days	Attor	Current of Arturn Jaco many Automotion	8*	1		seconds	ΔtLSF	Current or future leap second count	8*	1		seconds
Atts#       Current or future leap second court       §*       1       seconds       *       Current or future leap second court       Image: Current or future leap second court       Current or future leap se					ISB; indicated bit												



### Proposed Text IS705-332

Table 20-IX. UTC Parameters								
Parameter	Parameter Description	No. of Bite**	Scale Factor	Valid Range***	TInito			
A <sub>0-n</sub>	Bias coefficient of GPS time scale relative to UTC time scale	16*	2 <sup>-35</sup>	Kange	Seconds			
A <sub>1-n</sub>	Drift coefficient of GPS time scale relative to UTC time scale	13*	2-51		sec/sec			
A <sub>2-n</sub>	Drift rate correction coefficient of GPS time scale relative of UTC time scale	7*	2-68		sec/sec <sup>2</sup>			
ΔtLs	Current or past leap second count	8*	1		seconds			
tot	Time data reference Time of Week	16	24	0 to 604,784	seconds			
WN <sub>ot</sub>	Time data reference Week Number	13	1		weeks			
WNLSF	Leap second reference Week Number	<mark>8-13</mark>	1		weeks			
DN	Leap second reference Day Number	4	1	1 to 7	days			
$\Delta t_{LSF}$	Current or future leap second count	8*	1		seconds			
<ul> <li>Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;</li> <li>See Figure 20-6 for complete bit allocation</li> <li>Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor:</li> </ul>								

\*\*\*\* Right justified.

Affected Document(s)	IS-GPS-800				DOORS ID			IS800-682 (DOORS ID is actually IS800- 260)			
Paragraph	3.5.4.3.5.1.1	Reduced A	Imanac	;	Comme	ent Numbe	r 74	74			
Comment Type	Substantive				Dispos	ition	Acce	ept with Co	omments		
Comment Originator(s)	Steven Browr	n (GPS III/	LM)				-				
Comment	Consider rem Table 30-VI a	oving the f nd the RF0	ive aste C-318 u	erisk ann Ipdate to	otation f IS705 T	rom the "Pa able 20-VI.	arameter	" column f	or consist	ency wit	h IS200
Directorate Response	Consistency. 3.5-6, Reduce	Remove th ed Almana	ne five a c Paran	asterisk a neters (D	annotatio OOORS	on from the ID is actuall	"Parame y IS800-	ter" colum 260)	n for con	sistency	in Table
BASELINE TEXT (	WAS)		PIR	RN TEXT	(IS)			PROPOSED TEXT			
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	13 ***** trive Range ** Units ** Meters ** semi-circles ** semi-circles Illocation and scale factor;	its its its ers ircles ircles			rameters *****  Valid Range **  **  **  **  n;  it allocation and scale fa	Units Meters semi-circles semi-circles	Parameter S <sub>0</sub> *** Q <sub>0</sub> $\Phi_0$ *** * * Paramete ** Valid rar *** Relative **** Relative	Table 3.5-6.       No. of Bits       8 *       7 *       rs so indicated shall be in it       ge is the maximum range:       o A <sub>eff</sub> = 26,559,710 meter       ment of Latitude at Refer       o following reference value $z = 0$ $k_i = +0.0056$ semi-circles $2 = -2.6 \ge 10^{-9}$ semi-circles	IS : Reduced Almanac Pau Scale Factor (LSB) $2^{-9}$ $2^{-4}$ $2^{-4}$ $2^{-4}$ wo's complement notation trainable with indicated b 3; ence Time = $M_0 + \omega;$ es: (i = 55 degrees) //second	rameters ***** Valid Range ** ** ** ** n; it allocation and scale f	Units Meters semi-circles semi-circles



### Proposed Text IS800-682

			IS :						
	Table 3.5-6.       Reduced Almanac Parameters       *****								
Paran	neter <del>****</del>	No. of Bits	Scale Factor (LSB)	Valid Range **	Units				
	δ <sub>A</sub> ***	8 *	2+*	**	Meters				
	$\Omega_0$	7*	2-6	**	semi-circles				
	$\Phi_0^{***}$	7*	2-6	**	semi-circles				
*									
*	Parameters so	o indicated shall be in tw	o's complement notation	n;					
**	Valid range is	s the maximum range att	ainable with indicated b	it allocation and scale f	actor;				
***	Relative to A	A <sub>cef</sub> = 26,559,710 meters;							
****	$\Phi_0 = \operatorname{Argume}$	ent of Latitude at Referen	nce Time = $M_0 + \omega$ ;						
****	Relative to fo	llowing reference value:	50						
	e = ( 8; =	) +0.0056 semi-circles(	i = 55 degrees)						
	<u>Ω</u> =	-2.6 x 10° semi-circles/s	econd						

Affected Document(s)	IS-GPS-705	DOORS ID	IS705-1518; IS705-1519					
Paragraph	(New) 6.3.5 Pre-Operational Use:	Comment Number	78					
Comment Type	Substantive	Disposition	Accept					
Comment Originator(s)	Stephan Hillman (SMC/GPGX)							
Comment	The paragraph requested in Action Iter	The paragraph requested in Action Item 1532 does not appear in the PIRN.						
Directorate Response	The change was inadvertently left out. Add a new section, 6.3.5 Pre-Operational Use, right after Section 6.3.4 Additional PRN Sequences							

BASELINE TEXT (WAS)	PIRN TEXT (IS)	PROPOSED TEXT
(N/A: The proposed change was inadvertently left out in the original PIRN submitted for review)	(N/A: The proposed change was inadvertently left out in the original PIRN submitted for review. This is a new section to be added to IS-GPS-705)	6.3.5 Pre-Operational Use: Before any new signal or group of signals (e.g., L2C, L5, M, L1C, etcetera) is declared operational, the availability of and/or the configuration of the broadcast signal or group of signals may not comply with all requirements of the relevant IS or ICD. For example, the pre- operational broadcast of L2C signals from the IIR-M satellites did not include any NAV or CNAV data as required by IS-GPS-200. Pre- operational use of any new signal or group of signals is at the users own risk.



RFC-318 2016 Public Document Clean-up

**Critical Comments** 

### **Substantive Comments**

### **Rejected Administrative Comments (2)**

Affected Document(s)	IS-GPS-200	DOORS ID	Table 30-VI
Paragraph	IS-GPS-200, Table 30-VI	Comment Number	81
Comment Type	Administrative	Disposition	Reject
Comment Originator(s)	Stephan Hillman (SMC/GPGX)		
Comment	Why wasn't this table updated to replace Effective Range with Valid Range, as done elsewhere in this RFC?		
Directorate Response	This table is updated in IRN-IS-200H-003 of RFC-288 (CCB approved 7/29/2016)		

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

Affected Document(s)	N/A	DOORS ID	N/A
Paragraph	IS-GPS-200, Pre-RFC Issue 583	Comment Number	82
Comment Type	Administrative	Disposition	Reject
Comment Originator(s)	Stephan Hillman (SMC/GPGX)		
Comment	This does not appear to have been implemented in the PIRN. If it is in the PIRN, in which object was the change made?		
Directorate Response	Changes already made to: IS200-1286 IS200-97 IS200-1282		

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



## REVIEW OF 2015 PUBLIC CRM

CRM: Comment Resolution Matrix

Pauline Bennett



# Status Summary

Status	Quantity			
	2014	2015	2016	
Complete	22	14	0	
In Progress	1	3	2	
Pending Action	0	6	0	
Not Started	0	0	0	
Total	23	23	2	



## ACTION ITEM REVIEW

UNCLASSIFIED



### CLOSING COMMENTS

UNCLASSIFIED



# THANK YOU

The meeting will reconvene tomorrow at 0830 hrs PDT.



### Global Positioning Systems (GPS) Public Interface Control Working Group and Public Forum

21-22 September 2016 0830 – 1630 hrs PST

United States Air Force GPS Directorate Phone Number: 1-310-653-2663 Meeting ID: 6272252 Passcode: 000001 DCS Website: https://conference.apps.mil/webconf/2016PICWG A CONTROL OF THE OWNER

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# **Roll Call**

UNCLASSIFIED





# UNCLASSIFIED



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





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





• The purpose of the meeting is to:

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

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

Comments received will be vetted per the standard change management process



### Agenda – Day 1 (Public ICWG)

**Opening Remarks** 

Roll Call

Agenda Overview

Meeting Logistics / Rules of Engagement

Meeting Purpose ICWG Presentations

> - Request for Change (RFC) 308: Update Interface Control Document (ICD)-GPS-870 and Interface Control Document (ICD)-GPS-240

> - Request for Change (RFC) 312: Definition Clarification for Time of Predict

- Request for Change (RFC) 318: 2016 Public Document Clean-Up

- Review of 2015 Comment Resolution Matrix

Action Item Review

Adjourn

# A CHINESE STOTALS CHINA

### Agenda – Day 2 (Public Forum)

Reconvene

Roll Call

**Special Topic Presentations** 

- Appendix D to the Standard Positioning Service (SPS) Performance Standard (PS)

- Release of Receiver Independent Exchange Format (RINEX) Data from Control Segment to Civil Users

- Message Type 38
- Carrier Phase Noise via 3rd Order Jaffe-Rechtin Phase-locked loop (PLL)
- Operational Advisories

- How a Change in Interface Specification (IS)-GPS-705 and Interface Specification (IS)-GPS-800 Could Save Lives

- GPS Technical Baseline Overhaul (Tentative)

**Open Discussion Session** 

Action Item Review

Adjourn



# 2016 PUBLIC FORUM

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# APPENDIX D TO THE SPS PS

SPS: Standard Positioning Service PS: Performance Specification K. Kovach (GPE/Aerospace)



### Information Only: SPS PS Update



Karl Kovach, SMC/GPE(Aero)

Public Interface Control Working Group (PICWG) 21-22 September 2016

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### **Overview** - I

#### • Adding L2C and L5

- Objective: Include Performance Standard commitments on L2C and L5 signals
  - Additions for signal 'coverage', accuracy', and 'integrity'
  - Not ready to commit to 'continuity' or 'availability'
- Adding P<sub>const</sub> and P<sub>sat</sub>
  - Objective: Include considerations to support ARAIM and multiconstellation operations
    - Additions for signal 'coverage', accuracy', and 'integrity'



### **Overview - II**

- Resiliency Appendix (Appendix D)
  - Objective: Include civil receiver development best practices for processing the signal in space to increase resiliency and avoid SiS incompatibility
    - Topics listed on following slides
    - Include recommendations for civil developers similar to RSAM requirements (only use valid data as defined by IS-GPS 200)
  - Driving Actions
    - Action from NPEF, prompted by UTCO anomaly of 25-26 Jan 16
    - Supports other interagency objectives as well (e.g., FAA GIISST Report recommendations)



### **Appendix D Context**

- Appendix D "Resiliency Considerations" (Best Practices)
  - <u>Not</u> requirements per se
    - Verb is "should", not "must"
  - Think of as 'mandatory caveats'
    - If want to take advantage of SPS PS "SIS performance guarantees"
      - Then must comply with Appendix D recommendations
    - If don't care about SPS PS "SIS performance guarantees"
      - Then should comply with Appendix D recommendations
  - Appendix D is a 'carrot', not a 'stick'


# Appendix D Contents & Status as of 4 Jul 16

Торіс	Lead Author	Status
UTCO Validity	Kovach	Final Draft
Week Number rollovers	Kovach	In work
Almanac	Suprin	Final Draft
Data set cutover	Renfro	Final Draft
Extended NAV (Block II SVs Only)	Kovach	Final Draft
WAGE-2	Kovach	Postponed
URA processing in CNAV	Renfro	Final Draft
Known good NAV messages	Suprin	Final Draft
Higher PRNs (PRNs 33-63)	Kovach	Final Draft
Ephemeris/almanac cross checks	Renfro	Final Draft
Military use of L1 C/A, L2C, L5	Kovach	Postponed
When to use CNAV/ versus LNAV	Renfro	Final Draft
Reserved data in subframes 1&4	Suprin	Final Draft
Single Frequency Ionospheric Model Validity	Kovach	In Work
Appendix introduction and table of contents	Besson	In Work
Leap Second Validity	Powers	In Work
GGTO Validity	Powers	In Work
EOP Validity	Powers	In Work
IODE/IODC	Kovach	In Work
Unexpected CNAV Messages	Kovach	In Work
Pseudorange Step Detection	Kovach	In Work



# Appendix D Contents & Status as of 4 Jul 16

#### Sample to look at

Торіс	Lead Author	Status
UTCO Validity	Kovach	Final Draft
Week Number rollovers	Kovach	In work
Almanac	Suprin	Final Draft
Data set cutover	Renfro	Final Draft
Extended NAV (Block II SVs Only)	Kovach	Final Draft
WAGE-2	Kovach	Postponed
URA processing in CNAV	Renfro	Final Draft
Known good NAV messages	Suprin	Final Draft
Higher PRNs (PRNs 33-63)	Kovach	Final Draft
Ephemeris/almanac cross checks	Renfro	Final Draft
Military use of L1 C/A, L2C, L5	Kovach	Postponed
When to use CNAV/ versus LNAV	Renfro	Final Draft
Reserved data in subframes 1&4	Suprin	Final Draft
Single Frequency Ionospheric Model Validity	Kovach	In Work
Appendix introduction and table of contents	Besson	In Work
Leap Second Validity	Powers	In Work
GGTO Validity	Powers	In Work
EOP Validity	Powers	In Work
IODE/IODC	Kovach	In Work
Unexpected CNAV Messages	Kovach	In Work
Pseudorange Step Detection	Kovach	In Work



## Recommendation

• The PICWG is invited to consider the provided information and comment as appropriate.





# Thank You



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# **Resilience Considerations for UTC Offset**

	K <sup>2</sup> = Vb: 22 Jun 16
STANDARD POSITIONIN	G SERVICE (SPS) PERFORMANCE STANDARD (PS)
	APPENDIX D
R	ESILIENCY CONSIDERATIONS
.xx RESILIENCE CONSIDERATIONS	FOR UTC OFFSET (UTCO) INFORMATION
.xx.1 Definitions	
SF4, P18	Subframe 4 Page 18 of the LNAV message. Contains a set of four UTCO parameters (WNt, $t_{ot}$ , $A_0$ , and $A_1$ ), among other parameters.
UTCO Data Quartet	The set of four UTCO parameters (WNt, $t_{otr}A_{0r}$ and $A_{t}$ ) in Subframe 4 Page 18 of the LNAV message.
MT-33	Message Type 33 of the CNAV message. Contains a set of five UTCO parameters (WNt, $t_{ot}$ , $A_0$ , $A_1$ , and $A_2$ ), among other parameters.
UTCO Data Quintet	The set of five UTCO parameters (WNt, $t_{ot},A_0,A_1,$ and $A_2)$ in Message Type 33 of the CNAV message.
UTCO Data Reference Time	The reference time for the UTCO data quartet and UTCO data quintet the point in $t_{\text{OPS}}$ represented by the properly resolved (untruncated and rollover accounted) WNt and $t_{\text{ot}}$ parameters.
UTCO Data Reference Epoch	Same as UTCO Data Reference Time.
turco	Equivalent to UTCO Data Reference Time and UTCO Data Reference Epoch, expressed as time since the GPS epoch (e.g., seconds since the UTC(USNO) Saturday night/Sunday morning transition on 5/6 January 1980).
t <sub>ars</sub>	GPS time, expressed as time since the GPS epoch (e.g., seconds since the UTC(USNO) Saturday night/Sunday morning transition on 5/6 January 1980).
t	GPS receiver's estimate of current GPS time, expressed as time since the GPS epoch (e.g., seconds since the UTC(USNO) Saturday night/Sunday morning transition on 5/6 January 1980).
tε	GPS receiver's estimate of current GPS time of week (TOW), ignoring the week number (WN).
	DRAFT



UNCLASSIFIED





# RINEX DATA FROM CONTROL SEGMENT

RINEX: Receiver Independent Exchange Format

K. Kovach (GPE/Aerospace)

UNCLASSIFIED



# Output of RINEX Data; ICD-GPS-240A/870B



Karl Kovach, SMC/GPE(Aero)

Public Interface Control Working Group (PICWG) 21-22 September 2016

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## Overview

- Think 'Big Picture' Control Segment (BPCS)
  - Not just individual parts like MCS, MSs, GPSOC, etcetera
    - Note title of -240A & -870B is "Navstar GPS Control Segment to User Support Community Interfaces"

#### • NGA precise ephemeris is part of BPCS

- So is the data that goes into making the NGA precise ephemeris
  - i.e., BPCS ensemble of Monitor Station (MS) observation data

#### • BPCS can (should) provide MS observation data to the world

- What a "Gold Standard' BPCS would do
- Pre-existing mechanism for sharing MS observation data
  - International GNSS Service (IGS) network with 497 MSs as of 12 Aug 16
  - Very well-standardized format for sharing MS observation data:
    - "Receiver Independent Exchange Format" (RINEX)



# **GPS Classification/Declassification Guide**

ITEM	TOPIC	CLASS
:		
J5.10.1.1.4.2 (formerly 1901.1.4.2)	(U) Raw SV to receiving equipment ranging data	U
:	:	:
J5.10.1.1.4.5 (formerly 1901.1.4.5)	(U) <i>Broadcast ephemerides</i> or broadcast clock (i.e. uncorrected ephemeris).	U
:	: :	:



# ICD-GPS-240A, Paragraph 2.2

#### **Is Currently**

#### 2.2 Non-Government Documents

The following documents of the issue specified contribute to the definition of the interfaces in this ICD and form a part of this ICD to the extent specified herein.

#### **Specifications**

None

<u>Standards</u> None

Other Publications None

#### **Should Become**

#### 2.2 Non-Government Documents

The following documents of the issue specified contribute to the definition of the interfaces in this ICD and form a part of this ICD to the extent specified herein.

#### **Specifications**

None

#### **Standards**

None

## Other PublicationsRINEXThe Receiver Independent Exchange Format,

14 Jul 15 Version 3.03



## ICD-GPS-240A, Table I

#### **Is Currently**

#### **Should Become**

Table I Information Exchange Matrix							
Producer	ducer Consumer Data Exchange Information Nature of Security Identification						
GPS CS	GUSS Offline Software Tool	GPS Constellation Orbital and Performance Parameters	GPS ConstellationAlmanacTransfer viaUndOrbital anddiskettePerformanceParameters		Unclassified		
GPS CS	USCG NAVCEN	GPS Status Information	NANU Transmit via Unclas E-Mail		Unclassified		
GPS CS	USCG NAVCEN	GPS Constellation Status Summary	OA Post to Internet Website		Unclassified		
:	:			÷	:		
GPS CS	Military User Community	GPS Constellation Status Summary	OA	Post to Internet and SIPERNET Websites	Unclassified		
GPS CS	Military User Community	GPS Constellation Orbital and Performance Parameters	on Almanac Post to Internet Unclas and SIPERNET Websites		Unclassified		

Table I Information Exchange Matrix							
Producer	Consumer	Data Exchange Identification	Security				
GPS CS	GUSS Offline Software Tool	GPS Constellation Orbital and Performance Parameters	Almanac	Transfer via diskette	Unclassified		
GPS CS	USCG NAVCEN	GPS Status NANU Transmit via Information E-Mail		Unclassified			
GPS CS	USCG NAVCEN	GPS Constellation Status Summary	OA	Post to Internet Website	Unclassified		
:					:		
GPS CS	Military User Community	GPS Constellation Status Summary	OA	Post to Internet and SIPERNET Websites	Unclassified		
GPS CS	Military User Community	GPS Constellation Orbital and Performance Parameters	Almanac	Post to Internet and SIPERNET Websites	Unclassified		
<u>GPS CS</u>	<u>GPS User</u> <u>Community</u>	MS Observation Data	S Observation RINEX Post to Internet Use Website		<u>Unclassified</u>		



# ICD-GPS-240A, Paragraph 3.1

#### **Is Currently**

The information distributed by the CS includes Notice Advisory to Navstar Users (NANU), Operational Advisory (OA), and satellite almanac. The NANU is a message that informs users of satellite outages and other GPS issues. The OA is a descriptive summary of GPS constellation status. The satellite almanac contains orbital and performance parameters for operational GPS satellites. The primary means of data distribution include electronic mail (e-mail) and Internet and SIPRNET websites. All data transfer described in this ICD is unclassified.

#### **Should Become**

The information distributed by the CS includes Notice Advisory to Navstar Users (NANU), Operational Advisory (OA), and satellite almanac, and RINEX data. The NANU is a message that informs users of satellite outages and other GPS issues. The OA is a descriptive summary of GPS constellation status. The satellite almanac contains orbital and performance parameters for operational GPS satellites. The RINEX data contains monitor station (MS) observations. The primary means of data distribution include electronic mail (e-mail) and Internet and SIPRNET websites. All data transfer described in this ICD is unclassified.



# ICD-GPS-240A, Paragraph 3.2

#### **Is Currently**

#### 3.2 Interface Definitions

The following paragraphs define the physical interface between the CS and the Schriever AFB LAN on which the GUSS offline software tool resides. The following paragraphs also describe the functional interfaces between the CS and the GUSS tool, USCG NAVCEN, and the military user community.

Unless otherwise specified in the paragraphs below, e-mail used for data transfer is generated and transmitted using resources of the Schriever AFB LAN. Internet website hosting, uploads, and downloads are also accomplished using resources of the Schriever AFB LAN. SIPRNET website hosting, uploads, and downloads are accomplished using resources of the Peterson AFB LAN. The hardware and software interfaces of the internet and these LAN's are not controlled by this ICD. Therefore, these interfaces are described at the functional (application) level only in this ICD.

#### **Should Become**

#### 3.2 Interface Definitions

The following paragraphs define the physical interface between the CS and the Schriever AFB LAN on which the GUSS offline software tool resides. The following paragraphs also describe the functional interfaces between the CS and the GUSS tool, USCG NAVCEN, and the military user community, and the GPS user community.

Unless otherwise specified in the paragraphs below, e-mail used for data transfer is generated and transmitted using resources of the Schriever AFB LAN. Internet website hosting, uploads, and downloads are also accomplished using resources of the Schriever AFB LAN <u>or the National Geospatial</u> <u>Intelligence Agency (NGA)</u>. SIPRNET website hosting, uploads, and downloads are accomplished using resources of the Peterson AFB LAN. The hardware and software interfaces of the internet and these LAN's are not controlled by this ICD. Therefore, these interfaces are described at the functional (application) level only in this ICD.



# ICD-GPS-240A, Paragraph 3.2.4 (new)

**Is Currently** 

#### **Should Become**

3.2.4 Interfaces between the GPS CS and the IGS

The interface between the GPS CS and the IGS is shown in Figure 4.



## **ICD-GPS-240A**, Insert New Figure 4

• Insert new Figure 4



#### Figure 4 GPS CS to ICG Interface



# ICD-GPS-240A, Paragraph 3.2.4.1 (new)

#### **Is Currently**

#### **Should Become**

3.2.4.1 IGS RINEX Interface

RINEX data transmitted to the IGS for subsequent access by the GPS user community include the following ASCII files defined in RINEX Version 3.03 as available (e.g., L5 MS data will not be available if the subject satellite is not transmitting L5 signals):

- 1. Observation data file
- 2. Navigation message file
- 3. Meteorological data file

See RINEX Version 3.03 for additional details.



# ICD-GPS-240A, Paragraph 6.1

#### **Is Currently**

ICWG	Interface Control Working Group
ID	Identification
JDAY	Julian Day of the Year
NAV	Navigation
NAVCEN	Navigation Center
NC	No Change
OA	Operational Advisory
OCS	Operational Control System
POC	Point Of Contact
RB	Rubidium
S	Seconds
SEM	System Effectiveness Model

#### **Should Become**

ICWG	Interface Control Working Group
ID	Identification
<u>IGS</u>	International GNSS Service
JDAY	Julian Day of the Year
NAV	Navigation
NAVCEN	Navigation Center
NC	No Change
<u>NGA</u>	National Geospatial Intelligence Agency
OA	Operational Advisory
OCS	Operational Control System
:	
POC	Point Of Contact
RB	Rubidium
<u>RINEX</u>	Receiver Independent Exchange Format
S	Seconds
SEM	System Effectiveness Model
:	



# **ICD-GPS-870B** Changes

- BPCS does not change significantly with OCX
  - Architecturally, the MCS is still the MCS
    - Details about MCS SW/HW are not important at this level
- RINEX really is "Receiver Independent Exchange Format"
  - Observations independent of whether MSRE or OMSRE
- ICD-GPS-870B changes thus simply follow suit





# Thank You



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# MESSAGE TYPE 38 (MT-38)

K. Kovach (GPE/Aerospace)

UNCLASSIFIED



# Integrity Support Messages (ISMs); MT-38 for CNAV & CNAV-2

Karl Kovach, SMC/GPE(Aero)

Public Interface Control Working Group (PICWG) 21-22 September 2016

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#### • Technical references for Integrity Support Message (ISM):

- GPS-Galileo Working Group C, ARAIM Technical Subgroup Interim Report, Feb 13
- GPS-Galileo Working Group C, ARAIM Technical Subgroup Milestone 2 Report, Feb 15
- GPS-Galileo Working Group C, ARAIM Technical Subgroup Milestone 3 Report, Feb 16

#### • U.S. personnel

- Working Group C leadership: Mr. K. Alexander, FAA
- Working Group C technical contact: Mr. J. Burns, FAA
- ARAIM 'agent provocateur': Dr. P. Enge, Stanford University
- Author & 'worker bee': Mr. K. Kovach, Aerospace Corp.

#### • Proposed Interface Revision Notices (PIRNs)

- PIRNs for IS-GPS-705, IS-GPS-200, IS-GPS-800
- Public ICWG scheduled for Sep 16



# **Overview: ARAIM & Message Type 38**

- ARAIM is an advanced version of RAIM
  - *RAIM* = <u>*Receiver* <u>*Autonomous*</u> <u>*Integrity*</u> <u>*Monitoring*</u></u>
- Message Type 38 Definition
  - Message Type 38 expected to be presented at PICWG in September





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

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





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

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



	Table 20-XII. ISM Parameters							
	Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units			
GNSS ID	GNSS Constellation ID	4	1	8	see text			
P <sub>const</sub>	Probability of constellation integrity fault	3			see text			
$P_{sat}$	Probability of satellite integrity fault	3			see text			
t <sub>correl</sub>	Correlation time constant	3			see text			
$M_{\text{integrity}}$	URA multiplier for integrity	3			see text			
$M_{accuracy}$	URA multiplier for accuracy	3			see text			
b <sub>nominal</sub>	Nominal pseudorange bias	4			see text			
Flags	Valid for ARAIM flags	63 x (2)			see text			
<ul> <li>Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB.</li> <li>See Figure 20-15 for complete bit allocation in Message Type 38.</li> <li>Unless otherwise indicated in this column, effective range is the maximum range attainable with indicated bit allocation and scale factor.</li> </ul>								



#### 20.3.3.10.2 GNSS Constellation ID.

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

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



Table 20-XIII. ARAIM Validity Flag Mapping							
Bits	Galileo	GLONASS	BeiDou	GPS	SBAS	QZSS	IRNSS
151-152	SVID 1	Freq. 1	RCN 1	PRN 1	PRN 120	PRN 183	PRN 1
153-154	SVID 2	Freq. 2	RCN 2	PRN 2	PRN 121	PRN 184	PRN 2
155-156	SVID 3	Freq. 3	RCN 3	PRN 3	PRN 122	PRN 185	PRN 3
157-158	SVID 4	Freq. 4	RCN 4	PRN 4	PRN 123	PRN 186	PRN 4
159-160	SVID 5	Freq. 5	RCN 5	PRN 5	PRN 124	PRN 187	PRN 5
161-162	SVID 6	Freq. 6	RCN 6	PRN 6	PRN 125	PRN 188	PRN 6
163-164	SVID 7	Freq. 7	RCN 7	PRN 7	PRN 126	PRN 189	PRN 7
165-166	SVID 8	Freq. 8	RCN 8	PRN 8	PRN 127	PRN 190	Invalid
167-168	SVID 9	Freq. 9	RCN 9	PRN 9	PRN 128	PRN 191	Invalid
169-170	SVID 10	Freq. 10	RCN 10	PRN 10	PRN 129	PRN 192	Invalid
171-172	SVID 11	Freq. 11	RCN 11	PRN 11	PRN 130	PRN 193	Invalid
173-174	SVID 12	Freq. 12	RCN 12	PRN 12	PRN 131	PRN 194	Invalid
175-176	SVID 13	Freq. 13	RCN 13	PRN 13	PRN 132	PRN 195	Invalid
177-178	SVID 14	Freq. 14	RCN 14	PRN 14	PRN 133	PRN 196	Invalid
179-180	SVID 15	Freq. 15	RCN 15	PRN 15	PRN 134	PRN 197	Invalid
181-182	SVID 16	Freq. 16	RCN 16	PRN 16	PRN 135	PRN 198	Invalid
183-184	SVID 17	Freq. 17	RCN 17	PRN 17	PRN 136	PRN 199	Invalid
185-186	SVID 18	Freq. 18	RCN 18	PRN 18	PRN 137	PRN 200	Invalid
187-188	SVID 19	Freq. 19	RCN 19	PRN 19	PRN 138	PRN 201	Invalid
189-190	SVID 20	Freq. 20	RCN 20	PRN 20	PRN 139	PRN 202	Invalid
191-192	SVID 21	Freq. 21	RCN 21	PRN 21	PRN 140	Invalid	Invalid
193-194	SVID 22	Freq. 22	RCN 22	PRN 22	PRN 141	Invalid	Invalid
195-196	SVID 23	Freq. 23	RCN 23	PRN 23	PRN 142	Invalid	Invalid
197-198	SVID 24	Freq. 24	RCN 24	PRN 24	PRN 143	Invalid	Invalid
199-200	SVID 25	Freq. 25	RCN 25	PRN 25	PRN 144	Invalid	Invalid
201-202	SVID 26	Freq. 26	RCN 26	PRN 26	PRN 145	Invalid	Invalid
203-204	SVID 27	Freq. 27	RCN 27	PRN 27	PRN 146	Invalid	Invalid
205-206	SVID 28	Freq. 28	RCN 28	PRN 28	PRN 147	Invalid	Invalid
207-208	SVID 29	Freq. 29	RCN 29	PRN 29	PRN 148	Invalid	Invalid
209-210	SVID 30	Freq. 30	RCN 30	PRN 30	PRN 149	Invalid	Invalid
211-212	SVID 31	Freq. 31	RCN 31	PRN 31	PRN 150	Invalid	Invalid
213-214	SVID 32	Freq. 32	RCN 32	PRN 32	PRN 151	Invalid	Invalid
215-216	SVID 33	Invalid	RCN 33	PRN 33	PRN 152	Invalid	Invalid
217-218	SVID 34	Invalid	RCN 34	PRN 34	PRN 153	Invalid	Invalid
219-220	SVID 35	Invalid	RCN 35	PRN 35	PRN 154	Invalid	Invalid
221-222	SVID 36	Invalid	RCN 36	PRN 36	PRN 155	Invalid	Invalid
223-224	Invalid	Invalid	RCN 37	PRN 37	PRN 156	Invalid	Invalid
225-226	Invalid	Invalid	Invalid	PRN 38	PRN 157	Invalid	Invalid
227-228	Invalid	Invalid	Invalid	PRN 39	PRN 158	Invalid	Invalid
229-230	Invalid	Invalid	Invalid	PRN 40	Invalid	Invalid	Invalid
231-232	Invalid	Invalid	Invalid	PRN 41	Invalid	Invalid	Invalid
233-234	Invalid	Invalid	Invalid	PRN 42	Invalid	Invalid	Invalid
235-236	Invalid	Invalid	Invalid	PRN 43	Invalid	Invalid	Invalid
727 728	Involid	Involid	Involid	DDN 11	Involid	Involid	Involid





# Thank You



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### **MT-38 FOR IS-GPS-200**





### **MT-38 FOR IS-GPS-705**





### **MT-38 FOR IS-GPS-800**





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# CARRIER PHASE NOISE VIA 3<sup>RD</sup> ORDER JAFFE-RECHTIN PLL

PLL – Phase Lock Loop

K. Kovach (GPE/Aerospace) Ha Nguyen (GPC)

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# Carrier Phase Noise via 3<sup>rd</sup> Order Jaffe-Rechtin PLL: 350% Relaxation



Karl Kovach, SMC/GPE(Aero) Ha Nguyen, SMC/GPC

Public Interface Control Working Group (PICWG) 21-22 September 2016

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## **Overview**

#### This was an issue in the 2010 era

- Partially from Lockheed Martin
- Partially from Aerospace (Bakeman)
- Partially from GPC
- Issue has been settled
  - IS-GPS-200, IS-GPS-705, IS-GPS-800 are fine as now written
    - Not 'perfect', but 'acceptable'



# **Carrier Phase Noise in IS-GPS-200**

#### ICD-GPS-200 N/C (5 Nov 82)

- "The phase noise spectral density of the unmodulated carrier shall be such that a phase locked loop of 10 Hz one-sided noise bandwidth shall be able to track the carrier to an accuracy of 0.1 radians rms."
- ICD-GPS-200A, ICD-GPS-200B, ICD-GPS-200C
  - Ditto
- IS-GPS-200D, IS-GPS-200E, ICD-GPS-200F
  - Ditto
- IS-GPS-200G, ICD-GPS-200H
  - Ditto


### **Carrier Phase Noise in IS-GPS-705**

#### IS-GPS-705 N/C (24 Nov 03)

• "The phase noise spectral density of the unmodulated carrier shall be such that a phase locked loop of 10 Hz one-sided noise bandwidth shall be able to track the carrier to an accuracy of 0.1 radians root mean square (RMS). See additional supporting material for phase noise characteristics in section 6.3.2."

#### • IS-GPS-705A, IS-GPS-705B-R001, IS-GPS-705C, IS-GPS-705D

• Ditto



## **Carrier Phase Noise in IS-GPS-800**

#### • IS-GPS-800 N/C (4 Sep 08)

• "The phase noise spectral density of the unmodulated carrier shall not exceed the magnitude of a straight line (on a log-log plot) between -30 dBc/Hz at 1 Hz and -70 dBc/Hz at 1 x 10^4Hz, and the one-sided integrated phase noise spectrum between 1 Hz and 10 kHz shall not exceed 0.01 radians rms.

Or,

The phase noise spectral density of the unmodulated carrier shall be such that an approximation to the third order Jaffe-Rechtin phase lock loop, which has a 10 Hz one-sided loop noise bandwidth, shall be able to track the carrier to an accuracy of 0.01 radians rms."

#### • IS-GPS-800A, IS-GPS-800B

• Ditto



### **Carrier Phase Noise in IS-GPS-800**

- IS-GPS-800C (5 Sep 12)
  - *"The phase noise spectral density of the unmodulated carrier shall not exceed the magnitude of a straight line (on a log-log plot) between -30 dBc/Hz at 1 Hz and -70 dBc/Hz at 1 x 10^4Hz, and the one-sided integrated phase noise spectrum between 1 Hz and 10 kHz shall not exceed 0.01 radians rms.*

#### -<del>0r,</del>

The phase noise spectral density of the unmodulated carrier shall be such that an approximation to the third order Jaffe-Rechtin phase lock loop, <u>closed-loop transfer function H(f) such</u> <u>that  $|1 - H(f)|^2 = f^6/(f_n^6 + f^6)$  where  $f_n = 3B_L/(5\Pi)$ </u>, which has a 10 Hz one-sided loop noise bandwidth, shall be able to track the carrier to an accuracy of <del>0.01</del>0.035 radians rms."

#### • IS-GPS-800D

• Ditto



### Recommendations

- None
  - No issue here for ICWG to consider
    - Not in IS-GPS-800
    - Not across IS-GPS-200, IS-GPS-705, IS-GPS-800





# Thank You



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# OPERATIOAL ADVISORIES

B. Renfro (ARL:UT)

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### Comments on Operational Advisories – Mislabeled, Misleading, Mistaken

#### Brent A. Renfro

Applied Research Laboratories, The University of Texas at Austin

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September, 2016





APPLIED RESEARCH LABORATORIES

THE UNIVERSITY OF TEXAS AT AUSTIN

#### Background

- The Operational Advisory (OA) message is defined in
  - ICD-GPS-240
  - ICD-GPS-870
- Quote from ICD-GPS-240, Section 20.1

*"The Operational Advisory (OA) message provides a summary of the satellite constellation status."* 

- The OA consists of
  - Header
  - Section one satellites, planes, and clocks
  - Section two current and recent advisories
  - Section three points of contact for support and additional info.



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#### **Example of An Operational Advisory Message**

UNCLASSIFIED GPS OPERATIONAL ADVISORY 209.0A1 SUBJ: GPS STATUS 27 JUL 2016 1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM): A. BLOCK I : NONE B. BLOCK II: PRNS 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 : SLOT D2, D1, E1, E3, D4, A4, C3, F3, E2, D5, B4, F6, F1, F2 PLANE CLOCK : BLOCK II: PRNS 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 : SLOT B1, C4, E4, C5, B6, D3, E6, F4, A1, B2, B5, C2, B3, C1 PLANE CLOCK : BLOCK II: PRNS 30, 31, 32 : SLOT A3, A2, F5 PLANE CLOCK : RB, RB, RB 2. CURRENT ADVISORIES AND FORECASTS : A. FORECASTS: FOR SEVEN DAYS AFTER EVENT CONCLUDES. NANU MSG DATE/TIME SUMMARY (JDAY/ZULU PRN TYPE TIME START - STOP) 151521Z JUL 2016 26 2016043 FCSTDV 204/0820-204/2020 <Records omitted to reduce size> B. ADVISORIES: NANU MSG DATE/TIME PRN TYPE SUMMARY (JDAY/ZULU TIME START - STOP) C. GENERAL: NANU MSG DATE/TIME PRN TYPE SUMMARY (JDAY/ZULU TIME START - STOP) <Records omitted to reduce size> 3. REMARKS: A. THE POINT OF CONTACT FOR GPS MILITARY OPERATIONAL SUPPORT IS THE GPS OPERATIONS CENTER AT 719-567-2541 OR DSN 560-2541. B. CIVILIAN: FOR INFORMATION, CONTACT US COAST GUARD NAVCEN AT COMMERCIAL 703-313-5900 24 HOURS DAILY AND INTERNET HTTP://WWW.NAVCEN.USCG.GOV C. MILITARY SUPPORT WEBPAGES CAN BE FOUND AT THE FOLLOWING HTTPS://GPS.AFSPC.AF.MIL/GPS OR HTTPS://GPS.AFSPC.AF.MIL/GPSOC





THE UNIVERSITY OF TEXAS AT AUSTIN

#### Problems With Operational Advisory Messages

- Format limitations
  - Persistent problem since we moved to expanded slot constellation
- Inaccuracies
- Limitations in source of OA data
  - Problem whenever more than 6 SVs in a plane
- Concern Publishing and archiving incorrect information reduces trust in the product
- Examples of each of these problems follow





#### **Format Limitations**

- GPS has been operated as a 24+3 constellation with three expanded slots since 2011
  - AF press release on June 15, 2011 announced completion of transition
- SPS PS constellation definition
  - The three expanded slots have "fore" and "aft" positions
  - These are denoted by F/A in the SPS PS: e.g., B1F, F2A
  - Operators use this definition also
- OA definition does not support fore/aft nomenclature
  - Definition limited to one letter (plane) and one number (slot)
  - As a result, "aft" is shown as the base slot and "fore" is shown as slot 5
    - For example, F2A shows up as F2, F2F shows up as F5
  - The workaround is documented on the NAVCEN's GPS Constellation Status
    Page: <u>http://www.navcen.uscg.gov/?Do=constellationStatus</u>
  - Note: the workaround does not provide any way to distinguish between a slot that has been collapsed vs. a slot with the "fore" position empty
    - This already happened in slot B1F from March 2013 April 2015.



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#### Definition of 24+3 Constellation from SPS PS

		Slot	е	δ <sub>i</sub>	OMEGADOT	А	OMEGA₀	ω	Mo
		ID	(unit less)	(degrees)	(deg/sec)	(meters)	(degrees)	(degrees)	(degrees)
		A1	0.000	1.000	-4.4874E-7	26,559,710	357.734	0.000	268.126
	/	A2	0.000	1.000	-4.4874E-7	26,559,710	357.734	0.000	161.786
		A3	0.000	1.000	-4.4874E-7	26,559,710	357.734	0.000	11.676
		A4	0.000	1.000	-4.4874E-7	26,559,710	357.734	0.000	41.806
		B1F	0.000	1.000	-4.4874E-7	26,559,710	57.734	0.000	94.916
		B1A	0.000	1.000	-4.4874E-7	26,559,710	57.734	0.000	66.356
		B2	0.000	1.000	-4.4874E-7	26,559,710	57.734	0.000	173.336
		B3	0.000	1.000	-4.4874E-7	26,559,710	57.734	0.000	309.976
		B4	0.000	1.000	-4.4874E-7	26,559,710	57.734	0.000	204.376
expanded		C1	0.000	1.000	-4.4874E-7	26,559,710	117.734	0.000	111.876
slots	$\bigwedge$	C2	0.000	1.000	-4.4874E-7	26,559,710	117.734	0.000	11.796
		C3	0.000	1.000	-4.4874E-7	26,559,710	117.734	0.000	339.666
		C4	0.000	1.000	-4.4874E-7	26,559,710	117.734	0.000	241.556
	$\backslash \backslash$	D1	0.000	1.000	-4.4874E-7	26,559,710	177.734	0.000	135.226
		D2F	0.000	1.000	-4.4874E-7	26,559,710	177.734	0.000	282.676
		D2A	0.000	1.000	-4.4874E-7	26,559,710	177.734	0.000	257.976
		D3	0.000	1.000	-4.4874E-7	26,559,710	177.734	0.000	35.156
		D4	0.000	1.000	-4.4874E-7	26,559,710	177.734	0.000	167.356
		E1	0.000	1.000	-4.4874E-7	26,559,710	237.734	0.000	197.046
		E2	0.000	1.000	-4.4874E-7	26,559,710	237.734	0.000	302.596
		E3	0.000	1.000	-4.4874E-7	26,559,710	237.734	0.000	66.066
		E4	0.000	1.000	-4.4874E-7	26,559,710	237.734	0.000	333.686
		F1	0.000	1.000	-4.4874E-7	26,559,710	297.734	0.000	238.886
	4	F2F	0.000	1.000	-4.4874E-7	26,559,710	297.734	0.000	0.456
		F2A	0.000	1.000	-4.4874E-7	26,559,710	297.734	0.000	334.016
	[	F3	0.000	1.000	-4.4874E-7	26,559,710	297.734	0.000	105.206
		F4	0.000	1.000	-4.4874E-7	26,559,710	297.734	0.000	135.346

#### Table A.2-2. Expandable 24-Slot Constellation Almanac, at Epoch of 00:00:00 on 1 Jul 93

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#### **Example of An OA Inaccuracy**

- PRN 26 listed in both F5 (F2F) and B5 (B1F) for DOY 84-98, 2015
- Up through DOY 6, PRN 26 assigned to SVN 26
  - SVN 26 had occupied slot F2F. SVN 43/PRN 13 took over that responsibility
  - DECOM NANU 2015005. Transmission from SVN 26 as PRN 26 ceased DOY 10
- PRN 26 next assigned to SVN 71
  - SVN 71 launched on DOY 84 (NANU 2015019) into slot B1F (B5 by OA)
  - SVN 71 began transmission (unhealthy) on DOY 89
    - initially usable on DOY 110 (NANU 2015028)
- PRN 26 incorrectly appeared in OA as F5 (F2F) from DOY 11-98
  - PRN 26 should have been entirely missing for OA for DOY 11-83
- PRN 26 correctly appeared in OA as B5 (B1F) starting DOY 84
- Not only were we providing inaccurate information at the time, the problem persists in the historical record
  - Review of NANUs clears up the issues, but requires time and some level of expertise



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#### Example of an OA Inaccuracy – Time-History Plot



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#### Limitations in Source Data – The SV That Changed Planes

- OA shows SVN 51/PRN 20 assigned to E1 through DOY 110 of 2015
- OA designation for PRN 20 changes to B6 on DOY 111
  - PRN remains in this state up to this writing
  - DOY 111 corresponds to the day SVN 69/PRN 3 transitioned to E1
- From other sources, I believe the operators regard SVN 51/PRN 20 as being in E7
- Multiple sources tell me that there is a "six SV per plane" limit somewhere in the process. Therefore if there are more than six SVs in a plane, some are "administratively moved" to other planes for purposes of the OA
- If correct, this limitation leads to publication of inaccurate data
  - These data are being retained in the NAVCEN archives





#### Possible Fixes - 1

- Take no action
  - Continue publishing misleading, mislabeled, and mistaken data
  - Only a few subject matters experts appear to notice these flaws or care
  - On the other hand
    - OAs are archived by NAVCEN
    - FAA and ARL:UT need slot information for PAN reports, monthly report cards, and yearly performance analyses
    - GPS World and Univ. of New Brunswick both publish constellation data on-line
      - GPS World even includes notes on the SVN 51 E7/B6 confusion
- Fix the primary persistent problems
  - Change OA definition to accommodate unambiguous description of expanded/collapsed slot and F/A definition consistent with SPS PS
  - Change OA definition to show any SV beyond the "4 slots" as only being "in plane X" without specifying slot
    - Beyond the 24+3 slots, there are no defined locations for slots
  - Would need to develop a consensus on modified representation
  - Impacts requirements already on contract
  - Impacts deployed systems that refer to the OA (if any)



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#### Possible Fixes - 2

- Fix persistent problems and increase information in the OA
  - Fix the persistent problems as outline in previous option
  - Add PRN/SVN relationships
    - Currently documented in NANU as "header information" an "on change"
    - No official comprehensive record in public
  - Same impact as for fixing the problems
- TODAY'S PURPOSE
  - Bring this matter to the ICWG attempt to build some consensus for action
  - Doing anything will require a gov't sponsor/champion





## DISCUSSION





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# SOME BITS OF WARNING: HOW A CHANGE IN IS-GPS-705 AND IS-GPS-800 COULD SAVE LIVES

D. Spinden (Rockwell Collins)

**Special Topic** 

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# **OPEN DISCUSSION**

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# ACTION ITEM REVIEW

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# James Horejsi

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



## **Closing Comments**

- 2017 meetings for the GPS public documents are tentatively scheduled for September
- Direct any follow-up communication related to this meeting to smcgper@us.af.mil
- Final updates to the public documents will be available on GPS.gov following approval by the configuration control board
- Please provide feedback to the GPS requirements team to enable the continual improvement of this meeting



#### **Change Management High Level Process Flow**





# Thank You

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