Global Positioning System (GPS) Public Interface Control Working Group (ICWG) & Public Forum

June 16, 2026
0830-1500 PDT

GOVERNMENT POC
Dan Stevenson, SSC/SYD 831/S5, 310.653.3531

SE&I RESPONSIBLE ENGINEER POC
Tony Anthony, Integration & Tech Baseline, 310.418.7693

SE&I CONFIGURATION MANAGEMENT POC
Zena Walker, Configuration/Data Management, 310.386.1964

United States Space Force
Space Systems Command
System Delta 831
Daniel Stevenson

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Dial-in Information

MS Teams Meeting Link:

https://dod.teams.microsoft.us/l/meetup-join/19%3adod%3ameeting_aa4774f66ff44ad6b5f209643665195%40thread.v2/0?context=%7b%22Tid%22%3a%228331b18d-2d87-48ef-a35f-ac8818ebf9b4%22%2c%22Oid%22%3a%2287a32064-cfb0-4c32-867b-0f7cf2dd1434%22%7d

Meeting ID: 993 250 433 301

Passcode: Gt2o45Ea

Dial in by phone

+1 410-874-6750,,764408612# United States, Odenton

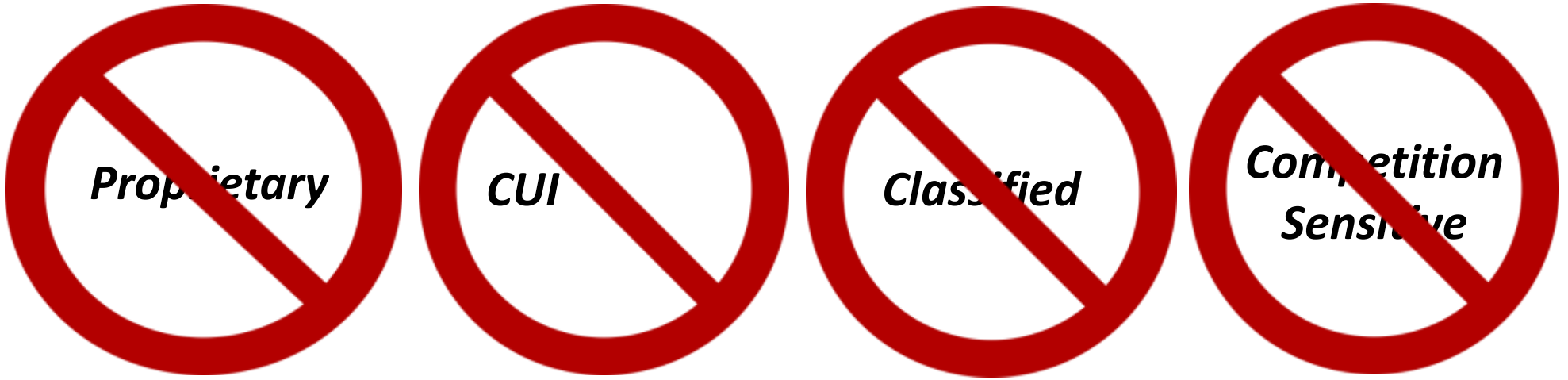
Find a local number

Phone conference ID: 764 408 612#

Roll Call

Rules of Engagement

UNCLASSIFIED



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

Rules of Engagement (Cont'd)

- Please place your phones on mute when not speaking to minimize background noise
- For dial-in attendees, DO NOT take calls from phone while on telecom
- Comments aligned with topics listed on the official agenda will get priority during discussion
- Topics that warrant additional discussion may be side-barred
- Walk-on topics may be discussed during the open discussion
- Meeting minutes and final Proposed Change Notices (PCNs) will be generated and distributed as a product of this meeting
- Please announce your name and organization before addressing the group

Rules of Engagement (Cont'd)

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

Rules of Engagement (Cont'd)

The purpose of the meeting is to:

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

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

Action Items and Feedback

- We will record actions during the discussions and share during the Action Item agenda item

- If you have further actions or feedback after the 2026 PICWG please submit to ssc.cg.picwg@spaceforce.mil

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PICWG Agenda

Public ICWG (1st Half of Day)	Presenter	Times
GPS Public ICWG and Public Forum Meeting Overview	Dan Stevenson	08:30 08:45
Opening Remarks / GPS Overview	Dan Stevenson	08:45 09:05
2026 Public ICWG RFC Discussion		
RFC-519 – Civil ISM Formats (Delta AWG)	Tony Anthony	09:05 9:30
Action Item Review		09:30 09:35
RFC-544 – Eccentric Anomaly Rate & No Cost Items (AWG)	Tony Anthony	09:35 10:30
Break		**10:30 10:40**
RFC-544 (Cont.)	Tony Anthony	10:40 11:50
Action Item Review		11:50 12:00

Public Forum Presentations (2nd Half of Day)	Presenter	Times
Lunch Break (1 hour)		12:00 13:00
Walk-on Topics, Open Discussion	--	13:00 13:30
Action Item Review		13:30 13:40
PRAT - Public Req. Accountability Tool	Tony Anthony	13:40 14:10
Action Item Review		14:10 14:25
Closing Remarks	Dan Stevenson	14:25 14:30

Opening Remarks

Global Positioning System (GPS) Position, Navigation, & Timing Mission Area

June 16, 2026

Mr. Daniel Stevenson

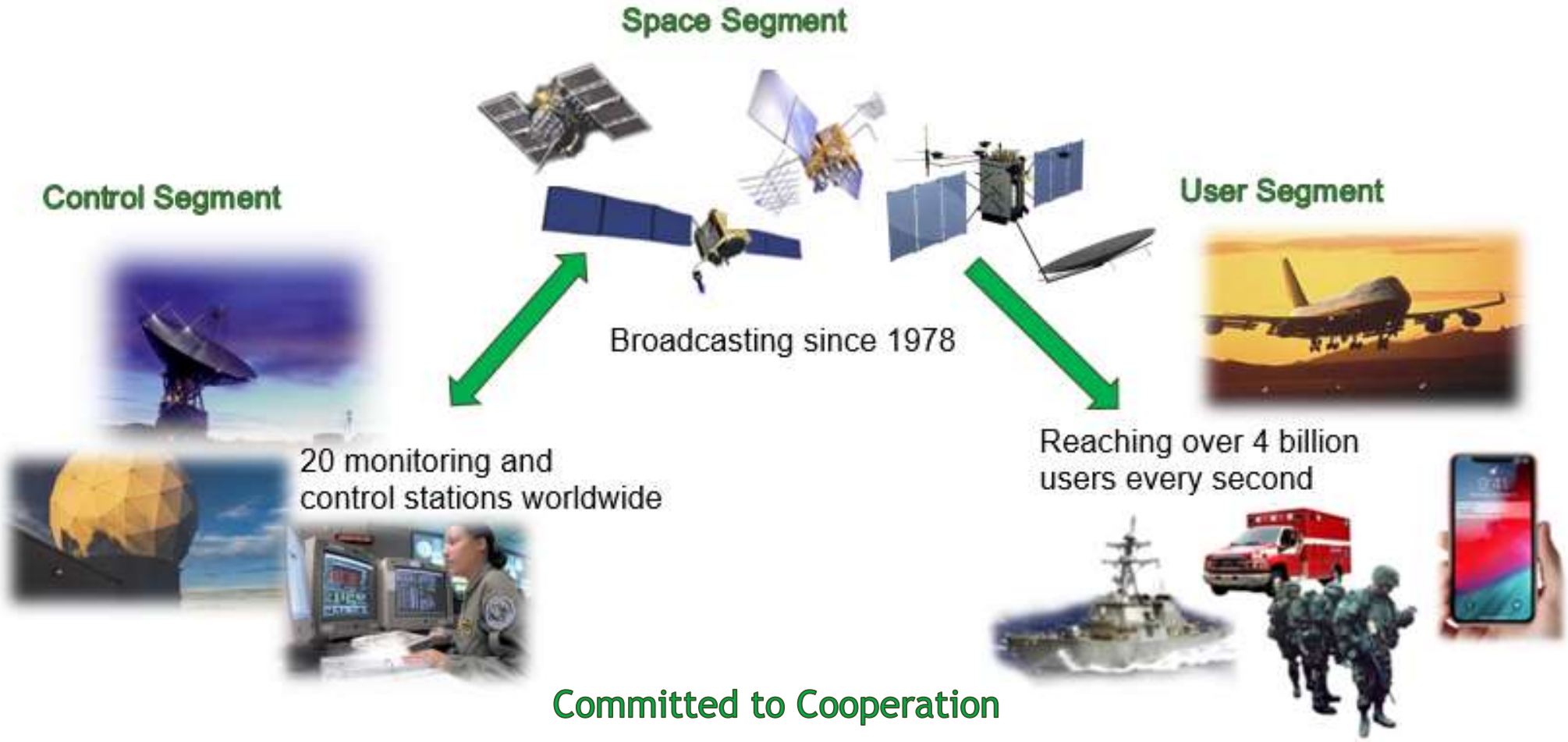
Director, Positioning, Navigation and Timing (PNT) Systems Engineering, Integration, and Test (SEIT)

GPS Overview

June 16, 2026

Mr. Daniel Stevenson
Chief, PNT SEIT Branch

GPS Overview



Committed to Cooperation

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

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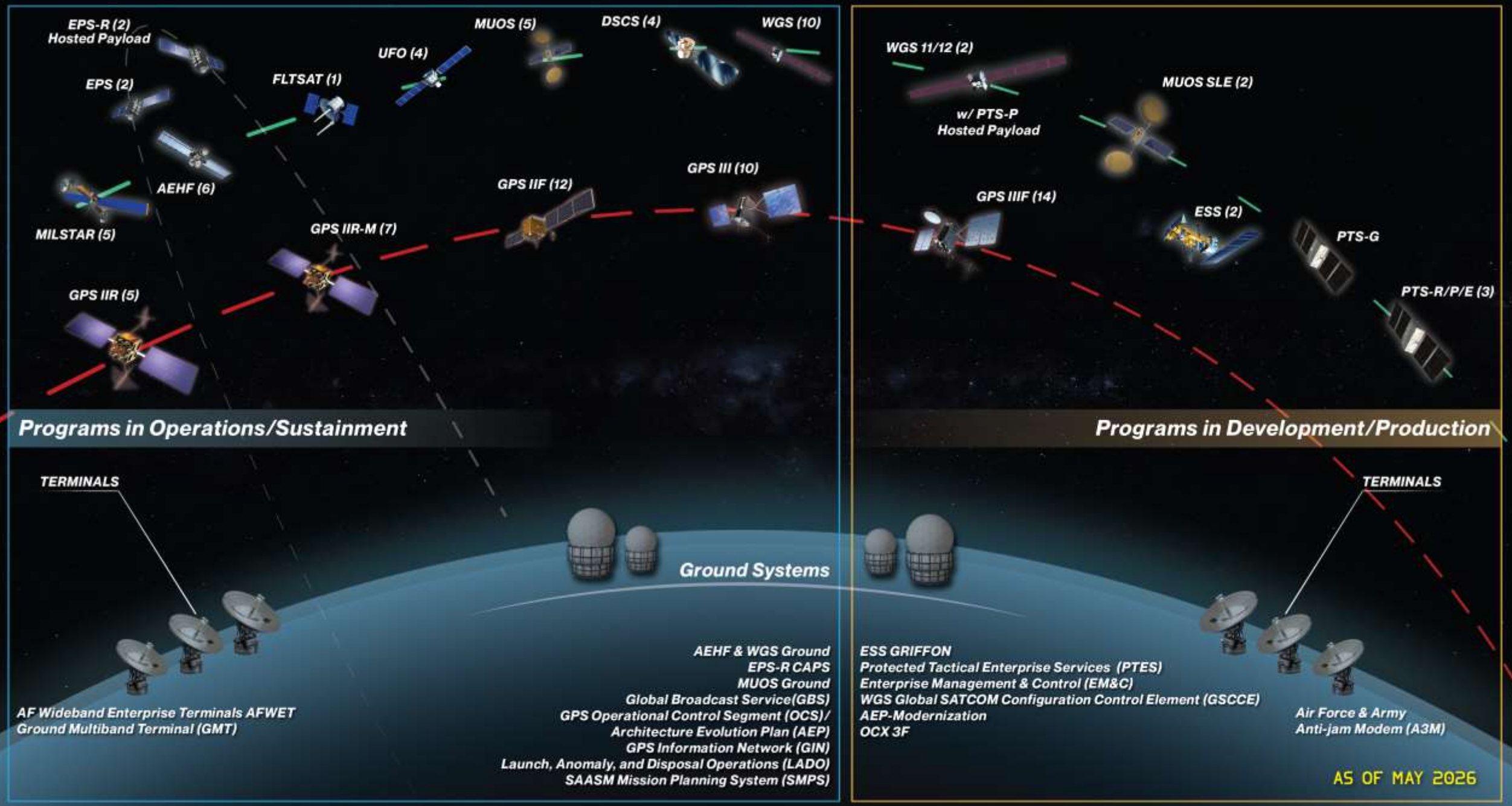
GPS Overview

Global Positioning Satellites: Encompassing the DoW and Civil Industry Partners

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

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


EPS-R (2)
Hosted Payload
EPS (2)
FLTSAT (1)
UFO (4)
MUOS (5)
DSCS (4)
WGS (10)
AEHF (6)
MILSTAR (5)
GPS IIF (12)
GPS III (10)
GPS IIR-M (7)
GPS IIR (5)
WGS 11/12 (2)
w/ PTS-P
Hosted Payload
MUOS SLE (2)
GPS IIIF (14)
ESS (2)
PTS-G
PTS-R/P/E (3)
Programs in Operations/Sustainment
Programs in Development/Production
TERMINALS
TERMINALS
Ground Systems
AF Wideband Enterprise Terminals AFWET
Ground Multiband Terminal (GMT)
AEHF & WGS Ground
EPS-R CAPS
MUOS Ground
Global Broadcast Service(GBS)
GPS Operational Control Segment (OCS)/
Architecture Evolution Plan (AEP)
GPS Information Network (GIN)
Launch, Anomaly, and Disposal Operations (LADO)
SAASM Mission Planning System (SMPS)
ESS GRIFFON
Protected Tactical Enterprise Services (PTES)
Enterprise Management & Control (EM&C)
WGS Global SATCOM Configuration Control Element (GSCCE)
AEP-Modernization
OCX 3F
Air Force & Army
Anti-jam Modem (A3M)
AS OF MAY 2026

GPS Constellation Status

39 Satellites • 32 Set Healthy
Baseline Constellation: 24 Satellites

Satellite Block	Quantity	Average Age (yrs)	Oldest (yrs)
GPS IIR	5 (4*)	24.6	28.8
GPS IIR-M	7 (1*)	18.6	20.6
GPS IIF	11 (1*)	12.3	16.0
GPS III	9 (1*)	3.7	7.4

*Not set healthy

As of 19 May 26

GPS Signal in Space (SIS) Performance

From 19 May 25 to 19 May 26

Average URE*	Best Day URE	Worst Day URE
30.8 cm	25.3 cm (04 Feb 2026)	38.1 cm (29 Mar 2026)

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

GPS III is the newest block of GPS satellites

GPS Signals
4 civil signals: L1 C/A, L1C, L2C, L5 4 military signals: L1/L2 P(Y), L1/L2M

GPS On-orbit Satellites

IIR On-orbit

SVNs	Mission	Launch Date	Years From Launch	Avg Operation Life
SVN43	IIR-02	23-Jul-97	28.8	24.6
SVN46*	IIR-03	7-Oct-99	26.6	
SVN51*	IIR-04	11-May-00	26.0	
SVN44	IIR-05	16-Jul-00	25.8	
SVN41*	IIR-06	10-Nov-00	25.5	
SVN56	IIR-08	29-Jan-03	23.3	
SVN59	IIR-11	20-Mar-04	22.2	
SVN60*	IIR-12	23-Jun-04	21.9	
SVN61	IIR-13	6-Nov-04	21.5	

IIR-M On-orbit

SVNs	Mission	Launch Date	Years From Launch	Avg Operation Life
SVN53	IIR-14M	26-Sep-05	20.6	18.6
SVN52	IIR-15M	25-Sep-06	19.6	
SVN58	IIR-16M	17-Nov-06	19.5	
SVN55	IIR-17M	17-Oct-07	18.6	
SVN57	IIR-18M	20-Dec-07	18.4	
SVN48	IIR-19M	15-Mar-08	18.2	
SVN49*	IIR-20M	24-Mar-09	17.2	
SVN50	IIR-21M	17-Aug-09	16.8	

IIF On-orbit

SVNs	Mission	Launch Date	Years From Launch	Avg Operation Life
SVN62	IIF-01	28-May-10	16.0	12.3
SVN63	IIF-02*	14-Jul-11	14.8	
SVN65	IIF-03	4-Oct-12	13.6	
SVN66	IIF-04	15-May-13	13.0	
SVN64	IIF-05	20-Feb-14	12.2	
SVN67	IIF-06	16-May-14	12.0	
SVN68	IIF-07	1-Aug-14	11.8	
SVN69	IIF-08	29-Oct-14	11.6	
SVN71	IIF-09	25-Mar-15	11.2	
SVN72	IIF-10	15-Jul-15	10.8	
SVN73	IIF-11	31-Oct-15	10.5	
SVN70	IIF-12	5-Feb-16	10.3	

III On-orbit

SVNs	Mission	Launch Date	Years From Launch	Avg Operation Life
SVN74	III-01	23-Dec-18	7.4	3.7
SVN75	III-02	22-Aug-19	6.7	
SVN76	III-03	30-Jun-20	5.9	
SVN77	III-04	5-Nov-20	5.5	
SVN78	III-05	17-Jun-21	4.9	
SVN79	III-06	18-Jan-23	3.3	
SVN80	III-07	17-Dec-24	1.4	
SVN81	III-08	30-May-25	1.0	
SVN82	III-09	28-Jan-26	0.3	
SVN83	III-10	21-Apr-26	0.1	

GPS L5: Safety of Life

Capability **L5 PNT IOC**

Forecast	FY2026	FY2029
Space	18+ L5 SVs • GPS IIF • GPS III	24+ L5 SVs • GPS IIF • GPS III • GPS IIIF
Control	C2 L5 SVs • Under Study	C2 L5 SVs • Under Study
User	Civil Receivers	Civil Receivers

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GPS III Spacecraft

- SV01 Set healthy and available for use on 13 Jan 20
- SV02 Set healthy and available for use on 01 Apr 20
- SV03 Set healthy and available for use on 01 Oct 20
- SV04 Set healthy and available for use on 02 Dec 20
- SV05 Set healthy and available for use on 25 May 22
- SV06 Set healthy and available for use on 16 Feb 23
- SV07 Set healthy and available for use on 22 Jan 25
- SV08 Set healthy and available for use on 25 Jun 25
- SV09 Set healthy and available for use on 07 Feb 26
- SV10 On orbit; Operational Acceptance occurred on 12 MAY 26

Ten GPS III satellites declared operational

GPS III Follow-On (GPS IIIF) Spacecraft

- GPS IIIF additional features:
  - Regional Military Protection (RMP)
  - Redesigned Nuclear Detonation (NUDET) Detection System (NDS)
  - Search-and-Rescue (SAR) payload – faster detection and location of distress signals
  - Laser Retroreflector Array (LRA) – provides more precise ranging data
- Total Program Quantity: Up to 22 (14 currently on-contract)
- GPS IIIF Non-Flight Satellite Testbed (GNST+) build-up
  - Completed July 2023
- GNST+ Pathfinding Completed Jul 2024
- SV11 launch forecast for NET 4QFY28

Ensuring the Gold Standard today and into the future

GPS Enterprise Modernization

SPACE SEGMENT (SATELLITES)

Legacy (GPS IIA/IIR)
- NUDET (Nuclear Detonation) Detection System (NDS)

GPS IIR-M
- 2nd Civil Signal (L2C)
- New Military Signal
- Increased Anti-Jam

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

GPS III (SV01-10)
- Accuracy & Power
- Increased Anti-Jam Power
- Inherent Signal Integrity
- 4th Civil Signal (L1C)

GPS IIIF (SV11-32)
- Search & Rescue (SAR) Payload
- Laser Retroreflector Array
- Redesigned NDS Payload
- Regional Military Protection (RMP)

CONTROL SEGMENT (GROUND)

Legacy (OCS)
- Command & Control
- Signal Monitoring

Architecture Evolution Plan (AEP)
- Distributed Architecture
- Increased Signal Monitoring & Accuracy

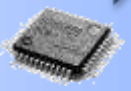
Architecture Evolution Plan-Modernized (AEP-M)
- Details to follow

USER SEGMENT (RECEIVERS)

Legacy (PLGR/GAS-1/MAGR)
- First Generation System

SAASM-era User Equipment
- Anti-Jam capability
- Electronic Protection

Military GPS User Equipment
- Common GPS Modules
- Increased Access
- Increased Accuracy, Availability, Anti-Tamper Anti-Spoof
- Increased Acquisition in Jamming

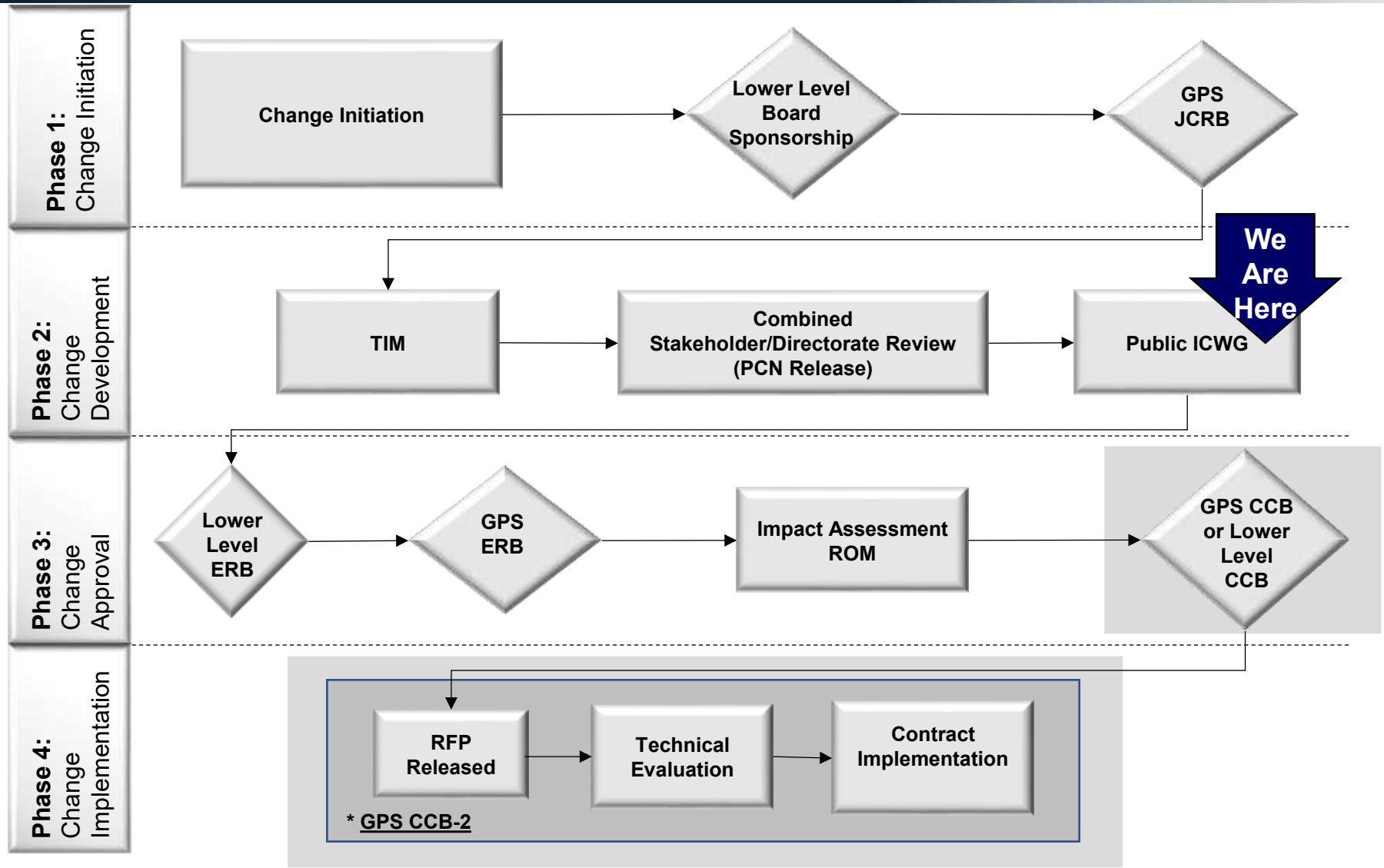


GPS Requirements Management

June 16, 2026

Mr. Daniel Stevenson
Director, PNT SEIT

Technical Baseline Change Management Process Flow Chart



JCRB= Joint Change Review Board
ERB= Engineering Review Board
TIM= Technical Interchange Meeting
ROM= Rough Order of Magnitude
PCN= Proposed Change Notice
CCB= Configuration Control Board
ICWG= Interface Control Working Group
RFP= Request for Proposal

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QUESTIONS?

Positioning, Navigation and Timing Mission Adjudication Working Group (AWG) Slides

Template Version 22a – March 3, 2026

PUBLIC “DELTA” AWG
16-JUN-2026

DOCUMENT CLASSIFICATION
Unclassified

REQUEST FOR CHANGE (RFC) NUMBER
RFC-00519

RFC TITLE
Civil Integrity Support Message (ISM) Formats

GOVERNMENT POC
Dan Stevenson, SSC/SYD 831/S5, 310.653.3531

SE&I RESPONSIBLE ENGINEER POC
Tony Anthony, Integration & Tech Baseline, 310.418.7693

SE&I CONFIGURATION MANAGEMENT POC
Zena Walker, Configuration/Data Management, 310.386.1964

RFC-00519 BLUF

- Two of the RFC-544 Comments were about issues that actually should be fixed in RFC-00519 “Civil Integrity Support Message (ISM) Formats”
  - Affects IS200-572 plus corresponding DOORS IDs IS705-261, IS800-190 as well
  - Solution also affects corresponding DOORS IDs IS200-1952, IS705-265, IS800-193
  - The corrections will go back into RFC-00519 and be reflected in that RFC’s IRNs since it has not yet reached the “Lower Level ERB” gate
  - A third comment was generated in the Government AWG and accepted
- This started as an incidental overlap between these paragraphs in RFC-519 and RFC-544 where we decided to normalize the multiply operators
- Most Redlines show red/blue for the changes shown in last year’s PCNs after the PICWG/AWG
  - Changes made recently in response to the comments are shown in green font

RFC-519: Civil Integrity Support Message (ISM) Formats

DISCOVERY EVENT:	FAA PMR – 30-Jul-2024
RFC CHANGE TYPE:	Correction or Clarification to Baseline

1) PROBLEM STATEMENT:

Complete the Civil Integrity Support Message format portion to enable the ARAIM capability in time to meet FAA's needs in support of RTCA/DO-401A and EUROCAE/ED-259B.

(Pre-RFC-1200, Pre-RFC 1269, partial Pre-RFC-1326)

2) SOLUTION:

Expand and update current related requirements to build solid definitions for the civil ISM messages:

1. L2C and L5 CNAV MT-40 (IS-GPS-200, IS-GPS-705)
2. L1C Subframe 3 Page 8 (IS-GPS-800)

RFC-00519

Comment Resolution Matrix (CRM) Status – for PICWG

16a) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:						
Disposition/Type	**Critical**	**Substantive**	**Administrative**	**Totals**	**Concurrence**	**Notes**
Accept	**00**	**3**	**00**	**3**	**3**	
Accept with Comment	**00**	**00**	**00**	**00**	**00**	
Reject	**00**	**00**	**00**	**00**	**00**	
Question	**00**	**00**	**00**	**00**	**00**	
Defer	**00**	**00**	**00**	**00**	**00**	
TBD	**00**	**00**	**00**	**00**	**00**	
Withdrawn	**00**	**00**	**00**	**00**	**00**	
Grand Totals:	**00**	**3**	**00**	**3**	**3**	

RFC-00519
Comment Resolution Matrix (CRM) Status – at PICWG

17a) CRM AWG REVIEW STATUS:						
Disposition/Type	**Critical**	**Substantive**	**Administrative**	**Totals**	**Concurrence**	**Notes**
Accept	**00**	**00**	**00**	**00**	**00**	
Accept with Comment	**00**	**00**	**00**	**00**	**00**	
Reject	**00**	**00**	**00**	**00**	**00**	
Defer	**00**	**00**	**00**	**00**	**00**	
Grand Totals:	**00**	**00**	**00**	**00**	**00**	

URA Formulae Not Correct

DOORS ID	IS200-572, IS705-261, IS800-190, IS200-1952, IS705-265, IS800-193		
Paragraph	30.3.3.2.4.0-3	**Comment Number**	#66, #68, #75
Comment Type	Substantive	**Disposition**	Accept
Comment Originator(s)	RTX Concurs L3 Harris Concurs		
Comment	66. Nominal URA_NED cannot be set to URA_NED0. Because of the optimized CNAV URA fitting scheme in NIM, NED0 does not reflect a monotonically increasing URA value. As time progresses, NED1 (and NED2) become dominate players to determining total URA_NED. Thus, NED0 values can shrink. It is common for NED0 index values to shrink from say -2 for first CNAV message at TOP, to -5 or -6 for the 4th or 5th CNAV message. In rare cases, NED0 values may shrink to -14 or -13 for AODs well past 24 hrs. This is because the NED1 and NED2 terms are sufficient to provide almost (or all) of the required total URA_NED value. It is likely GPS III does much the same as NIM. This info is still being sought for GPS III CSM message validation. NIM would need a SW change to fix this. But making NED0 a reasonable approximation of nominal URA would have severe impacts to upper bound performance and potentially drastically increase the size of URAs. 68. These objects redefine nominal URA for NED. Would potentially impact OCX NAV metric output and CSM URA approach. Assume OCX NAV URA metrics remain calculating nominal URA including time dependent terms. 75. Remove “zeroth order” since this term no longer has relevance		
Government Response	Accept. Formulae need correction and additions in all three documents. DOORS IDs IS200-1952, IS705-265, IS800-193 all needed updating for a full correction		

Nominal URA_{NED} Formula Corrections

Paragraph	IS200-572, IS705-261, IS800-190
IS200-572, IS705-261, IS800-190	The user shall calculate the NED-related URA with the equation (in meters);

- **Blue is prior RFC-519 PICWG presented changes**
- **Green is recent changes**
- **The "for t…" conditions were moved above the dependent formulas**
- **Moves and deletions are removed**

for $t - t_{op} + 604{,}800\ (WN - WN_{op}) \leq 93{,}600$ seconds

$$\text{nominal } URA_{NED} = \text{nominal } URA_{NED0} + URA_{NED1}\ (t - t_{op} + 604{,}800\ (WN - WN_{op}))$$

$$IAURA_{NED} = \text{Upper Bound } URA_{NED0} + URA_{NED1}\ (t - t_{op} + 604{,}800\ (WN - WN_{op}))$$

for $t - t_{op} + 604{,}800\ (WN - WN_{op}) > 93{,}600$ seconds

$$\text{nominal } URA_{NED} = \text{nominal } URA_{NED0} + URA_{NED1}\ (t - t_{op} + 604{,}800\ (WN - WN_{op})) + URA_{NED2}\ (t - t_{op} + 604{,}800\ (WN - WN_{op}) - 93{,}600)^2$$

$$IAURA_{NED} = \text{Upper Bound } URA_{NED0} + URA_{NED1}\ (t - t_{op} + 604{,}800\ (WN - WN_{op})) + URA_{NED2}\ (t - t_{op} + 604{,}800\ (WN - WN_{op}) - 93{,}600)^2$$

where

t is the GPS system time

IS-GPS-200 URA Corrections

Paragraph	IS200-1952 30.3.3.2.4.0-9
IS200-576 • **Blue is prior RFC-519 approved changes** • **Green is recent changes**	For each URA_{NED0} index (N), users may compute a nominal URA_{NED0} value (X) as given by: • If the value of N is 6 or less, but more than -16, $X = 2^{(1 + N/2)}$, • If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$, • N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk. For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively.
IS200-1952	The nominal URA_{NED0} value ~~(X)~~ computed from the non-elevation dependent indices shall be suitable for use as a conservative prediction of the RMS NED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting RAIM, FOM computations). Integrity properties of the $IAURA_{NED}$ are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the URA_{NED0} index, and values of the URA_{NED1} index, and URA_{NED2} index (see 30.3.3.1.1). Non-elevation dependent URA_{NED0} accounts for ~~zeroth order~~ SIS-contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error; the net effect of CNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A and L2C users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. Non-elevation dependent URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

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IS-GPS-705 URA Corrections

Paragraph	IS705-265 20.3.3.2.4.0-8
IS705-265 • **There were no prior RFC-519 approved changes** • **Green is recent changes**	For each URA_{NED0} index (N), users may compute a nominal URA_{NED0} value (X) as given by: • If the value of N is 6 or less, but more than -16, $X = 2^{(1 + N/2)}$, • If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$, • N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk. For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively. The nominal URA_{NED0} value computed from the non-elevation dependent indices shall be suitable for use as a conservative prediction of the RMS NED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting RAIM, FOM computations). Integrity properties of the $IAURA_{NED}$ are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the URA_{NED0} index, and values of the URA_{NED1} index, and URA_{NED2} index (see 20.3.3.1.1). Non-elevation dependent URA_{NED0} accounts for ~~zeroth order~~ SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L5 users who correct the code phase as described in Section 20.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A/L5 users who correct for group delay and ionospheric effects as described in Section 20.3.3.3.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. Non-elevation dependent URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

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IS-GPS-800 URA Corrections

Paragraph	IS800-193 3.5.3.8.0-8
IS800-1106 (lower half)	… For each URA_{NED0} index (N), users may compute a nominal URA_{NED0} value (X) as given by: • If the value of N is 6 or less, but more than -16, $X = 2^{(1 + N/2)}$, • If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$, • N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk.
IS800-193 • **Blue is prior RFC-519 approved changes** • **Green is recent changes**	For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively. The nominal URA_{NED0} value ~~(X)~~ computed from the non-elevation dependent indices shall be suitable for use as a conservative prediction of the RMS NED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting RAIM, FOM computations). Integrity properties of the IAURA$_{NED}$ are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the URA_{NED0} index, and values of the URA_{NED1} index, and URA_{NED2} index (see 3.5.3.10.1). Non-elevation dependent URA_{NED0} accounts for ~~zeroth order~~ SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C users who correct the code phase as described in Section 3.5.3.9; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1C/L2C and L1C/L5 users who correct for group delay and ionospheric effects as described in Section 3.5.3.9; radial ephemeris error; anisotropic antenna errors; and signal deformation error. Non-elevation dependent URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

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RFC-00519 AWG Open Discussion

QUESTIONS & COMMENTS?

Action Item Review

Positioning, Navigation and Timing Mission Adjudication Working Group (AWG) Slides

Template Version 22a – March 3, 2026

PUBLIC ICWG AWG
16-JUN-2026

DOCUMENT CLASSIFICATION
Unclassified

REQUEST FOR CHANGE (RFC) NUMBER
RFC-00544

RFC TITLE
Eccentric Anomaly Rate Fix and No Cost Items

GOVERNMENT POC
Dan Stevenson, SSC/SYD 831/S5, 310.653.3531

SE&I RESPONSIBLE ENGINEER POC
Tony Anthony, Integration & Tech Baseline, 310.418.7693

SE&I CONFIGURATION MANAGEMENT POC
Zena Walker, Configuration/Data Management, 310.386.1964

RFC-00544 Review Results So Far

- Received 72 comments from 6 government stakeholders or prime contractors
  - All of these comments have been dispositioned and concurred by the originators
  - This presentation shows the changes made due to these dispositions since the public review went out in January 2026
- Received one comment from the public
- Most Redlines show red/blue for the changes shown in January PCNs
  - Changes since then are typically shown in green font
- Next Up Revs
  - Planning to have all approved RFC-519 and RFC-544 updates
  - Planning to have all table notes updated from “****” to “NOTEn” convention

RFC-000544: Eccentric Anomaly Rate Fix and No Cost Items

DISCOVERY EVENT:	13-May-2025 Public ICWG
RFC CHANGE TYPE:	Correction or Clarification to Baseline / As-Built or As-Designed Baseline Update from XML

1) PROBLEM STATEMENT:

1. The Eccentric Anomaly Rate formula in all documents that describe this CNAV formula are incorrect
2. There are requirements and description changes from RFC-495A and RFC-502 which did not make it into the requirements baseline but are still correct and would help civil user equipment engineers make better civil receivers. This includes a number of Core CEI description changes that were worked out, but did not make it into RFC-502.
3. PRAT Item 2020-03 to normalize the use of scientific notation across the Public GPS interface documents has only been partially implemented
4. During the last Public ICWG, it became apparent that the Public interface documents do not use a uniform method of documenting multiplication in formulas
5. RFC-515 made a number of changes to XML which still need to be made to ICD-GPS-870 to ensure that Public users of XML are executing XML correctly

2) SOLUTION:

1. The Eccentric Anomaly Rate formula will be corrected in all CNAV Public documents (PRAT 2025-02, Pre-RFC-1445)
2. The changes from RFCs-495A and 502 would be added into the requirements baseline (PRAT 2021-03)
3. The changes needed to normalize the use of scientific notation in the Public GPS interface documents will be completed (PRAT 2020-03)
4. The few places that used “*” or “x” to denote multiplication of scalar values would be normalized to what is used across the Public Signal-In-Space documents
5. The XML to ICD-GPS-870 would be completed so it describes the as-built XML system (Pre-RFC-1354, promulgates and completes the work started in RFC-515)

RFC Approval and Schedule

3) APPROVAL AUTHORITY:		
☑ Inter-Delta		Proposed change affects BOTH SYD 831 and MD 31 Technical Baseline documentation
❑ Intra-SYD 831	❑ Intra-MD 31	Proposed change affects EITHER SYD 831 or MD 31 Technical Baseline documentation
Lower-Level ❑ S5 ❑ SYD3	Lower-Level ❑ CHEG ❑ 31 CDS ❑ 31 STS	Proposed change affects EITHER SYD 831 or MD 31 Technical Baseline documentation. Authority for subsequent decisions delegated to Lower-Level Board

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

Sponsor: CGEV | Driver Event: L2C / L5 IOC | Driver Event Date: TBD

CRB	TIM	Stakeholder Review	Comments Due	Resolve Comments	AWG	LL ERB	ERB	CRB2	Impact Assessment Period	LL CCB	CCB
4 Aug 25	23 Sep 25	Govt Review 6 Oct 25	Govt Due 19 Dec 25	Govt Comm. Resolve 15 Jan 26	Govt AWG 18 Mar 26	31 Aug 26	15 Sep 26	15 Sep 26	18 Sep 26 – 13 Nov 26	1 Dec 26	15 Dec 26
		Public Review 27 Jan 26	Public Comm. Due 13 Mar 26	Public Comm. Resolve 27 Mar 26	PICWG 16 Jun 26						

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Enterprise Priority Rating (EPR)

5c) ENTERPRISE PRIORITY RATING: 13 Ref. EPR - hyperlink)

The following weighted criteria were chosen to develop this EPR:

Category	Weight	Description
Mission Impact (32.5%)	100	Mission Critical is defined as a requirement vital for the present and/or immediate GPS Enterprise's, Space Force, and/or National Defense goals and objectives. Failure to fund will result in extreme risk or high probability of catastrophic consequences to mission accomplishment and there are no work-arounds or alternative solutions.
	75	Mission Essential is defined as a requirement needed for impending GPS Enterprise's, Space Force, and/or National Defense goals and objectives. Failure to fund will significantly degrade, but not prevent GPS Enterprise's mission accomplishment and there are no acceptable work-arounds or alternative solutions.-
	50	Mission Enhancement I (for many or high priority users) is defined as a requirement that will improve or increase future abilities to meet GPS Enterprise objectives; if not funded will not adversely affect the current mission accomplishment.
	25	Mission Enhancement II (for few users) is defined as a requirement that will improve or increase future abilities to meet GPS Enterprise objectives; if not funded will not adversely affect the current mission accomplishment.
	0	No Mission Impact
CDD / Guidance / Capability Impact (32.5%)	100	Not making change precludes system from meeting a KPP or providing a GPS Capability.
	75	Not making change precludes system from meeting a KSA, and/or precludes system from meeting other high level guidance, and/or impairs ability to meet KPP or provide a GPS Capability
	50	Not making change precludes system from meeting an APA, and/or impairs ability to meet other high level guidance.
	25	Not making change reduces supportability of any CDD requirement or GPS capability, can be tolerated with little impact on program objectives.
	0	Change has minimal/no consequences to meeting CDD requirements or delivering GPS Capabilities.

Category	Weight	Description
Performance / Operator Impact / Cyber / NAVWAR (20%)	100	Without change, unable to meet PPS, SPS, or SS-SYS-800 requirements. And/or resolves a "Critical" operator issue. And/or mitigates an assessed cyber "Very High" or "High". mitigates an assessed NAVWAR risk(s) of "Very High" or "High".
	75	Significant performance impact affecting GPS user PNT. And/or resolves a "Moderate" operator issue. And/or mitigates an assessed cyber "Moderate". mitigates an assessed NAVWAR risk(s) of "Moderate".
	50	Minor performance impact affecting GPS user PNT. And/or resolves a "Minor" operator issue. And/or mitigates an assessed cyber risk(s) of "Low". mitigates an assessed NAVWAR risk(s) of "Low".
	25	Minimal performance impact affecting GPS user PNT. And/or resolves a "Minimal" operator issue. And/or mitigates an assessed cyber "Very Low". mitigates an assessed NAVWAR risk(s) of "Very Low".
	0	No performance impact. Does not resolve an operator issue. Does not mitigate a cyber risk. Does not mitigate a NAVWAR risk.
Enterprise or Program Milestone Impact (15%)	100	Without change: unable to meet major enterprise or program milestone.
	75	Without change: impact to major enterprise or program milestone. Significant work-arounds required to achieve milestone. And/or Without change: creates significant lien.
	50	Without change: impact to major enterprise or program milestone, moderate work-arounds required to achieve milestone. And/or Without change: creates moderate lien. And/or Without change: significant impact to other non-GPS enterprise or program milestones. And/or Without change: negative impact to the perception of GPS publicly.
	25	Without change: impact to major enterprise or program milestone, minor work-arounds required to achieve program milestone. And/or Without change: Less than significant impact to other non-GPS enterprise or program milestones.
	0	No impact to major enterprise or program milestone.

Coordinated with SE&I Capabilities POC (Wayne Su), Date: 31-JUL-2025

Technical Impacts

6) IMPACTED MISSION/OPERATIONAL/PERFORMANCE (If NOT Approved):
Mission Impact: None Operational Impact: • If the change is not made per Solution Item 5, public users will not have access to the new TYPE value FCSTUUFN which indicates a scheduled outage of indefinite duration Performance Impact: • If the change is not made per Solution Item 1, CNAV user equipment may have slightly lower accuracy PNT solutions • If the change is not made per Solution Item 2, civil user equipment will mis-estimate when it has an assured solution (typically too pessimistic)
7) ASSOCIATED RISKS/OPEN TECHNICAL ISSUES:
Open Technical Issues: • Concern 1453 “MNAV Eccentric Anomaly Rate Corrections”, is essentially the same correction as item 1 in this Problem Statement, but for MNAV and ICD-GPS-700. It will be handled by another RFC.
8) ASSOCIATED TRADE STUDIES:

RFC Summary Changes

10a) SUMMARY OF CHANGES:

Document	# of Reqts Add/Del/Mod	TBD/TBRs (+/-)	Effectivity Changes	# of VCRM Add/Del/Mod	# of Descriptive Text/Table/Figure	Tracing Impacts Up/Down	Notes
ICD-GPS-870	0 /0/0	0/0	0	0 /0/ 0	1/4/0	0/0	
IS-GPS-200	0/0/8	0/0	0	0 /0/ 0	21/13/2	0/0	
IS-GPS-705	0/0/6	0/0	0	0 /0/ 0	11/10/0	0/0	
IS-GPS-800	0/0/4	0/0	0	0 /0/ 0	11/7/0	0/0	

- Correction of Eccentric Anomaly Rate Formulae
- Clarifications of CEI Core Parameters
- Normalization of power of 10 notation, power of 2 notation, normalization of multiply operators in formulae
- Clarification, correction (and definition if needed) of IAURA and URA values

Stakeholder Review
Comment Resolution Matrix (CRM) Status – for PICWG

16a) CRM – COMBINED STAKEHOLDER/DIRECTORATE REVIEW STATUS:						
Disposition/Type	**Critical**	**Substantive**	**Administrative**	**Totals**	**Concurrence**	**Notes**
Accept	**00**	**7**	**8**	**15**	**17**	
Accept with Comment	**00**	**7**	**6**	**13**	**13**	
Reject	**00**	**2**	**2**	**4**	**4**	
Question	**00**	**4**	**00**	**4**	**4**	
Defer	**00**	**1**	**33**	**34**	**34**	
TBD	**00**	**1**	**00**	**1**	**00**	
Withdrawn	**00**	**2**	**00**	**2**	**2**	
Grand Totals:	**00**	**24**	**49**	**73**	**72**	

Adjudication Working Group (AWG) CRM Status

17a) CRM AWG REVIEW STATUS:						
Disposition/Type	**Critical**	**Substantive**	**Administrative**	**Totals**	**Concurrence**	**Notes**
Accept	**00**	**00**	**00**	**00**	**00**	
Accept with Comment	**00**	**00**	**00**	**00**	**00**	
Reject	**00**	**00**	**00**	**00**	**00**	
Defer	**00**	**00**	**00**	**00**	**00**	
Grand Totals:	**00**	**00**	**00**	**00**	**00**	

Public Comments Received

- 1 From Thales

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Specific Alarm Indications Suggest Change

DOORS ID	IS200-1760, IS705-1603		
Paragraph	IS-GPS-200 6.4.6.2.2 IS-GPS-705 6.4.5.1.2	**Comment Number**	CRM #74
Comment Type	Substantive	**Disposition**	TBD
Comment Originator(s)	Thales		
Comment	Wants to clarify point (d) of CM-Code Signal (in 705 it's point (d) of I5-Code Signal) When such a Signal Alarm condition is triggered, it is not clear whether the affected satellite will broadcast bits 39 through 276 set to 0's (or alternatively to 1's) in all message types 30 through 37, or if some of these message types may still have bits 39-276 that are not set to 0's (or to 1's). This question is relevant for defining the condition under which the satellite can be considered as having returned to normal operation. - Under the first interpretation (where all MT30 through MT37 messages have bits 39-276 set to 0's — or 1's), decoding a single MT3x message with bits 39-276 not set to 0's (or 1's) will be sufficient to consider the satellite usable again. - Under the second interpretation (where at least one message among MT30 through MT37 has bits 39-276 set to 0's or 1's), it is necessary to precisely identify the MT3x message type(s) in which the bits are replaced by 0's (or 1's), and then wait for a new message of the same type(s) with bits 39-276 not all set to 0's (or 1's) before considering the satellite usable again.		
Government Response	TBD. Two options shown on next slide plus deciding that current text is OK Our recommendation is to make (d) Reserved		

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Specific Alarm Indications Suggested Options

Paragraph	IS200-1760, IS705-1603
Current IS200-1760 segment for context	CM-Code Signal (a) The failure of the cyclic redundancy check (CRC) on 5 successive CNAV messages (60 seconds) (see paragraph 30.3.5). (b) The broadcast time of ephemeris (t_{oe}) is not current (i.e. not within the current curve-fit) or does not match the broadcast time of clock (t_{oc}) (excluding normal data set cutovers, see paragraphs 30.3.3.1.1 and 30.3.4.4). (c) The broadcast t_{op} is not consistent across the Message Types 10, 11 and Type 30's messages which comprise the current (i.e. not within the current curve-fit) CEI data set (excluding normal data set cutovers, see paragraph 30.3.4.4). (d) The transmitted bits (bits 39 through 276) in one or more of Message Types 10, 11 or 30 through 37 are all set to 0's or all set to 1's. (e) The 8-bit preamble does not equal 10001011_2, decimal 139, or hexadecimal 8B (see paragraph 30.3.3).
Option A Redlines	(d) The transmitted bits (bits 39 through 276) in one or more of Message Type 10, or in one or more of Message Type 11 or in one or more of each Message Type 30 through 37 broadcast by the satellite are all set to 0's or all set to 1's.
Option B Redlines	(d) The transmitted bits (bits 39 through 276) in one or more of Message Types 10, 11, ~~or~~ 30~~,~~ ~~through~~ 31, 32, 33, 34, 35, 36, or 37 are all set to 0's or all set to 1's.
Our Recommendation	(d) Reserved ~~The transmitted bits (bits 39 through 276) in one or more of Message Types 10, 11 or 30 through 37 are all set to 0's or all set to 1's.~~

LMCO Feedback on CRM #74

- LMCO SME Queried On Best Response

  I do not believe we will **ever** broadcast MT10 or MT11 or MT3x with bits 39-276 set to all 0's or all 1's. On Block IIR-M/Block IIF SVs, I guess it's theoretically possible for those SVs to broadcast MT10 or MT11 or MT3x with bits 39-276 set to all 0's or all 1's, but the Control Segment would have to upload the messages to the SVs in that configuration so that the SVs can "regurgitate" the uploaded bits as-is…I don't believe the CS ever does that

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Back to RFC-00544 Deferred Comments

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Extending Asterisk to NOTEn Conversion

DOORS ID	Numerous		
Paragraph	Numerous	**Comment Number**	CRM #34 through #62
Comment Type	Administrative	**Disposition**	Defer
Comment Originator(s)	LMCO Concur		
Comment	If one of the goals of RFC-544 is for NOTE identifiers to replace asterisks, why was this object excluded? Update table to replace asterisks with NOTEn (all tables in all 4 documents which have not had their asterisks updated to NOTEn are implied) Consistency of RFC-544 updates		
Government Response	Defer. SE&I processes have been updated to allow purely administrative and readability issues with documents to be corrected in the Up Rev process, which is scheduled to happen directly after this RFC is approved at CCB. This includes: i. Organizational and institutional process changes typically described in Section 1 and Section 2. These changes do not change technical or engineering intent. ii. Grammar, punctuation, white space, spelling, font, layout and other changes that do not change technical or engineering intent iii. Managed through DOORS "Virtual" IRNs reviewed extensively to ensure technical intent is not compromised.		

Substantive Accepted

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Add Cross-correlation Advice

DOORS ID	New DOORS IDs IS200-2405, IS200-2406, IS200-2407, IS200-2408, IS705-1751, IS705-1752, IS800-1190, IS800-1191		
Paragraph	IS-GPS-200 3.2.1.3 3.2.1.5.2 IS-GPS-705 3.2.1.1.1 IS-GPS-800 3.2.2.1.3	**Comment Number**	CRM #6
Comment Type	Substantive	**Disposition**	Accept
Comment Originator(s)	FAA Concur		
Comment	Develop advice to the user with respect to cross-correlation		
Government Response	Agree. i. The added text seems to be responsive to the request ii. There is some debate about if the chosen locations are the best. Would consider specific proposals to other locations		

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IS-GPS-200 Cross-correlation Additions

Paragraph	
IS200-2405 / IS200-2406 IS:	**3.2.1.3.2 C/A Code Cross-correlation Mitigation** The code-division-multiple-access techniques that allow differentiation between SVs generally provide about 25 dB of margin between signals. This separation is generally sufficient to provide cross-correlation protection. However, some user integrations are able to track signals that are more than 25 dB below nominal power levels. To preclude cross-correlation, users should perform a cross-correlation check on acquisition or reacquisition. One cross-correlation check is to compare the satellite position calculated from the broadcast ephemeris in Subframes 1, 2, and 3 with the satellite position calculated from a valid almanac and to reject signals when the difference is greater than 3,000 km.
IS200-2407 / IS200-2408 IS:	**3.2.1.5.2 L2 CL-Code Cross-correlation Mitigation** To preclude cross-correlation on the L2C signal, users should perform a cross-correlation check on signal acquisition or reacquisition. One cross-correlation check for equipment that processes the data (L2-CL) and the pilot (L2-CM) components using a single tracking loop driven by the pilot signal is to check the PRN code number used for signal tracking with the PRN parameter broadcast in the CNAV messages.

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IS-GPS-705/800 Cross-correlation Additions

Paragraph	
IS705-1751 / IS705-1752 IS:	**3.2.1.1.1 L5 Code Cross-correlation Mitigation** To preclude cross-correlation on the L5 signal, users should perform a cross-correlation check on signal acquisition or reacquisition. One cross-correlation check for equipment that processes the data (L5-I5) and the pilot (L5-Q5) components using a single tracking loop driven by the pilot signal is to check the PRN code number used for signal tracking with the PRN parameter broadcast in the CNAV messages.
IS800-1190 / IS800-1191 IS:	**3.2.2.1.3 L1C Code Cross-correlation Mitigation** To preclude cross-correlation on the L1C signal, users should perform a cross-correlation check on signal acquisition or reacquisition. One cross-correlation check for equipment that processes the data ($L1C_D$) and the pilot ($L1C_P$) components using a single tracking loop driven by the pilot signal is to check the PRN code number used for signal tracking with the PRN parameter broadcast in Subframe 3 of the CNAV-2 messages.

Bounding of URE - Options

DOORS ID	IS200-1292		
Paragraph	6.2.1.0-5	**Comment Number**	CRM #3
Comment Type	Substantive	**Disposition**	Accept with Comments
Comment Originator(s)	FAA Concurs		
Comment	Need to address bounding of URE with either absolute value or +/- 4.42. Suggested Options A. (a) if the integrity flag is "0", an alert is issued to the users no more than 8.0 seconds after the instantaneous URE exceeds the interval defined by +/- 4.42 times the IAURA, or B. (a) if the integrity flag is "0", an alert is issued to the users no more than 8.0 seconds after the absolute value of the instantaneous URE exceeds 4.42 times the IAURA,		
Government Response	Accept With Comments: Went with "±" Expanded this convention to 5.73 and all areas of this RFC where: i. a paragraph is already being changed ii. Either 4.42 or 5.73 already occur iii. These numbers are used as bounds and ± is appropriate to use iv. Slightly reworded to "goes outside the interval defined by ±4.42 times the" No paragraphs that aren't already being changed have been changed on this go around		

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Bounding using ±

Paragraph	IS200-1292
Redlines from Review PCN	Note #4: The LNAV IAURA is not required to bound the instantaneous URE using the LNAV CEI data and the CNAV IAURA is not required to bound the instantaneous URE using the CNAV CEI data when: (a) an alert is issued to the users before the instantaneous URE ~~exceeds~~ goes outside the interval defined by ±4.42 times the IAURA ; or (b) if the integrity status flag is "0", an alert is issued to the users no more than 8.0 seconds after the instantaneous URE ~~exceeds~~ goes outside the interval defined by ±4.42 times the IAURA; or (c) if the integrity status flag is "1", both an alert is issued to the users no more than 8.0 seconds after the instantaneous URE ~~exceeds~~ goes outside the interval defined by ±4.42 times either of IAURA values; and an alert is issued to users no more than 5.2 seconds after the instantaneous URE ~~exceeds~~ goes outside the interval defined by ±5.73 times the IAURA. In this context, an "alert" is defined as any indication or characteristic of the conveying signal, as specified elsewhere in this document, which signifies to users that the conveying signal may be invalid or should not be used, such as the health bits not indicating operational-healthy, broadcasting non-standard code, parity error, etc.

Clarify maximum accuracy and initial position

DOORS ID	IS200-1513		
Paragraph	6.2.9.0-1	**Comment Number**	CRM #4
Comment Type	Substantive	**Disposition**	Accept With Comments
Comment Originator(s)	FAA Concurs		
Comment	The terms maximum accuracy and initial position are vague. GDGPS that did not apply the ISC values showed ORDs that had a several meter bias. Does the SPS PS identify the difference in these values? Also, integrity (IAURA)may not bound without application of ISCs. Suggested Text: … is sufficient for an initial (rough) position without IAURA bounding.		
Government Response	Accept With Comments: i. Decided that "(rough)" is not standardized enough an other word convey the intent		

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Clarify maximum accuracy and initial position

Paragraph	IS200-1513
Redlines responding to this comment	The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6-I-1. The entire CEI data set is needed for maximum accuracy. However, the core CNAV CEI data set (parameters without ~~NOTE1~~NOTE2~~3~~ in Table 6-I-1) is sufficient for an initial position solution~~. The t_{op} term provides the epoch time of week of the state data utilized for the~~without ~~core~~full ~~CEI~~accuracy ~~data~~and ~~set~~integrity.
IS	The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6-I-1. The entire CEI data set is needed for maximum accuracy. However, the core CNAV CEI data set (parameters without NOTE2 in Table 6-I-1) is sufficient for an initial position solution without full accuracy and integrity.

Core CEI Data Set Changes

DOORS ID	IS200-1649 IS705-1524 IS800-920		
Paragraph	IS-GPS-200 6.2.9.1.0-1 IS-GPS-705 6.2.8.1.0-1 IS-GPS-920 6.2.8.1.0-1	**Comment Number**	CRM #7, #8
Comment Type	Substantive	**Disposition**	#7, #8 Accept with Comments
Comment Originator(s)	FAA #7, #8 Concurs		
Comment	7. Clarify expectations related to ISC. 8. There is a discussion about whether an ISC or TGD change is indicated with a change in t_oe or t_oc such that user equipment is warned that the value has changed. If not, then the control segment should ensure that signal integrity is maintained for any ISC value broadcast with a specific t_oc, T_oe such that the use of any value by the user equipment is safe. (Reference IFOR-). Not related to specific IS text, but is for control segment monitoring or space segment increment of t_oe/t_oc values with an ISC change.		
Government Response	Our disposition is based on the assumption that RFC-312 is going to be deployed eventually 7. Accept with Comments. Specific wording chosen to be added at the Government AWG is "For proper IAURA bounding, users must apply the CEI refinement parameters." 8. Accept with Comments. i. During the discussion, it was determined that the added wording "These parameters may not change with t_{op}, t_{oe} or t_{oc}" was no longer valuable and was dropped. ii. "a NOTE3" has been converted to just "NOTE2"		

IS-GPS-200 Proposed ISC Clarification

Paragraph	IS200-1649
IS200-1649 Redlines	A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac). The t_{oc}/t_{oe} terms provide the reference Time Of Week for the CEI curve fit. The t_{op} term provides the epoch time of week of the state data used for predicting the CEI curve fit. Parameters marked with NOTE2~~3~~ in Table 6-I-1 are properties of the SV and do not routinely change with CEI curve fits. ~~These parameters may not change with t_{op}, t_{oe} or t_{oe}.~~For proper IAURA bounding, users must apply the CEI refinement parameters.
IS705-1524 Redlines	A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac). The t_{oc}/t_{oe} terms provide the reference Time Of Week for the CEI curve fit. The t_{op} term provides the epoch time of week of the state data used for predicting the CEI curve fit. Parameters marked with NOTE2~~3~~ in Table 6-I-1 are properties of the SV and do not routinely change with CEI curve fits. ~~These parameters may not change with t_{op}, t_{oe} or t_{oe}.~~For proper IAURA bounding, users must apply the CEI refinement parameters.
IS800-920 Redlines	A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac). The t_{oe} term provides the reference Time Of Week for the CEI curve fit. The t_{op} term provides the epoch time of week of the state data used for predicting the CEI curve fit. Parameters marked with NOTE2~~3~~ in Table 6.2-18 are properties of the SV and do not routinely change with CEI curve fits. ~~These parameters may not change with t_{op}, t_{oe} or t_{oe}.~~For proper IAURA bounding, users must apply the CEI refinement parameters.

Core CEI Table Notes Improvements & Corrections

DOORS ID	IS200-1639 IS705-1521 IS800-917 IS200-1513 IS200-1649 IS705-1515 IS705-1524 IS800-912 IS200-920		
Paragraph	IS-GPS-200 Table 6-I-1. IS-GPS-705 Table 6-I-1. IS-GPS-800 Table 6.2-18.	**Comment Number**	CRM #9, #10, #11
Comment Type	Substantive	**Disposition**	Accept With Comments
Comment Originator(s)	FAA Concurs		
Comment	9. Still difficult to understand the table notes. NOTE1 applies to Integrity Status Flag and Alert Flag. Updates to parameters in this table, except those indicated with NOTE1 (and NOTE3?) will prompt changes in ….. NOTE1: Updates to this parameter are independent of curve fit and may occur without updates to …. NOTE2: delete NOTE3: Parameters are for CEI refinement and are independent of ephemeris estimation (state vector and curve fit). 10. NOTE2 added to "SV Health" and "Signal Health" lines in the "IS" section but is not there in the "REDLINES" section. Indicate as a REDLINE change 11. SV Healthy and Signal Health only have NOTE2. However, they only change with an upload and will be accompanied by toe/toc/IODE/IODC change. While not related to the ephemeris estimation, why is this relevant to the user segment? Suggested Text: Delete NOTE2		
Government Response	Accept With Comments At Govt AWG negotiated the wording of NOTE2 so NOTE2 & NOTE3 are combined causing external references to be changed to NOTE2		

APPROVED FOR PUBLIC RELEASE

IS-GPS-200 Core CEI Parameters

Paragraph IS200-1639

Redlines

Symbol	Parameter Name	Subframe	Message
SV Health	SV Health (6 bits)	1	N/A
IODC	Issue of Data, Clock	1	N/A
URA	URA Index	1	N/A
WN	Week Number	1	10
T_{GD}	Group Delay Differential NOTE2	1	30
WN_{OP}	CEI Data Sequence Propagation Week Number	N/A	30
a_{f0}	SV Clock Bias Correction Coefficient	1	30-37
a_{f1}	SV Clock Drift Correction Coefficient	1	30-37
a_{f2}	Drift Rate Correction Coefficient	1	30-37
t_{oc}	Time of Clock	1	30-37
$\sqrt{A}$	Square Root of the Semi-Major Axis	2	N/A
Δn	Mean Motion Difference from Computed Value	2	N/A
Fit Interval Flag	Fit Interval Flag	2	N/A
e	Eccentricity	2	10
M_0	Mean Anomaly at Reference Time	2	10
t_{oe}	Time of Ephemeris	2	10, 11
~~C_{crs}~~	Amplitude of the Sine Correction Term to the Orbit Radius	2	11
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2	11
~~C_{uns}~~	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2	11
IODE	Issue of Data, Ephemeris	2, 3	N/A
ISF	Integrity Status Flag NOTE1	All	10
ω	Argument of Perigee	3	10
$\dot{\Omega}$	Rate of Right Ascension	3	N/A
$\Delta\dot{\Omega}$	Rate of Right Ascension Difference	N/A	11
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	3	11
i_0	Inclination Angle at Reference Time	3	11
IDOT	Rate of Inclination Angle	3	11
~~C_{cic}~~	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	3	11

Symbol	Parameter Name	Subframe	Message
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	3	11
~~C_{rc}~~	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	3	11
ΔA	Semi-major Axis Difference at Reference Time	N/A	10
$\dot{A}$	Change Rate in Semi-major Axis	N/A	10
Δn_0	Mean Motion Difference from Computed Value at Reference Time	N/A	10
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	N/A	10
(L1/L2/L5)	Signal Health (3 bits)	N/A	10
URA_{ED}	Elevation Dependent User Range Accuracy	N/A	10
$ISC_{L1C/A}$	Inter-signal Correction NOTE2	N/A	30
ISC_{L2C}	Inter-signal Correction NOTE2	N/A	30
ISC_{L5I5}	Inter-signal Correction NOTE2	N/A	30
ISC_{L5Q5}	Inter-signal Correction NOTE2	N/A	30
t_{op}	CEI Data Sequence Propagation Time of Week	N/A	10, 30-37
URA_{NED0}	NED Accuracy Index	N/A	30-37
URA_{NED1}	NED Accuracy Change Index	N/A	30-37
URA_{NED2}	NED Accuracy Change Rate Index	N/A	30-37
Alert	Alert Flag NOTE1	All	All

Updates to parameters in this table will prompt changes in t_{oe}/t_{oc}/IODC/IODE for LNAV and t_{oe}/t_{oc} for CNAV

NOTE1: Updates to this parameter are independent of curve fit and may occur without updates to t_{oe}/t_{oc}/IODC/IODE for LNAV or t_{oe}/t_{oc} for CNAV

NOTE2: This parameter is for CEI Refinement and is independent of ephemeris estimation (state vector and curve fit) so it commonly remains constant across changes in t_{oe}/t_{oc}/IODC/IODE for LNAV and t_{oe}/t_{oc} for CNAV

~~NOTE1: Parameters so indicated are for CEI Refinement – not limited to curve fit. Parameters not indicated are needed for/limited to curve fit.~~

~~Updates to parameters in table shall prompt changes in t_{oe}/t_{oc} for CNAV and t_{oe}/t_{oc}/IODC/IODE for LNAV. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}/t_{oc}/IODC/IODE~~.

IS-705 Core CEI Parameters

Paragraph

IS705-1521

Redlines

Symbol	Parameter Name	Message
$\dot{A}$	Change Rate in Semi-major Axis	10
ΔA	Semi-major Axis Difference at Reference Time	10
Δn_0	Mean Motion Difference from Computed Value at Reference Time	10
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	10
ω	Argument of Perigee	10
e	Eccentricity	10
ISF	Integrity Status Flag[NOTE1]	10
(L1/L2/L5)	Signal Health (3 bits)	10
M_0	Mean Anomaly at Reference Time	10
URA_{ED}	Elevation Dependent User Range Accuracy	10
WN	Week Number	10
t_{oe}	Time of Ephemeris	10, 11
t_{op}	CEI Data Sequence Propagation Time of Week	10, 30-37
$\Delta\dot{\Omega}$	Rate of Right Ascension Difference	11
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	11
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	11
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	11
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	11
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	11
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	11
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	11

Symbol	Parameter Name	Message
i_0	Inclination Angle at Reference Time	11
IDOT	Rate of Inclination Angle	11
$ISC_{L1C/A}$	Inter-signal Correction[NOTE2]	30
ISC_{L2C}	Inter-signal Correction[NOTE2]	30
ISC_{L5I5}	Inter-signal Correction[NOTE2]	30
ISC_{L5Q5}	Inter-signal Correction[NOTE2]	30
T_{GD}	Group Delay Differential[NOTE2]	30
WN_{OP}	CEI Data Sequence Propagation Week Number	30
a_{f0}	SV Clock Bias Correction Coefficient	30-37
a_{f1}	SV Clock Drift Correction Coefficient	30-37
a_{f2}	Drift Rate Correction Coefficient ~~Index~~	30-37
t_{oc}	Time of Clock	30-37
URA_{NED0}	NED Accuracy Index	30-37
URA_{NED1}	NED Accuracy Change Index	30-37
URA_{NED2}	NED Accuracy Change Rate Index	30-37
Alert	Alert Flag[NOTE1]	All

Updates to parameters in this table will prompt changes in t_{oe}/t_{gs}

NOTE1: Updates to this parameter are independent of curve fit and may occur without updates to t_{oe}/t_{oc}

NOTE2: This parameter is for CEI Refinement and are independent of ephemeris estimation (state vector and curve fit) so it commonly remains constant across changes in t_{oe}/t_{gs}

~~NOTE1: Parameters so indicated are for CEI Refinement – not limited to curve fit. Parameters not indicated are needed for/limited to curve fit.~~

~~Updates to parameters in table shall prompt changes in t_{oe}/t_{oc}. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}/t_{oc}.~~

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IS-GPS-800 Core CEI Parameters

Paragraph

IS800-917

Redlines

Symbol	Parameter Name	Subframe
$\dot{A}$	Change Rate in Semi-major Axis	2
ΔA	Semi-major Axis Difference at Reference Time	2
Δn_0	Mean Motion Difference from Computed Value at Reference Time	2
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	2
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	2
$\Delta \dot{\Omega}$	Rate of Right Ascension Difference	2
ω	Argument of Perigee	2
a_{f0}	SV Clock Bias Correction Coefficient	2
a_{f1}	SV Clock Drift Correction Coefficient	2
a_{f2}	Drift Rate Correction Coefficient	2
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	2
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	2
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	2
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	2
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2
e	Eccentricity	2
i_0	Inclination Angle at Reference Time	2
IDOT	Rate of Inclination Angle	2
ISC_{L1CP}	Inter-signal Correction NOTE2	2
ISC_{L1CD}	Inter-signal Correction NOTE2	2
ISC_{L1CA}	Inter-signal Correction NOTE2	3

Symbol	Parameter Name	Subframe
ISC_{L2C}	Inter-signal Correction NOTE2	3
ISC_{L5I5}	Inter-signal Correction NOTE2	3
ISC_{L5Q5}	Inter-signal Correction NOTE2	3
ISF	Integrity Status Flag NOTE1	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits) NOTE2	2
M_0	Mean Anomaly at Reference Time	2
T_{GD}	Group Delay Differential NOTE2	2
WN_{OP}	CEI Data Sequence Propagation Week Number	2
t_{oe}	Time of Ephemeris	2
t_{op}	CEI Data Sequence Propagation Time of Week	2
URA_{ED} Index	Elevation Dependent User Range Accuracy, URA_{ED} Index	2
URA_{NED0} Index	NED Accuracy Index	2
URA_{NED1} Index	NED Accuracy Change Index	2
URA_{NED2} Index	NED Accuracy Change Rate Index	2
WN	Week Number	2

Updates to parameters in this table will prompt changes in t_{oe}

NOTE1: Updates to this parameter are independent of curve fit and may occur without updates to t_{oe}

NOTE2: This parameter is for CEI Refinement and are independent of ephemeris estimation (state vector and curve fit) so it commonly remains constant across changes in t_{oe}

~~NOTE1: Parameters so indicated are for CEI Refinement – not limited to curve fit. Parameters not indicated are needed for/limited to curve fit.~~

~~Updates to parameters in table shall prompt changes in t_{oe}. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}.~~

Shift URA & IAURA Formulae Change sin → cos

DOORS ID	IS200-1946, IS705-1407, IS800-1100		
Paragraph	IS-GPS-200 30.3.3.1.1.4.0-6 IS-GPS-705 20.3.3.1.1.4.0-6 IS-GPS-800 3.5.3.5.0-5	**Comment Number**	CRM #14, #67
Comment Type	Substantive	**Disposition**	14., 16. Accept With Comments, 67. Question
Comment Originator(s)	FAA #14 Concurs L3/Harris Concurs		
Comment	14. When we shift to cos, the term "+ 90 degrees" should be deleted. The "degrees" indicated the units on the 90. It is not needed for cos E. i. cos(E) or ii. xxURA_ED x cos(E) or iii. xxURA_ED x cos E 67. Regarding a new rounded nominal URA. Assume that OCX NAV will not be updated to output this rounded value for URA metrics.		
Government Response	14. Accept. E is an angle regardless of its units. There is no need to specify "Degrees" because a software developer should know how to scale for the sin or cos function depending on the computer language being used. Finally, multiply is going to be implied as a standard across the public documents. 67. This is probably true, will reconsider by PICWG		

IS-GPS-200 Adjusting from sin(E+90) to cos E

Paragraph

IS200-1946

Redlines

- Green is recent changes
- Blue is prior RFC-544 approved changes

For each URA_{ED} index (N), users may compute a nominal URA_{ED} value (X) as given by:

- If the value of N is 6 or less, but more than -16, $X = 2^{(1 + N/2)}$,
- If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$,
- N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk.

For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively.

The nominal URA_{ED} value (X) is suitable for use as a conservative prediction of the RMS ED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement deweighting, RAIM, FOM computations). Integrity properties of the $IAURA_{ED}$ are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the broadcast URA_{ED} index (see 30.3.3.1.1).

For the nominal URA_{ED} value and the $IAURA_{ED}$ value, users may compute an adjusted URA_{ED} value as a function of SV elevation angle (E), for $E \geq 0$, as follows:

$$\text{Adjusted Nominal } URA_{ED} = \text{Nominal } URA_{ED} \cos E \ \text{~~(sin(E+90 degrees))~~}$$
$$\text{Adjusted } IAURA_{ED} = IAURA_{ED} \cos E \ \text{~~(sin(E+90 degrees))~~}$$

URA_{ED} and $IAURA_{ED}$ account for SIS contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error, CNAV ~~alongtrack~~along-track ephemeris errors, and ~~crosstrack~~cross-track CNAV ephemeris errors. URA_{ED} and $IAURA_{ED}$ do not account for user range error contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

IS-GPS-705 Adjusting from sin(E+90) to cos E

Paragraph

IS705-1704

Redlines

- Green is recent changes
- Blue is prior RFC-544 approved changes

For each ~~URA~~URA_{ED} index (N), users may compute a nominal ~~URA~~ URA_{ED} value (X) as given by:

- If the value of N is 6 or less, but more than -16, $X = 2^{(1 + N/2)}$,
- If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$,
- N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk.

For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively.

The nominal URA_{ED} value (X) is suitable for use as a conservative prediction of the RMS ED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement ~~de-weighting~~deweighting, RAIM, FOM computations). Integrity properties of the $IAURA_{ED}$ are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the broadcast URA_{ED} index (see 20.3.3.1.1).

For the nominal URA_{ED} value and the $IAURA_{ED}$ value, users may compute an adjusted URA_{ED} value as a function of SV elevation angle (E), for $E \geq 0$, as follows:

$$\text{Adjusted Nominal } URA_{ED} = \text{Nominal } URA_{ED} \cos E \ (\sin(E+90 \text{ degrees}))$$
$$\text{Adjusted } IAURA_{ED} = IAURA_{ED} \cos E \ (\sin(E+90 \text{ degrees}))$$

URA_{ED} and $IAURA_{ED}$ account for SIS contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error, ~~alongtrack~~CNAV along-track ephemeris errors, and ~~crosstrack~~cross-track CNAV ephemeris errors. URA_{ED} and $IAURA_{ED}$ do not account for user range error contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

IS-GPS-800 Adjusting from sin(E+90) to cos E

Paragraph	IS800-1100
Redlines	⋮ For each URA_{ED} index (N), users may compute a nominal URA_{ED} value (X) as given by: • If the value of N is 6 or less, but more than -16, $X = 2^{(1 + N/2)}$, • If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$, • N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk. For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively. The nominal URA_{ED} value (X) is suitable for use as a conservative prediction of the RMS ED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement deweighting, RAIM, FOM computations). Integrity properties of the $IAURA_{ED}$ are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the broadcast URA_{ED} index (see 3.5.3.10.1 ~~30.3.3.1.1~~). For the nominal URA_{ED} value and the $IAURA_{ED}$ value, users may compute an adjusted URA_{ED} value as a function of SV elevation angle (E), for E ≥ 0, as follows: Adjusted Nominal URA_{ED} = Nominal URA_{ED} cos E ~~(sin(E+90 degrees))~~ Adjusted $IAURA_{ED}$ = = $IAURA_{ED}$ cos E ~~(sin(E+90 degrees))~~ URA_{ED} and $IAURA_{ED}$ account for SIS contributions to user range error which include, but are not limited to, the following: CNAV-2 LSB representation/truncation error, CNAV-2 ~~alongtrack~~along-track ephemeris errors, and ~~crosstrack~~cross-track CNAV-2 ephemeris errors. URA_{ED} and $IAURA_{ED}$ do not account for user range error contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects

- Everything is recent changes (Forgotten paragraph)

Administrative Comments

- Front Matter
- Rejected
- Accepted

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Front Matter Comments

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Changes in Section 1 & 2 Front Matter

DOORS ID	IS200-5, IS200-6, IS705-5, IS705-6, IS800-1123, ICD870-10, ICD870-67, IS800-8		
Paragraph		**Comment Number**	CRM #26, #27, #28, #29, #30, #64
Comment Type	Substantive	**Disposition**	26. – 29. Defer 30., 64. Accept With Comments
Comment Originator(s)	LMCO Concurs RTX Concur		
Comment	26. Through 29. The IS800 PCN shows a proposed change to IS800-8 to update the AWG charter document from GP-03-001 to PNT-03-001, but the IS200 PCN does not make the same change to this object--why? 30. The IS800 PCN shows a proposed change to IS800-8 to update the AWG charter document from GP-03-001 to PNT-03-001, but the proposed changes to this object still cite GP-03-001--why? 64. PNT-03-001 is not yet on contract for OCX. It requires a contract mod to get PNT-03-001 into the compliance document section for OCX.		
Government Response	Accept With Comments. i. All changes are being withdrawn. These DOORS IDs will not change with this RFC. DOORS IDs that haven't changed yet are deferred. ii. Internal discussions have revealed the PNT-03-001 is going to be subsumed into a future Technical Baseline Configuration Management Plan (TBCMP). Therefore, this and all other changes that refer to PNT-03-001 are being withdrawn. The same applies to ICD870-67 which was going to change ICWG to AWG, but should wait for the new TBMCP. Changes that are being withdrawn are: IS800-8, IS800-1122, IS800-1123, ICD870-10, and ICD870-67		

Changes Withdrawn Since Review

Paragraph	
IS800-8 Withdrawn	The Interface Control Contractor (ICC), designated by the government, is responsible for the basic preparation, obtaining approval, distribution, retention, and Interface Control Working Group (ICWG) coordination of this IS in accordance with ~~GP~~PNT-03-~~001A~~001.
IS800-1122 Withdrawn	IS-GPS-200 (current issue) Navstar GPS Space Segment/Navigation User Interfaces
IS800-1123 Withdrawn	GP-03-001 (current issue) GPS Adjudication Working Group (AWG) and Rough Order of Magnitude (ROM)/ Impact Assessment (IA) Charter

Changes Withdrawn Since Review

Paragraph	
ICD870-10 Withdrawn	The Interface Control Contractor (ICC), designated by the government, is responsible for the basic preparation, approval, distribution, and retention of the ICD in accordance with the ~~Interface Control~~Adjudication Working Group (~~ICWG~~AWG) and Rough Order of Magnitude (ROM) / Impact Assessment (IA) charter ~~GP~~PNT-03-001.
ICD870-67 Withdrawn	The GPS CS will support modular addition or replacement of DoD PKI algorithms, key lengths, certificate authorities, certificates, and certificate structure. Coordination in a public ~~ICWG~~AWG will occur prior to any changes on the Public Release interface.

Administrative Rejected

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Rejected Change back to Asterisk for Sign NOTE1

DOORS ID	General		
Paragraph	N/A	**Comment Number**	CRM #1
Comment Type	Administrative	**Disposition**	Reject
Comment Originator(s)	FAA Concurs		
Comment	For the data tables, the conversion of the single asterisk to NOTE1 for the twos complement, while consistent, seems to overwhelm the information in the table. My opinion is that the use of the asterisk for twos-complement should change, other items should be notes as shown' Consider reverting the NOTE1 back to asterisk if it indicates twos complement.		
Government Response	Reject. The use of too many asterisks was also overwhelming readers' ability to understand how to interpret the notes. Mixing note styles will add to the confusion. Since there is a tradeoff of negatives either way one goes, our tendency is to keep with NOTEn.		

Sample with Table 20-VI. Almanac Parameters

Paragraph	IS200-397
WAS / IS	**When Using Asterisks**

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
e	16	2^{-21}	0.0 to 0.03	dimensionless
t_{oa}	8	2^{12}	0 to 602,112	seconds
δ_i****	16*	2^{-19}		semi-circles
$\dot{\Omega}$	16*	2^{-38}	-1.19E-07 to 0	semi-circles/sec
$\sqrt{A}$	24	2^{-11}	2530 to 8192	$\sqrt{\text{meters}}$
Ω_0	24*	2^{-23}		semi-circles
ω	24*	2^{-23}		semi-circles
M_0	24*	2^{-23}		semi-circles
a_{f0}	11*	2^{-20}		seconds
a_{f1}	11*	2^{-38}		sec/sec

* 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;

**** Relative to i_0 = 0.30 semi-circles.

When Using NOTEn

Parameter	No. of Bits[NOTE2]	Scale Factor (LSB)	Valid Range[NOTE3]	Units
e	16	2^{-21}	0.0 to 0.03	dimensionless
t_{oa}	8	2^{+12}	0 to 602,112	seconds
δ_i[NOTE4]	16[NOTE1]	2^{-19}		semi-circles
$\dot{\Omega}$	16[NOTE1]	2^{-38}	-1.19×10^{-7} to 0	semi-circles/sec
$\sqrt{A}$	24	2^{-11}	2530 to 8192	$\sqrt{\text{meters}}$
Ω_0	24[NOTE1]	2^{-23}		semi-circles
ω	24[NOTE1]	2^{-23}		semi-circles
M_0	24[NOTE1]	2^{-23}		semi-circles
a_{f0}	11[NOTE1]	2^{-20}		seconds
a_{f1}	11[NOTE1]	2^{-38}		sec/sec

NOTE1: Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB

NOTE2: See Figure 20-10 for complete bit allocation in subframe

NOTE3: Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor

NOTE4: Relative to i_0 = 0.30 semi-circles

Exception to Core CEI Data Set Parameters

DOORS ID	IS200-1644		
Paragraph	20.3.4.4.0-7	**Comment Number**	CRM #33
Comment Type	Substantive	**Disposition**	Reject
Comment Originator(s)	LMCO Concurs		
Comment	IS200 PCN appears to be missing this change; for consistency with other RFC-544 updates, shouldn't NOTE1 be updated to NOTE3? Suggested Text for NOTE3: Updates to parameters in table 6-I-1 shall prompt changes in toe/toc/IODC/IODE. Any parameter marked with NOTE3 may be changed with or without a change in toe/toc/IODC/IODE.		
Government Response	Reject. While the notes for the CEI Core Parameters table have been updated, the currently proposed Table 6-I-1 notes indicate that NOTE1 is correct as is.		

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Table 6-I-1 NOTE1 Still Applicable

Paragraph	IS200-1644
IS	Updates to parameters in Table 6-I-1 shall prompt changes in t_{oe}/t_{oc}/IODC/IODE. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}/t_{oc}/IODC/IODE.
Proposed (but Rejected)	Updates to parameters in Table 6-I-1 shall prompt changes in t_{oe}/t_{oc}/IODC/IODE. Any parameter marked with NOTE3 may be changed with or without a change in t_{oe}/t_{oc}/IODC/IODE.

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Status of WN & WN_e

DOORS ID	IS705-1496		
Paragraph	6.1.0-1	**Comment Number**	#31
Comment Type	Administrative	**Disposition**	Reject
Comment Originator(s)	LMCO Concur		
Comment	RFC-544 is correcting the definition of "WN" within the acronym list, but it looks like RFC-502 deleted the equivalent entry from IS200. Should RFC-544 re-instate the WN (and WN_e) entries to the equivalent object (IS200-1488) for consistency between IS200 and IS705?		
Government Response	Reject. Interesting catch but: i. It turns out that WNe is not used anywhere in IS-GPS-200/705/800 so removing it was the correct decision ii. WN is actually a parameter, and parameters should not be in the Acronym List. Instead, it is in **Table 6-I-1. CEI Data Set Parameters**.		

WN & WN_e Removed from the Acronym List

Paragraph	IS705-1496

IS705-1496 Redlines

US	-	User Segment
USNO	-	US Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984
~~WN~~	-	~~Data Sequence Propagation Week Number~~
~~WNe~~	-	~~Extended Week Number~~

Compared to IS200-1488

US	-	User Segment
USNO	-	U.S. Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984

Compared to IS800-893

US	-	User Segment
USNO	-	U.S. Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984

Administrative Accepted

Includes

- Font/symbol corrections
- Reference corrections
- Rationale that was incorrect
- Improvements to readability

APPROVED FOR PUBLIC RELEASE

Cover Page Change Suggestion

DOORS ID			
Paragraph	IS-GPS-800 PCN/IRN Cover Page	**Comment Number**	CRM #63
Comment Type	Administrative	**Disposition**	Accept With Comments
Comment Originator(s)	RTX Concurs		
Comment	A. Reason for Change - add item 6 so that the Reason for Change and Description of Change are in sync (1-1 mapping). B. For item 5 under "Description of Change" - replace "Pre-RFC-1354" with "RFC-515".		
Government Response	Accept with comment: will remove bullet 6 because we aren't going do it (i.e. withdrawn) Will also add reference to "RFC-515"		

Sample PCN Cover Page for RFC-00544

Paragraph	Cover Page Segment
Redlines Agreed to	

Reason For Change (Driver):

1. The Eccentric Anomaly Rate formula in all documents that describe this CNAV formula are incorrect
2. There are requirements and description changes from RFC-495A and RFC-502 which did not make it into the requirements baseline but are still correct and would help civil user equipment engineers make better civil receivers. This includes a number of Core CEI description changes that were worked out, but did not make it into RFC-502.
3. PRAT Item 2020-03 to normalize the use of scientific notation across the Public GPS interface documents has only been partially implemented
4. During the last Public ICWG, it became apparent that the Public interface documents do not use a uniform method of documenting multiplication in formulas
5. RFC-515 made a number of changes to XML which still need to be made to ICD-GPS-870 to ensure that Public users of XML are executing XML correctly

Description of Change:

1. The Eccentric Anomaly Rate formula will be corrected in all CNAV Public documents (PRAT 2025-02, Pre-RFC-1445)
2. The changes from RFCs-495A and 502 would be added into the requirements baseline (PRAT 2021-03)
3. The changes needed to normalize the use of scientific notation in the Public GPS interface documents will be completed (PRAT 2020-03)
4. The few places that used "*" or "x" to denote multiplication of scalar values will~~would~~ be normalized to what is used across the Public Signal-In-Space documents
5. The XML to ICD-GPS-870 would be completed so it describes the as-built XML system (Pre-RFC-1354, promulgates and completes the work started in RFC-515)
6. ~~There is one vetted change in IS-GPS-200 which should be included in this RFC~~

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Deconflict use of “T” vs “t”

DOORS ID	IS200-97		
Paragraph	3.3.2.1.0-1	**Comment Number**	CRM #1, CRM #2
Comment Type	Administrative	**Disposition**	Accept, Accept With Comments
Comment Originator(s)	FAA Concurs		
Comment	1. This section remains unclear. T is used to mean two things in the paragraph, and in one equation, () are used as clarifying information and in the other it is used as a multiply operator. 2. Presumably period of a P-code chip is known. Still could just update instead of remove. Suggested: ($1/10.23x10^{+6}$)		
Government Response	1. Accept 2. Accept With Comments: Used “(9.77517107 × 10^{-8} seconds)” instead of “($1/10.23x10^{+6}$)” or the original “and equals (1.023E7)-1 seconds”		

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Redlines for Deconflicting “T” vs “t”

Paragraph	IS200-97
Redlines:	For PRN codes 1 through 37, the Pi(t) pattern (P-code) is generated by the modulo-2 summation of two PRN codes, X1(t) and X2(t ~~–~~ ~~iT~~i T_P), where ~~T~~T_P is the ~~period~~duration of one P-code chip ~~and equals~~ (~~1~~9.~~023E7~~)77517107 × 10^{-1}~~8~~ 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, Pi(t) where 38 ≤ i ≤ 63, are described as follows: $P_i(t) = P_{i-37}$(t + ~~T) (where T will equal 24~~86,400 ~~hours~~seconds) therefore, the equation is $P_i(t) = P_{i-37x}$(t + ~~i *~~86,400 ~~24~~i ~~hours~~), where t is in units of seconds i is an integer from 64 to 210~~,~~ x is an integer portion of (i-1)/37~~.~~ As an example, the P-code sequence for PRN 38 is the same sequence as PRN 1 shifted 24 hours into a week (i.e. 1st chip of PRN 38 at beginning of week is the same chip for PRN 1 at 24 hours after beginning of week).~~-~~ The list of expanded P-code PRN assignments is identified in Table 3-Ib.
IS:	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 – i T_P), where T_P is the duration of one P-code chip (9.77517107 × 10^{-8} 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 ≤ i ≤ 63, are described as follows: $P_i(t) = P_{i-37}$(t + 86,400 seconds) therefore, the equation is $P_i(t) = P_{i-37x}$(t + 86,400 i) where t is in units of seconds i is an integer from 64 to 210 x is an integer portion of (i-1)/37 As an example, the P-code sequence for PRN 38 is the same sequence as PRN 1 shifted 24 hours into a week (i.e. 1st chip of PRN 38 at beginning of week is the same chip for PRN 1 at 24 hours after beginning of week). The list of expanded P-code PRN assignments is identified in Table 3-Ib.

Fix Missing SQRT (A)

DOORS ID	IS200-370		
Paragraph	20.3.3.4.3.2.0-1	**Comment Number**	CRM #12
Comment Type	Administrative	**Disposition**	Accept
Comment Originator(s)	FAA Concurs		
Comment	The root(A) term is not showing in the redlines or the "IS". Rationale does not address this. Is it an artifact of the printing or incomplete update to transfer root(A) to unicode or a better means to include it?		
Government Response	Accept. This is a sustainability issue we are working on. Thanks for the catch		

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Correction of SQRT(A)

Paragraph	IS200-370
Redlines	The sensitivity of the SV's antenna phase center position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters $\sqrt{A}$, C_{rc} and C_{rs} is about one meter/meter. The sensitivity of position to the angular parameters is on the order of ~~108~~$1 \times 10^{+8}$ meters/semicircle, and to the angular rate parameters is on the order of ~~1012~~$1 \times 10^{+12}$ meters/semicircle/second. Because of this extreme sensitivity to angular perturbations, the value of ~~p~~π used in the curve fit is given here. ~~p~~π is a mathematical constant, the ratio of a circle's circumference to its diameter.
IS	The sensitivity of the SV's antenna phase center position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters $\sqrt{A}$, C_{rc} and C_{rs} is about one meter/meter. The sensitivity of position to the angular parameters is on the order of $1 \times 10^{+8}$ meters/semicircle, and to the angular rate parameters is on the order of $1 \times 10^{+12}$ meters/semicircle/second. Because of this extreme sensitivity to angular perturbations, the value of π used in the curve fit is given here. π is a mathematical constant, the ratio of a circle's circumference to its diameter.

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Fixing Dashes

DOORS ID	IS200-367, IS200-554, IS705-243, IS800-181		
Paragraph	IS-GPS-200 20.3.3.4.3.1.0-6, 30.3.3.1.3.0-9 IS-GPS-705 20.3.3.1.3.0-10 IS-GPS-800 3.5.3.6.1.0-5	**Comment Number**	CRM #15
Comment Type	Administrative	**Disposition**	Accept
Comment Originator(s)	FAA Concurs		
Comment	Three description entries after the Kepler's equation line have "-" in front of the description. This seems unnecessary.		
Government Response	Accept. The extra dashes will be removed		

Table 20-IV. Fixed Dashes

Paragraph

Redlines / IS

IS200-367 Table 20-IV. Broadcast Navigation User Equations (sheet 1 of 4)

$\mu = 3.986005 \times 10^{+14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A = (\sqrt{A})^2$	Semi-major axis
$n_0 = \sqrt{\frac{\mu}{A^3}}$	Computed mean motion (rad/sec)
$t_k = t - t_{oe}$*	Time from ephemeris reference epoch NOTE 1
$n = n_0 + \Delta n$	Corrected mean motion
$M_k = M_0 + n\, t_k$	Mean anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric anomaly (E_k) by iteration:	
$E_0 = M_k$	–Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	–Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	–Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)
NOTE 1* t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total time difference between the time t and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is, if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

$\mu = 3.986005 \times 10^{+14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A = (\sqrt{A})^2$	Semi-major axis
$n_0 = \sqrt{\frac{\mu}{A^3}}$	Computed mean motion (rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference epoch NOTE 1
$n = n_0 + \Delta n$	Corrected mean motion
$M_k = M_0 + n t_k$	Mean anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric anomaly (E_k) by iteration:	
$E_0 = M_k$	Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)
NOTE 1: t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total time difference between the time t and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is, if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

Table 30-II. Fixed Dashes

Paragraph

Redlines / IS

IS200-554 Table 30-II. Broadcast Navigation User Equations (sheet 1 of 4)

Element/Equation	Description
$\mu = 3.986005 \times 10^{14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$ NOTE1*	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time (rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
~~$t_k = t - t_{oe}$ **~~	~~Time from ephemeris reference time~~
~~$\Delta n_A = \Delta n_0 + \frac{1}{2} \Delta \dot{n}_0 t_k$~~	~~Mean motion difference from computed value~~
~~$n_A = n_0 + \Delta n_A$~~	~~Corrected Mean Motion~~
$n_0' = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n_0' + \Delta \dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n_0' t_k + \Delta \dot{n}_0\, t_k^2/2$ ~~$M_k = M_0 + n_A t_k$~~	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	–Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	–Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	–Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)
NOTE1: * A_{REF} = 26,559,710 meters	
NOTE2: ** t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time t and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

Element/Equation	Description
$\mu = 3.986005 \times 10^{+14}$ meters^3/sec^2	WGS 84 value of the earth's gravitatsional constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time(rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n_0' = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n_0' + \Delta \dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n_0' t_k + \Delta \dot{n}_0\, t_k^2/2$	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)
NOTE1: A_{REF} = 26,559,710 meters	
NOTE2: t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time t and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

IS705-243 Fixed Dashes

Paragraph

Redlines / IS

IS705-243 Table 20-II. Broadcast Navigation User Equations (sheet 1 of 4)

Element/Equation	Description
$\mu = 3.986005 \times 10^{\pm 14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$ NOTE1*	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time (rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
~~$t_k = t - t_{oe}$ **~~	~~Time from ephemeris reference time~~
~~$\Delta n_A = \Delta n_0 + \frac{1}{2} \Delta \dot{n}_0 t_k$~~	~~Mean motion difference from computed value~~
~~$n_A = n_0 + \Delta n_A$~~	~~Corrected Mean Motion~~
$n'_0 = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n'_0 + \Delta \dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n'_0\, t_k + \Delta \dot{n}_0\, t_k^2/2$ ~~$M_k = M_0 + n_A t_k$~~	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)

NOTE1: * A_{REF} = 26,559,710 meters

NOTE2: ** **t** is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time **t** and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.

Element/Equation	Description
$\mu = 3.986005 \times 10^{+14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time(rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n'_0 = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n'_0 + \Delta \dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n'_0\, t_k + \Delta \dot{n}_0\, t_k^2/2$	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)

NOTE1: A_{REF} = 26,559,710 meters

NOTE2: **t** is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time **t** and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.

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Table 3.5-2. Fixed Dashes

Paragraph

Redlines / IS

IS800-181 Table 3.5-2. Broadcast Navigation User Equations (sheet 1 of 4)

Element/Equation	Description
$\mu = 3.986005 \times\!\!\times 10^{\pm 14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times\!\!\times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$ NOTE1*	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time (rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
~~$t_k = t - t_{oe}$ **~~	~~Time from ephemeris reference time~~
~~$\Delta n_A = \Delta n_0 + \frac{1}{2} \Delta \dot{n}_0 t_k$~~	~~Mean motion difference from computed value~~
~~$n_A = n_0 + \Delta n_A$~~	~~Corrected Mean Motion~~
$n'_0 = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n'_0 + \Delta \dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n'_0\, t_k + \Delta \dot{n}_0\, t_k^2/2$ ~~$M_k = M_0 + n_A t_k$~~	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	–Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	–Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	–Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)
NOTE1: * A_{REF} = 26,559,710 meters	
NOTE2: ** **t** is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time **t** and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

Element/Equation	Description
$\mu = 3.986005 \times 10^{+14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time(rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n'_0 = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n'_0 + \Delta \dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n'_0\, t_k + \Delta \dot{n}_0\, t_k^2/2$	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	Final Value (radians)
$v_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)
NOTE1: A_{REF} = 26,559,710 meters	
NOTE2: **t** is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time **t** and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

Consistent Fonts

DOORS ID	IS200-451		
Paragraph	20.3.3.5.2.6.0-6	**Comment Number**	CRM #13
Comment Type	Administrative	**Disposition**	Accept With Comments
Comment Originator(s)	FAA Concurs		
Comment	In the "IS", the 10^+4 term is a different font than the 4.32. Suggestion: Same fonts in the t= line		
Government Response	Accept With Comments. Using MS Equation, some fonts and sizes are not controllable, but the "t" line font consistency has been improved		

Fonts Made Consistent

Paragraph	IS200-451	BEFORE	AFTER
WAS/IS		Other equations that must be solved are $\phi_m = \phi_i + 0.064\cos(\lambda_i - 1.617)$ (semi-circles) $\lambda_i = \lambda_u + \frac{\psi \sin A}{\cos \phi_i}$ (semi-circles) $\phi_i = \begin{cases} \phi_u + \psi \cos A, & \lvert\phi_i\rvert \le 0.416 \\ \text{if } \phi_i > +0.416, \text{ then } \phi_i = +0.416 \\ \text{if } \phi_i < -0.416, \text{ then } \phi_i = -0.416 \end{cases}$ (semi-circles) $\psi = \frac{0.0137}{E + 0.11} - 0.022$ (semi-circles) $t = 4.32\,(10^4)\,\lambda_i + \text{GPS time}$ (sec) where $0 \le t < 86400$: therefore, if $t \ge 86400$ seconds, subtract 86400 seconds; if $t < 0$ seconds, add 86400 seconds.	Other equations that must be solved are $\phi_m = \phi_i + 0.064\cos(\lambda_i - 1.617)$ (semi-circles) $\lambda_i = \lambda_u + \frac{\psi \sin A}{\cos \phi_i}$ (semi-circles) $\varphi_i = \begin{cases} \varphi_u + \psi \cos A, & \lvert\varphi_i\rvert \le 0.416 \\ \text{if } \varphi_i > +0.416, \text{ then } \varphi_i = +0.416 \\ \text{if } \varphi_i < -0.416, \text{ then } \varphi_i = -0.416 \end{cases}$ (semi-circles) $\psi = \frac{0.0137}{E - 0.11} - 0.022$ (semi-circles) $t = 4.32 \times 10^{-4}\,\lambda_i + \text{GPS time}$ (sec) where $0 \le t < 86,400$: therefore, if $t \ge 86,400$ seconds, subtract 86,400 seconds; if $t < 0$ seconds, add 86,400 seconds.

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URA & IAURA Inter Document Consistency

DOORS ID	IS200-157, IS800-297		
Paragraph	IS-GPS-200 6.2.1.0-1 IS-GPS-800 6.2.1.0-1	**Comment Number**	#32
Comment Type	Substantive	**Disposition**	Accept With Comments
Comment Originator(s)	LMCO		
Comment	Why aren't the proposed redlines between IS200-157 and IS800-297 self-consistent?		
Government Response	Accept With Comments: i. Much of what's suggested for 200 is already in the PCN, and 800 will be changed so 'off' goes to "0" and 'on' goes to "1" to be consistent across all documents ii. During examination of this issue, we found that a reference to "RSS" (root sum of the squares) is not appropriate when calculating IAURA and should be replaced with "sum" which is a more conservative (i.e. safer) calculation method iii. 800 will be updated to the 200 wording removing anything specific to LNAV. Note: The corresponding IS-GPS-705 section 6.2.1 just references IS-GPS-200 6.2.1 so no consistency issue with 705 exists		

Corresponding Redlines

Paragraph	IS200-157 New Redlines:	IS800-297 New Redlines:
New Redlines • **Green is recent additional text to respond to the comment suggestion** • **Purple is areas that are still different, because they are LNAV-only**	User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV for all errors for which the Space and Control Segments are responsible. There is a URA for LNAV and a second URA for CNAV. Nominal URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the specific signal and SV. Integrity Assured URA (IAURA) is a statistical indicator for bounding the instantaneous URE obtainable with a specific signal and SV. Whether the integrity status flag is "0" or "1", ±4.42 times IAURA bounds the instantaneous URE with 1-(1 × 10^{-5}) per hour probability ('legacy' level of integrity assurance). When the integrity status flag is set to "1", ±5.73 times IAURA bounds the instantaneous URE with 1-(1 × 10^{-8}) per hour probability ('enhanced' level of integrity assurance). Integrity properties of the IAURA are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the URA index when using the LNAV Clock, Ephemeris, Integrity (CEI) data set or ~~the RSS~~ sum of an elevation-dependent URA and a non-elevation dependent URA developed using the upper bound values of the associated URA indexes when using the CNAV CEI data set.	User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV for all errors for which the Space and Control Segments are responsible. Nominal URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the specific signal and SV. Integrity Assured URA (IAURA) is a statistical indicator for bounding the instantaneous URE obtainable with a specific signal and SV. Whether the integrity status flag is "0" or "1", ±4.42 times IAURA bounds the instantaneous URE with 1-(1 × 10^{-5}) per hour probability ('legacy' level of integrity assurance). When the integrity status flag is set to "1", ±5.73 times IAURA bounds the instantaneous URE with 1-(1 × 10^{-8}) per hour probability ('enhanced' level of integrity assurance). Integrity properties of the IAURA are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) sum of an elevation-dependent URA and a non-elevation dependent URA developed using the upper bound values of the associated URA indexes when using the CNAV-2 CEI data set.

Incorrect Rationale

DOORS ID	IS200-1943		
Paragraph	30.3.3.1.1.0-8	**Comment Number**	CRM #19
Comment Type	Administrative	**Disposition**	Accept
Comment Originator(s)	LMCO Concur		
Comment	The rationale provided appears to be incorrect; these redlines are for scientific notation standardization and are unrelated to the RFC-502 Core CEI changes. Rationale: PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)		
Government Response	Accept. Rationale has been changed per the text below **Rationale**: PRAT 2020-03 9/10/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)		

Correcting Greek Letters

DOORS ID	IS200-1966, ID705-1721		
Paragraph	30.3.3.7.4.0-4	**Comment Number**	CRM #22, #23
Comment Type	Substantive	**Disposition**	Accept
Comment Originator(s)	LMCO		
Comment	**IS705-1721** 22. It looks like the Greek symbol for delta was inadvertently changed to "D" and needs to be fixed. ...provided in the EDC data packet of the message type 34 or 14 and ΔM0 is obtained from… **IS200-1966** 23. This change appears to be missing and should align with the updates made to IS705-1721 IS200 PCN should have the equivalent redlines to IS200-1966 that appear in IS705-1721.		
Government Response	Accept. The root cause was the old text mixed in Greek fonts instead of using Unicode.		

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IS-GPS-200 Greek Letter Corrections

Paragraph	IS200-1966
WAS:	The quasi-Keplerian elements are then corrected by $A_c = A_i + \Delta A$ $e_c = (\alpha_c^2 + \beta_c^2)^{1/2}$ $i_c = i_i + \Delta i$ $\Omega_c = \Omega_i + \Delta\Omega$ $\omega_c = \tan^{-1}(\beta_c/\alpha_c)$ $M_{0\text{-}c} = \gamma_c - \omega_c + \Delta M_0$ where ΔA, Δi and $\Delta\Omega$ are provided in the EDC data packet of the Message Type 34 or 14 and ΔM_0 is obtained from $\Delta M_0 = \frac{-3}{2}\left(\frac{\mu}{A_0^{\,3}}\right)^{\frac{1}{2}}\left(\frac{\Delta A_0}{A_0}\right)\left[\left(t_{oe} + WN_{oe} * 604{,}800\right) - \left(t_{OD} + WN * 604{,}800\right)\right]$ where WN(oe) is the week number associated with the t(oe) and WN is the current week number. The corrected quasi-Keplerian elements above are applied to the user algorithm for determination of antenna phase center position in Section 30.3.3.1.3, Table 30-II.
New IS:	The quasi-Keplerian elements are then corrected by $A_c = A_i + \Delta A$ $e_c = (\alpha_c^2 + \beta_c^2)^{1/2}$ $i_c = i_i + \Delta i$ $\Omega_c = \Omega_i + \Delta\Omega$ $\omega_c = \tan^{-1}(\beta_c/\alpha_c)$ $M_{0\ c} = \gamma_c - \omega_c + \Delta M_0$ where ΔA, Δi and $\Delta\Omega$ are provided in the EDC data packet of the message type 34 or 14 and D$\underline{\Delta}$M$_0$ is obtained from $\Delta M_0 = -\frac{3}{2}\sqrt{\frac{\mu}{A_0^{\,3}}}\left(\frac{\Delta A_0}{A_0}\right)\left[\left(t_{oe} + 604{,}800\ WN_{oe}\right) - \left(t_{OD} - 604{,}800\ WN\right)\right]$ where WN_{oe} is the week number associated with the t_{oe} and WN is the current week number. The corrected quasi-Keplerian elements above are applied to the user algorithm for determination of antenna phase center position in Section 30.3.3.1.3, Table 30-II.
Rationale:	12/10/2025 CRM #23 Normalize the notation for scalar value multiply, use only implied multiply. Now matches IS705-1721 (T. Anthony) Administrative fix 12/10/2025 Many parameters needed to have their Greek letters redone in Unicode. Also some of the terms for the formula were redone because the square root was used many places, but was 1/2 power here. (T. Anthony)

IS-GPS-705 Greek Letter Corrections

Paragraph	IS705-1721
WAS:	The quasi-Keplerian elements are then corrected by $A_c = A_i + \Delta A$ $e_c = (\alpha_c^2 + \beta_c^2)^{1/2}$ $i_c = i_i + \Delta i$ $\Omega_c = \Omega_i + \Delta\Omega$ $\omega_c = \tan^{-1}(\beta_c/\alpha_c)$ $M_{0\_c} = \gamma_c - \omega_c + \Delta M_0$ where ΔA, Δi and ΔΩ are provided in the EDC data packet of the message type 34 or 14 and ΔM_0 is obtained from $\Delta M_0 = \frac{-3}{2}\left(\frac{\mu}{A_0^3}\right)^{\frac{1}{2}}\left(\frac{\Delta A_0}{A_0}\right)\left[\left(t_{oe} + WN_{oe} * 604{,}800\right) - \left(t_{OD} + WN * 604{,}800\right)\right]$
New IS:	The quasi-Keplerian elements are then corrected by $A_c = A_i + \Delta A$ $e_c = (\alpha_c^2 + \beta_c^2)^{1/2}$ $i_c = i_i + \Delta i$ $\Omega_c = \Omega_i + \Delta\Omega$ $\omega_c = \tan^{-1}(\beta_c/\alpha_c)$ $M_{0\ c} = \gamma_c - \omega_c + \Delta M_0$ where ΔA, Δ*i* and ΔΩ are provided in the EDC data packet of the message type 34 or 14 and ΔM_0 is obtained from $\Delta M_0 = -\frac{3}{2}\sqrt{\frac{\mu}{A_0^3}}\left(\frac{\Delta A_0}{A_0}\right)\left[(t_{oe} + 604{,}800\ WN_{oe}) - (t_{OD} - 604{,}800\ WN)\right]$
Rationale:	12/10/2025 CRM #22 fixed "D" to unicode equivalent "Δ" (T. Anthony) 8/5/2025 Normalize the notation for scalar value multiply, use only implied multiply. (T. Anthony) Administrative fix 8/5/2025 Many parameters needed to have their Greek letters redone in Unicode. Also, some of the terms for the formula were redone because the square root was used many places, but was 1/2 power here. (T. Anthony)

Normalizing Power of 2 Notation

DOORS ID	IS200-366, ~~IS200-367~~, IS200-610		
Paragraph	IS-GPS-200 20.3.3.4.3.1.0-4, 30.3.3.4.6.2.1.0-3	**Comment Number**	CRM #18
Comment Type	Administrative	**Disposition**	Accept With Comments
Comment Originator(s)	Boeing Concurs		
Comment	Inconsistent use of positive exponents. These sections represent a positive exponent with no sign, but other sections represents a positive exponent with a plus sign before the exponent value.		
Government Response	Accept With Comments. i. With power of 10 notation using + and - in exponents, adding + to power of 2 exponents is a reasonable normalization. ii. Where appropriate non-breaking spaces were added after all power of 2 exponents with 1 digit in order to vertically align the "2"s. iii. Because squaring and cubing is so common in formulas, I did not use "+" in those cases where a factor or unit was being squared or cubed. iv. IS200-367 had a lot of editing, but none of it regarded 2^n notation		

Table 20-III 2^n and NOTEn

Paragraph

Redlines / IS

IS200-366 Table 20-III. Ephemeris Parameters

Parameter	No. of Bits**NOTE2	Scale Factor (LSB)	Valid Range***NOTE3	Units
IODE	8			(see text)
C_{rs}	16*NOTE1	2^{-5}		meters
Δn	16*NOTE1	2^{-43}		semi-circles/sec
M_0	32*NOTE1	2^{-31}		semi-circles
C_{uc}	16*NOTE1	2^{-29}		radians
e	32	2^{-33}	0.0 to 0.03	dimensionless
C_{us}	16*NOTE1	2^{-29}		radians
$\sqrt{A}$	32	2^{-19}	2530 to 8192	$\sqrt{meters}$
t_{oe}	16	2^{+4}	0 to 604,784	seconds
C_{ic}	16*NOTE1	2^{-29}		radians
Ω_0	32*NOTE1	2^{-31}		semi-circles
C_{is}	16*NOTE1	2^{-29}		radians
i_0	32*NOTE1	2^{-31}		semi-circles
C_{rc}	16*NOTE1	2^{-5}		meters
ω	32*NOTE1	2^{-31}		semi-circles
$\dot{\Omega}$	24*NOTE1	2^{-43}	-6.33×10^{-7} E-07to 0	semi-circles/sec
IDOT	14*NOTE1	2^{-43}		semi-circles/sec

NOTE1: * Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB

NOTE2: ** See Figure 20-10 for complete bit allocation in subframe

NOTE3: *** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor*

Parameter	No. of Bits NOTE2	Scale Factor (LSB)	Valid Range NOTE3	Units
IODE	8			(see text)
C_{rs}	16 NOTE1	2^{-5}		meters
Δn	16 NOTE1	2^{-43}		semi-circles/sec
M_0	32 NOTE1	2^{-31}		semi-circles
C_{uc}	16 NOTE1	2^{-29}		radians
e	32	2^{-33}	0.0 to 0.03	dimensionless
C_{us}	16 NOTE1	2^{-29}		radians
$\sqrt{A}$	32	2^{-19}	2530 to 8192	$\sqrt{meters}$
t_{oe}	16	2^{+4}	0 to 604,784	seconds
C_{ic}	16 NOTE1	2^{-29}		radians
Ω_0	32 NOTE1	2^{-31}		semi-circles
C_{is}	16 NOTE1	2^{-29}		radians
i_0	32 NOTE1	2^{-31}		semi-circles
C_{rc}	16 NOTE1	2^{-5}		meters
ω	32 NOTE1	2^{-31}		semi-circles
$\dot{\Omega}$	24 NOTE1	2^{-43}	-6.33×10^{-7} to 0	semi-circles/sec
IDOT	14 NOTE1	2^{-43}		semi-circles/sec

NOTE1: Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB

NOTE2: See Figure 20-10 for complete bit allocation in subframe

NOTE3: Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor

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Table 30-V. Fix 2^n

Paragraph

Redlines / IS

IS200-610 Table 30-V. Midi Almanac Parameters

Parameter	No. of Bits**NOTE2	Scale Factor (LSB)	Valid Range***NOTE3	Units
t_{oa}	8	2^{+12}	0 to 602,112	seconds
e	11	2^{-16}	0.0 to 0.03	dimensionless
δ_i****NOTE4	11*NOTE1	2^{-14}		semi-circles
$\dot{\Omega}$	11*NOTE1	2^{-33}	-1.19 × 10^{-7} E-7 to 0	semi-circles/sec
$\sqrt{A}$	17	2^{-4}	2530 to 8192	$\sqrt{\text{meters}}$
Ω_0	16*NOTE1	2^{-15}		semi-circles
ω	16*NOTE1	2^{-15}		semi-circles
M_0	16*NOTE1	2^{-15}		semi-circles
a_{f0}	11*NOTE1	2^{-20}		seconds
a_{f1}	10*NOTE1	2^{-37}		sec/sec

NOTE1:* Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;

NOTE2:** See Figure 30-10 for complete bit allocation in message type 37;

NOTE3:*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor;

NOTE4:**** Relative to i_0 = 0.30 semi-circles.

Parameter	No. of Bits[NOTE2]	Scale Factor (LSB)	Valid Range[NOTE3]	Units
t_{oa}	8	2^{+12}	0 to 602,112	seconds
e	11	2^{-16}	0.0 to 0.03	dimensionless
δ_i[NOTE4]	11[NOTE1]	2^{-14}		semi-circles
$\dot{\Omega}$	11[NOTE1]	2^{-33}	-1.19 × 10^{-7} to 0	semi-circles/sec
$\sqrt{A}$	17	2^{-4}	2530 to 8192	$\sqrt{\text{meters}}$
Ω_0	16[NOTE1]	2^{-15}		semi-circles
ω	16[NOTE1]	2^{-15}		semi-circles
M_0	16[NOTE1]	2^{-15}		semi-circles
a_{f0}	11[NOTE1]	2^{-20}		seconds
a_{f1}	10[NOTE1]	2^{-37}		sec/sec

NOTE1: Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB

NOTE2: See Figure 30-10 for complete bit allocation in message type 37

NOTE3: Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor

NOTE4: Relative to i_0 = 0.30 semi-circles

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Fixes to SV Velocity Tables

DOORS ID	IS200-1730, IS705-1594, IS800-1011		
Paragraph	IS-GPS-200 30.3.3.1.3.0-13 IS-GPS-705 20.3.3.1.3.0-14 IS-GPS-800 3.5.3.6.1.0-9	**Comment Number**	CRM #16, #24
Comment Type	16. Administrative 24. Substantive	**Disposition**	16. Accept With Comments 24. Accept
Comment Originator(s)	FAA Concur LMCO Concur		
Comment	16. In the Description column, there are several parameters that are hyphenated, but have a space between the hyphen and the following text. 24. The description of the fifth equation in this table should be "Corrected Radius Rate for CNAV-2" but the updated table says "CNAV“ (applies only to IS800-1011)		
Government Response	16. In each case "in-plane" and "Earth-fixed" should be hyphenated because they are compound adjectives modifying a noun. This means there should not be a space after the hyphen, but the hyphen is proper English. 24. Accept.		

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Table 30-II. Fix Hyphenated Words

Paragraph

IS200-1730 Table 30-II. Broadcast Navigation User Equations (sheet 3 of 4)
IS705-1594 Table 20-II. Broadcast Navigation User Equations (sheet 3 of 4)

Redlines / IS

Element/Equation	Description
SV Velocity	
$\dot{E}_k = \frac{n_k}{1 - e\cos E_k}$	Eccentric Anomaly Rate
$\dot{v_k} = \dot{E}_k \sqrt{1-e^2}/(1 - e\cos E_k)$	True Anomaly Rate
$(di_k/dt) = (\text{IDOT}) + 2\,\dot{v_k}(\text{~~e~~}C_{is}\cos 2\phi_k - \text{~~e~~}C_{ic}\sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u_k} = \dot{v_k} + 2\dot{v_k}\,(\text{~~e~~}C_{us}\cos 2\phi_k - \text{~~e~~}C_{uc}\sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r_k} = \dot{A}(1\text{-e}\cos(E_k)) + A_k\, e \sin(E_k)\,\dot{E}_k + 2\,(\text{~~e~~}C_{rs}\cos(2\phi_k) - \text{~~e~~}C_{rc}\sin(2\phi_k))\,\dot{v_k}$	Corrected Radius Rate for CNAV
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r_k}\cos u_k - r_k \dot{u_k}\sin u_k$	In-~~-~~plane *x* velocity
$\dot{y}'_k = \dot{r_k}\sin u_k + r_k \dot{u_k}\cos u_k$	In-~~-~~plane *y* velocity
$\dot{x}_k = -x'_k\,\dot{\Omega}_k \sin\Omega_k + \dot{x}'_k\cos\Omega_k - \dot{y}'_k \sin\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \cos\Omega_k \cos i_k - (di_k/dt)\sin\Omega_k \sin i_k)$	Earth-~~F~~fixed *x* velocity (m/s)
$\dot{y}_k = x'_k\,\dot{\Omega}_k \cos\Omega_k + \dot{x}'_k\sin\Omega_k + \dot{y}'_k \cos\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \sin\Omega_k \cos i_k + (di_k/dt)\cos\Omega_k \sin i_k)$	Earth-~~F~~fixed *y* velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k\,(di_k/dt)\cos i_k$	Earth-~~F~~fixed *z* velocity (m/s)

Element/Equation	Description
SV Velocity	
$\dot{E}_k = \frac{n_k}{1 - e\cos E_k}$	Eccentric Anomaly Rate
$\dot{v_k} = \dot{E}_k\sqrt{1-e^2}/(1 - e\cos E_k)$	True Anomaly Rate
$(di_k/dt) = (\text{IDOT}) + 2\,\dot{v_k}(C_{is}\cos 2\phi_k - C_{ic}\sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u_k} = \dot{v_k} + 2\dot{v_k}\,(C_{us}\cos 2\phi_k - C_{uc}\sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r_k} = \dot{A}(1\text{-e}\cos(E_k)) + A_k\, e \sin(E_k)\,\dot{E}_k + 2\,(C_{rs}\cos(2\phi_k) - C_{rc}\sin(2\phi_k))\,\dot{v_k}$	Corrected Radius Rate for CNAV
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r_k}\cos u_k - r_k \dot{u_k}\sin u_k$	In-plane *x* velocity
$\dot{y}'_k = \dot{r_k}\sin u_k + r_k \dot{u_k}\cos u_k$	In-plane *y* velocity
$\dot{x}_k = -x'_k\,\dot{\Omega}_k \sin\Omega_k + \dot{x}'_k\cos\Omega_k - \dot{y}'_k \sin\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \cos\Omega_k \cos i_k - (di_k/dt)\sin\Omega_k \sin i_k)$	Earth-fixed *x* velocity (m/s)
$\dot{y}_k = x'_k\,\dot{\Omega}_k \cos\Omega_k + \dot{x}'_k\sin\Omega_k + \dot{y}'_k \cos\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \sin\Omega_k \cos i_k + (di_k/dt)\cos\Omega_k \sin i_k)$	Earth-fixed *y* velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k\,(di_k/dt)\cos i_k$	Earth-fixed *z* velocity (m/s)

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Table 3.5-2. Fix Hyphenated Words

Paragraph

Redlines / IS

IS800-1011 Table 3.5-2. Broadcast Navigation User Equations (sheet 3 of 4)

Element/Equation	Description
SV Velocity	
$\dot{E}_k = \frac{n_k}{1 - e\cos E_k}$	Eccentric Anomaly Rate
$\dot{v_k} = \dot{E}_k \sqrt{1-e^2}/(1 - e\cos E_k)$	True Anomaly Rate
$(di_k / dt) = (\text{IDOT}) + 2\,\dot{v_k}\,(\text{~~e~~}C_{is}\cos 2\phi_k - \text{~~e~~}C_{ic}\sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u_k} = \dot{v_k} + 2\dot{v_k}\,(\text{~~e~~}C_{us}\cos 2\phi_k - \text{~~e~~}C_{uc}\sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r_k} = \dot{A}(1\text{-e}\cos(E_k)) + A_k\, e \sin(E_k)\,\dot{E}_k + 2\,(\text{~~e~~}C_{rs}\cos(2\phi_k) - \text{~~e~~}C_{rc}\sin(2\phi_k))\,\dot{v_k}$	Corrected Radius Rate for CNAV-2
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r_k}\cos u_k - r_k \dot{u_k} \sin u_k$	In-~~-~~plane *x* velocity
$\dot{y}'_k = \dot{r_k}\sin u_k + r_k \dot{u_k} \cos u_k$	In-~~-~~plane *y* velocity
$\dot{x}_k = -x'_k\,\dot{\Omega}_k \sin\Omega_k + \dot{x}'_k\cos\Omega_k - \dot{y}'_k \sin\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \cos\Omega_k \cos i_k - (di_k/dt)\sin\Omega_k \sin i_k)$	Earth-~~F~~fixed *x* velocity (m/s)
$\dot{y}_k = x'_k\,\dot{\Omega}_k \cos\Omega_k + \dot{x}'_k\sin\Omega_k + \dot{y}'_k \cos\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \sin\Omega_k \cos i_k + (di_k/dt)\cos\Omega_k \sin i_k)$	Earth-~~F~~fixed *y* velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k\,(di_k/dt)\cos i_k$	Earth-~~F~~fixed *z* velocity (m/s)

Element/Equation	Description
SV Velocity	
$\dot{E}_k = \frac{n_k}{1 - e\cos E_k}$	Eccentric Anomaly Rate
$\dot{v_k} = \dot{E}_k \sqrt{1-e^2}/(1 - e\cos E_k)$	True Anomaly Rate
$(di_k / dt) = (\text{IDOT}) + 2\,\dot{v_k}\,(C_{is}\cos 2\phi_k - C_{ic}\sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u_k} = \dot{v_k} + 2\dot{v_k}\,(C_{us}\cos 2\phi_k - C_{uc}\sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r_k} = \dot{A}(1\text{-e}\cos(E_k)) + A_k\, e \sin(E_k)\,\dot{E}_k + 2\,(C_{rs}\cos(2\phi_k) - C_{rc}\sin(2\phi_k))\,\dot{v_k}$	Corrected Radius Rate for CNAV-2
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r_k}\cos u_k - r_k \dot{u_k} \sin u_k$	In-plane *x* velocity
$\dot{y}'_k = \dot{r_k}\sin u_k + r_k \dot{u_k} \cos u_k$	In-plane *y* velocity
$\dot{x}_k = -x'_k\,\dot{\Omega}_k \sin\Omega_k + \dot{x}'_k\cos\Omega_k - \dot{y}'_k \sin\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \cos\Omega_k \cos i_k - (di_k/dt)\sin\Omega_k \sin i_k)$	Earth-fixed *x* velocity (m/s)
$\dot{y}_k = x'_k\,\dot{\Omega}_k \cos\Omega_k + \dot{x}'_k\sin\Omega_k + \dot{y}'_k \cos\Omega_k \cos i_k - y'_k(\dot{\Omega}_k \sin\Omega_k \cos i_k + (di_k/dt)\cos\Omega_k \sin i_k)$	Earth-fixed *y* velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k\,(di_k/dt)\cos i_k$	Earth-fixed *z* velocity (m/s)

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Fix in Table 40-II SEM Almanac Description for Current.al3 (Sheet 1 of 2)

DOORS ID	ICD870-234		
Paragraph		**Comment Number**	CRM #70
Comment Type	Administrative	**Disposition**	Accept
Comment Originator(s)	RTX Concur		
Comment	Almanac reference week number (WNa) - should be Wn_a		
Government Response	Accept. This defect existed before this RFC. Glad to fix it.		

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Fix Wn_a on Line 2

Paragraph: ICD870-234

WAS

2	GPS Week Number	The Almanac reference week number (WNa) for all Almanac data in the file	Weeks	0 to 1023 *	1	4 significant digits

Before Redlines

2	GPS Week Number	The Almanac reference week number (WNa) for all Almanac data in the file	Weeks	0 to 1023 * NOTE1	1	4 significant digits

After Redlines

2	GPS Week Number	The Almanac reference week number (WN~~a~~$_a$) for all Almanac data in the file	Weeks	0 to 1023 * NOTE1	1	4 significant digits

After IS

2	GPS Week Number	The Almanac reference week number (WN_a) for all Almanac data in the file	Weeks	0 to 1023 NOTE1	1	4 significant digits

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Fix Redlines In Table 40-II SEM Almanac Description for Current.al3 (Sheet 2 of 2)

DOORS ID	ICD870-237		
Paragraph		**Comment Number**	CRM #71
Comment Type	Administrative	**Disposition**	Accept
Comment Originator(s)	RTX Concur		
Comment	In the "Redlines" Under "Description" column for Line R-5. A1/2 should be $A^{1/2}$ In the "Redlines" Under "Precision" column for Line R-5. "ICD870" should be "9 significant digits"		
Government Response	Accept. These Redlines are in OLE Objects where Redline defects can be permanently fixed.		

Two Fixes on Line R-5

Paragraph	ICD870-237

Redlines Before

R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee (A1/2) **NOTE2	Meters$^{1/2}$	0 to 8,192	4.88 × 10^{-4} ~~E-4~~	ICD870

Redlines After

R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$) **NOTE2	Meters$^{1/2}$	0 to 8,192	4.88 × 10^{-4} ~~E-4~~	9 significant digits

IS After

R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$) NOTE2	Meters$^{1/2}$	0 to 8,192	4.88 × 10^{-4}	9 significant digits

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Fix Table 40-IOI SEM Almanac Description for Current.bl3 (Sheet 1 of 2)

DOORS ID	ICD870-239		
Paragraph		**Comment Number**	CRM #72
Comment Type	Administrative	**Disposition**	Accept With Comments
Comment Originator(s)	RTX Concur		
Comment	In the "Redlines" Under "Description" column for Line 2. A1/2 should be $A^{1/2}$		
Government Response	Accept. Actually Fixed WN_a		

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Fix to Redlines and IS of WN_a

Paragraph	IS870-239
Redlines Before	

2	GPS Week Number	The Almanac reference week number (WNa) for all Almanac data in the file	Weeks	0 to 1023 * NOTE1	1	4 significant digits
	Blank space for format spacing					

Redlines After	

2	GPS Week Number	The Almanac reference week number (~~WNa~~ WN_a) for all Almanac data in the file	Weeks	0 to 1023 * NOTE1	1	4 significant digits
	Blank space for format spacing					

IS After	

2	GPS Week Number	The Almanac reference week number (WN_a) for all Almanac data in the file	Weeks	0 to 1023 NOTE1	1	4 significant digits
	Blank space for format spacing					

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Open RFC-544 Discussion

QUESTIONS & COMMENTS?

Action Item Review

LUNCH BREAK

Positioning, Navigation and Timing Mission Public ICWG Slides

Template Version 16 .1a –Jan 2023

WALK ON SPECIAL TOPICS

Open Discussion

QUESTIONS & COMMENTS?

Action Item Review

Positioning, Navigation and Timing Mission Public ICWG Slides

Template Version 16 .1a –Jan 2023

AFTERNOON SPECIAL TOPICS

Open Discussion

QUESTIONS & COMMENTS?

10 MINUTE BREAK

Walk-on Topics

June 16, 2026

(In separate presentations, if any)

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Action Item Review

Public Requirements Accountability Tool (PRAT) Item Status

16-JUN-2026

Tony Anthony

SE&I Senior Principal Systems Engineer

Public Requirements Accountability Tool (PRAT)

- Status and Discussion of Closure of Existing Items 2020 through 2025
  - Total of 7 Open PRAT Items
  - 4 are candidates to close soon
- New PRAT Items for 2026
  - Only available after the 2026 Public ICWG

Public Requirements Accountability Tool (PRAT)

- 7 Items Open as of the PICWG
- 1 Tied to RFC-519 Completion
  - PRAT 2023-01 Drive ISM Message Formats to Final State
- 3 Tied to RFC-544 Completion
  - PRAT 2020-03 Normalize Power of 10 Notation
  - PRAT 2021-03 Remove Inter Signal Corrections from Core CEI
  - PRAT 2025-02 CNAV Velocity Correction
- 3 Remaining Open
  - PRAT 2021-02 Almanac Ephemeris URE
  - PRAT 2023-02 Investigate CNAV-2 Schedules Technical Baseline changes for future Public Documents Updates
  - PRAT 2025-01 Investigate PRAT Handling Mechanisms

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PRAT Items

Tied to RFC-519 Completion

- PRAT 2023-01 Drive ISM Message Formats to Final State

PRAT 2023-01 Drive ISM Message Formats to Final State

Yr	2023	**Number**	1	**Status**	In Progress
Originator	Calvin Miles			**POC**	Dan Stevenson/Tony Anthony

Description *Drive ISM Message Formats to Final State*

Livelink

Notes 16 Jun 26: GPS leadershp is considering approving this RFC.

9 Aug 24: Rescoped due to the RFC-519 JCRB to include only public facing interfaces so it can more directly respond to RFC-519 which itself was rescoped to define the ISM message formats. Can be closed once RFC-519 is complete.

27 Sep 23: Complete the system engineering for a PRN/IRN set and update the technical baseline. Refer to the 2023 Public ICWG Special Topic on the associated RFCs for the current state. This supersedes PRAT 2021-4 which never had its associated RFC-495A CCB approved. This PRAT Item will replace the ISM related changes from RFC-495A and the ISM related changes deferred from RFC-502.

PRAT Items

Tied to RFC-544 Completion

- PRAT 2020-03 Normalize Power of 10 Notation
- PRAT 2021-03 Remove Inter Signal Corrections from Core CEI
- PRAT 2025-02 CNAV Velocity Correction

PRAT 2020-03 Normalize Power of 10 Notation

Yr	2020	**Number**	3	**Status**	In Progress
Originator	Rhonda Slattery			**POC**	Tony Anthony (SE&I)

Description *Make documents consistent between using the notation "x10^-1" and "1E-1". Choose one option and make all other ocassions consistent.*

Livelink

Notes

16 Jun 26: Satisfied once RFC-544 is complete except for ICD-GPS-240 which may be slated for obsolescence.

13 Mar 25: The number of changes recommended for change (after RFC-519 completes) are as follows:
IS-GPS-200 - 5 places
IS-GPS-705 - 10 places
IS-GPS-800 - 10 places
ICD-GPS-240 - 3 places
ICD-GPS-870 - 6 places

27 Sep 23: This work item was not included in RFC-502 for the 2023 Public ICWG. Still Open.

PRAT 2021-03 Investigate ISC for Core CEI

Yr	2021	**Number**	3	**Status**	In Progress
Originator	Mr. Karl Kovach (Aerospace Corporation)			**POC**	Karl Kovach (Aerospace)

Description *Investigate the removal of Inter Signal Corrections from the Core CEI Data in the public documents and develop any requirements baseline changes needed to satisfy any consistency shortfalls or operational needs*

Livelink

Notes

16 Jun 26: The CEI changes have been extensively reworked to clearly explain how to use each parameter, have been reviewed and this item will be satisfied once RFC-544 is accepted.
31 May 23: The proposed CEI changes from RFC-502 have been placed on hold by GPS leadershp at ERB, but can be considered for future implementation.

27 Sep 23: In Progress. Still Open.

26 Oct 22: The Special Topic presentation advanced the subject, but had specific recommendations for baseline requirements changes. Will consider Pre-RFC-1201 for 2023 Public Documents Update RFC. Include Denis Bouvet, Rhonda Slattery and Jeff Stevens during investigation.

PRAT 2025-02 CNAV Velocity Correction

Yr	2025	**Number**	2	**Status**	In Progress
Originator	TBD			**POC**	Tony Anthony / David Allen (Aerospace)

Description *Implement the CNAV velocity formula corrections in the public Signal-in-Space documents*

Livelink

Notes 16 Jun 26: The fix has been extensively reviewed and this item will be satisfied once RFC-544 is complete.

14-May-2025: Per David Allen's Special Topic on mistakes in several CNAV velocity formulae, these formulae need to be corrected in all places in the public Signal-in-Space documents well before CNAV IOC is declared.

PRAT Items

Remaining Open

- PRAT 2021-02 Almanac Ephemeris URE
- PRAT 2023-02 Investigate CNAV-2 Schedules Technical Baseline changes
- PRAT 2025-01 Investigate PRAT Handling Mechanisms

PRAT 2021-02 Almanac Ephemeris URE

Yr	2021	**Number**	2	**Status**	In Progress
Originator	Mr. Albert H. Hayden (SE&I)			**POC**	Bert Hayden (Aerospace)

Description *Investigate the Almanac Ephemeris URE Table in IS-GPS-200 20.3.3.5.2.1 Almanac for RFC 467 and develop any requirements baseline changes needed to satisfy any consistency shortfalls or operational needs.*

Livelink

Notes

16 Jun 26: Is being delayed until actual OCX based CNAV data can be obtained.

13 May 25: The Special Topic on this subject to be presented at the May 2025 PICWG was unable to be presented. This subject will be addressed at a future time.

27 Sep 23: In Progress. Still Open. Will consider Pre-RFC-1202 for future Public Documents Update RFC.

26 Oct 22: Assessment not complete. Will consider Pre-RFC-1202 for 2023 Public Documents Update RFC.

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PRAT 2023-02 Investigate CNAV-2 Schedules Technical Baseline Changes

Yr	2023	**Number**	2	**Status**	In Progress
Originator	Rhonda Slattery			**POC**	Bert Hayden

Description *Investigate CNAV-2 Schedules Technical Baseline changes for future Public Documents Updates*

Livelink

Notes 16 Jun 26: The Biweekly Integrated Team Meeting is continuing.

18 Dec 24: Bert Hayden initiated a biweekly integrated team meeting on this subject and will report progress in the future. GPS leadership is deferring cost items like this until needed. The predicted need is some time after L1C IOC (currently estimated 2030/2031).

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PRAT 2025-01 More Effective PRAT Mechanisms

Yr	2025	**Number**	1	**Status**	In Progress
Originator	Rhonda Slattery			**POC**	Emily Hendrickson

Description *Investigate more effective mechanisms to handle and discharge PRAT items and public document oriented Concerns.*

Livelink

Notes

16 Jun 26: No specific new approach has been developed, but there are only 2 PRAT Items slated to be left open, not counting this one.

14 May 25: SSC/CGEP has fewer resources to effect change to the requirements baseline than in the past. This applies both PRAT items and pre-RFCs and Actions against the public documents, which are stacking up without getting implemented or acted on for years.

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PRAT Items

New 2026 PRAT Items

- TBD

Action Item Review

Closing Remarks

BACKUP SLIDES

Acronyms

2 NWS	2nd Navigation Warfare Squadron
AEP	Architecture Evolution Plan
AFL	Available for Launch
AODO	Age of Data Offset
ASIC	Application Specific Integrated Circuit
CDD	Capability Development Document
CDR	Critical Design Review
CEI	Clock/Ephemeris/Integrity
CNAV	Civil Navigation
CUI	Controlled Unclassified Information
DAGR	Defense Advanced GPS Receiver
DDG	Arleigh Burke Guide Missile Destroyer
DT	Developmental Testing
FOT&E	Follow-on Operational Test and Evaluation
FQT	Formal Qualification Testing
FUE	Field User Evaluation
GNST+	GPS IIIF Non-flight Satellite Test Bed
GRAM–S/M	GPS Receiver Application Module – Standard Elec Module/Modernized
HH	Handheld
HPE	Hewlett Packard Enterprise
IAURA	Integrity Assured User Range Accuracy
IBM	International Business Machines
IBR	Integrated Baseline Review
IDR	Implementation Design Review
ISF	Integrity Status Flag
ISM	Integrity Support Message
JTLV	Joint Light Tactical Vehicle
LCS	Launch and Checkout System
MGUE	Military GPS User Equipment
MSF	Major Service Failure
MSI	Miniature Serial Interface
NIWC-PAC	Naval Information Warfare Center -Pacific
NMCT	Navigation Message Correction Table
OT	Operational Testing
PCN	Proposed Change Notice
PDR	Preliminary Design Review
PICWG	Public Interface Control Working Group
PNT	Positioning, Navigation, and Timing
PRAT	Public Requirements Accountability Tool
PRN	Pseudo-Random Noise
RFC	Request for Change
RSS	Root Sum of the Squares
SIS	Signal in Space
TIM	Technical Interface Meeting
TRV	Technical Requirements Verification
UE	User Equipment
URA	User Range Accuracy
URE	User Range Error
USAF	United States Air Force
USMC	United States Marine Corps
USN	United States Navy
WAGE	Wide Area GPS Enhancement