CHANGE NOTICE

Affected Document: IS-GPS-200 Rev K	**IRN/SCN Number** XXX-XXXX-XXX	**Date:** DD-MMM-YYYY
Authority: RFC-00395	**Proposed Change Notice** IS200K-RFC395	**Date:** 31-MAY-2019

CLASSIFIED BY: N/A
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Document Title: Navstar GPS Space Segment/ Navigation User Interfaces

RFC Title: 2019 Public Document Proposed Changes

Reason For Change (Driver):

1. IS-GPS-705 identifies dual frequency users as “L1/L2” and “L1/L5 (recommended)”. Users may interpret frequency pair (L2/L5) as a viable dual frequency; that is not recommended.
2. The user implementation community has identified equations in the Elements of Coordinates Systems tables in documents IS-GPS-200, IS-GPS-705, and IS-GPS-800 that can benefit from an improvement.
3. Documents IS-GPS-200, IS-GPS-705, and IS-GPS 800 are not consistent in their definition of when to broadcast CNAV UTC data. These documents need to be made consistent.
4. ICD-GPS-870 Appendices 1-6, public release GPS products, were derived and developed from ICD-GPS-240 (AEP) to account for OCX transition. Currently OCX uses a translator tool to convert modernized into legacy format to maintain backwards compatibility that AEP produces. Appendices 1-6 must reflect the backwards compatibility format until the public users are well-informed of availability of the modernized format (GPS community).
5. OCX provides a utility to convert modernized GPS products to the legacy, AEP-formatted GPS products. The legacy formats are characterized with default filenames, which are important for the public user community to interpret and process the GPS products. However, these default filenames are not described in ICD-GPS-870.
6. Public documents need clarification and clean-up, as identified in past Public ICWGs and as newly-identified changes of administrative nature.
7. Currently the Operational Advisories (OAs) that are published and archived contain plane/slot descriptions that are not in the constellation definition provided to the public in the SPS Performance Standard as well as the data provided by the National Geospatial-Intelligence Agency (NGA) (refer to http://earth-info.nga.mil/GandG/sathtml/satinfo.html). The OA does not have the capability to correctly publish information regarding fore/aft position since moving to the 24+3 constellation with three expanded slots. (Moved from RFC-374)

Description of Change:

1. In IS-GPS-705, state operational use of the group of signals (L2/L5) is at the users own risk.
2. Recommend a different, less complicated kinematic formulation that improves the equations in the Elements of Coordinate Systems tables in the Signal in Space (SiS) documents.
3. Ensure consistency across documentation of when to broadcast CNAV UTC data in documents IS-GPS-200, IS-GPS-705, and IS-GPS 800.
4. Clarify ICD-GPS-870 Appendix 1-6 are legacy and update definitions in Appendices 1-6 read as built (eg. Appendix 1 describes the legacy NANU types and NANU message format. The sample file in this section is consistent with the legacy format. Sample file for the modernized format will be provided by the GPS community).
5. Add in ICD-GPS-870 a description of default filenames for all legacy GPS products.
6. Provide clarity and clean up identified administrative changes in all public documents.
7. This topic was originally addressed in RFC-374 but needs to be re-addressed in order to update ICD-GPS-870 such that OCX produces an OA with section one set to the original data or set to “RESERVED.”

Authored By: RE: Albert Sicam **Checked By: RE: Philip Kwan**

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	GPS Directorate Space & Missile Systems Center (SMC) – LAAFB	

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THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED.	Interface Control Contractor: SAIC (GPS SE&I) 200 N. Pacific Coast Highway, Suite 1800 El Segundo, CA 90245
	CODE IDENT 66RP1

IS200-11 :

Section Number :
2.1.0-2

WAS :

Specifications	
Federal	None
Military	None
Other Government Activity	None
Standards	
Federal	None
Military	None
Other Publications	
	GP-03-001 (GPS Interface Control Working Group Charter)
	International Earth Rotation and Reference Systems Service (IERS) Technical Note 36

Redlines :

Specifications	
Federal	None
Military	None
Other Government Activity	None
Standards	
Federal	None
Military	None
Other Publications	
GP-03-001 Current Version	~~GP-03-001 (GPS Interface Control Working Group Charter)~~ GPS Adjudication Working Group (AWG) and Rough Order of Magnitude (ROM)/ Impact Assessment (IA) Charter
	International Earth Rotation and Reference Systems Service (IERS) Technical Note 36

IS :

Specifications	
Federal	None
Military	None
Other Government Activity	None
Standards	
Federal	None
Military	None
Other Publications	
GP-03-001 Current Version	GPS Adjudication Working Group (AWG) and Rough Order of Magnitude (ROM)/ Impact Assessment (IA) Charter
	International Earth Rotation and Reference Systems Service (IERS) Technical Note 36

Rationale :
Need to update version of ICWG charter and change ICWG to AWG

IS200-1325 :

Section Number :
3.2.1.5.1

WAS :
Expanded L2 CL-Code (GPS III and subsequent blocks)

Redlines :
Expanded L2 CL-Code (GPS III, GPS IIIF, and subsequent blocks)

IS :
Expanded L2 CL-Code (GPS III, GPS IIIF, and subsequent blocks)

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1518 :

Section Number :
3.2.1.5.1.0-6

WAS :
Table 3-Ib. Expanded Code Phase Assignments (III and subsequent blocks only)

Redlines :
Table 3-Ib. Expanded Code Phase Assignments (GPS III, GPS IIIF, and subsequent blocks only)

IS :
Table 3-Ib. Expanded Code Phase Assignments (GPS III, GPS IIIF, and subsequent blocks only)

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1521 :

Section Number :
3.2.1.5.1.0-12

WAS :
Table 3-IIb. Expanded Code Phase Assignments (III and subsequent blocks only)

Redlines :
Table 3-IIb. Expanded Code Phase Assignments (GPS III, GPS IIIF, and subsequent blocks only)

IS :
Table 3-IIb. Expanded Code Phase Assignments (GPS III, GPS IIIF, and subsequent blocks only)

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-50 :

Section Number :
3.2.3.1-3

WAS :
Table 3-III.

SV Blocks	L1		L2**	
	In-Phase*	Quadrature-Phase*	In-Phase*	Quadrature-Phase*
Block II/IIA/IIR	P(Y) ⊕ D(t)	C/A ⊕ D(t)	P(Y) ⊕ D(t) or P(Y) or C/A ⊕ D(t)	Not Applicable
Block IIR-M/IIF/ and GPS III	P(Y) ⊕ D(t)	C/A ⊕ D(t)	P(Y) ⊕ D(t) or P(Y)	L2 CM ⊕ $D_C(t)$ with L2 CL or C/A ⊕ D(t) or C/A

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

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

* Terminology of "in-phase" and "quadrature-phase" is used only to identify the relative phase quadrature relationship of the carrier components (i.e. 90 degrees offset of each other).
** The two carrier components on L2 may not have the phase quadrature relationship. They may be broadcast on same phase (ref. Section 3.3.1.5).

Redlines :

Table 3-III.

SV Blocks	L1		L2**	
	In-Phase*	Quadrature-Phase*	In-Phase*	Quadrature-Phase*
Block II/IIA/IIR	P(Y) ⊕ D(t)	C/A ⊕ D(t)	P(Y) ⊕ D(t) or P(Y) or C/A ⊕ D(t)	Not Applicable
Block IIR-M/IIF/ and GPS III/ IIIF	P(Y) ⊕ D(t)	C/A ⊕ D(t)	P(Y) ⊕ D(t) or P(Y)	L2 CM ⊕ D_C(t) with L2 CL or C/A ⊕ D(t) or C/A

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

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

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

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

IS :
Table 3-III.

SV Blocks	L1		L2**	
	In-Phase*	Quadrature-Phase*	In-Phase*	Quadrature-Phase*
Block II/IIA/IIR	P(Y) ⊕ D(t)	C/A ⊕ D(t)	P(Y) ⊕ D(t) or P(Y) or C/A ⊕ D(t)	Not Applicable
Block IIR-M/IIF/ and GPS III/ IIIF	P(Y) ⊕ D(t)	C/A ⊕ D(t)	P(Y) ⊕ D(t) or P(Y)	L2 CM ⊕ D_C(t) with L2 CL or C/A ⊕ D(t) or C/A

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

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

* Terminology of "in-phase" and "quadrature-phase" is used only to identify the relative phase quadrature relationship of the carrier components (i.e. 90 degrees offset of each other).
** The two carrier components on L2 may not have the phase quadrature relationship. They may be broadcast on same phase (ref. Section 3.3.1.5).

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-56 :

Section Number :
3.3.1.1.0-1

WAS :
For Block IIA, IIR, IIR-M, and IIF satellites, the requirements specified in this IS shall pertain to the signal contained within two 20.46 MHz bands; one centered about the L1 nominal frequency and the other centered about the L2 nominal frequency (see Table 3-Vb). For GPS III and subsequent satellites, the requirements specified in this IS shall pertain to the signal contained within two 30.69 MHz bands; one centered about the L1 nominal frequency and the other centered about the L2 nominal frequency (see Table 3-Vc). The carrier frequencies for the L1 and L2 signals shall be coherently derived from a common frequency source within the SV. The nominal frequency of this source -- as it appears to an observer on the ground -- is 10.23 MHz. The SV carrier frequency and clock rates -- as they would appear to an observer located in the SV -- are offset to compensate for relativistic effects. The clock rates are offset by Δ f/f = -4.4647E-10, equivalent to a change in the P-code chipping rate of 10.23 MHz offset by a Δ f = -4.5674E-3 Hz. This is equal to 10.2299999954326 MHz. The nominal carrier frequencies (f_0) shall be 1575.42 MHz, and 1227.6 MHz for L1 and L2, respectively.

Redlines :
For Block IIA, IIR, IIR-M, and IIF satellites, the requirements specified in this IS shall pertain to the signal contained within two 20.46 MHz bands; one centered about the L1 nominal frequency and the other centered about the L2 nominal frequency (see Table 3-Vb). For GPS III, GPS IIIF, and subsequent satellites, the requirements specified in this IS shall pertain to the signal contained within two 30.69 MHz bands; one centered about the L1 nominal frequency and the other centered about the L2 nominal frequency (see Table 3-Vc). The carrier frequencies for the L1 and L2 signals shall be coherently derived from a common frequency source within the SV. The nominal frequency of this source -- as it appears to an observer on the ground -- is 10.23 MHz. The SV carrier frequency and clock rates -- as they would appear to an observer located in the SV -- are offset to compensate for relativistic effects. The clock rates are offset by Δ f/f = -4.4647E-10, equivalent to a change in the P-code chipping rate of 10.23 MHz offset by a Δ f = -4.5674E-3 Hz. This is equal to 10.2299999954326 MHz. The nominal carrier frequencies (f_0) shall be 1575.42 MHz, and 1227.6 MHz for L1 and L2, respectively.

IS :
For Block IIA, IIR, IIR-M, and IIF satellites, the requirements specified in this IS shall pertain to the signal contained within two 20.46 MHz bands; one centered about the L1 nominal frequency and the other centered about the L2 nominal frequency (see Table 3-Vb). For GPS III, GPS IIIF, and subsequent satellites, the requirements specified in this IS shall pertain to the signal contained within two 30.69 MHz bands; one centered about the L1 nominal frequency and the other centered about the L2 nominal frequency (see Table 3-Vc). The carrier frequencies for the L1 and L2 signals shall be coherently derived from a common frequency source within the SV. The nominal frequency of this source -- as it appears to an observer on the ground -- is 10.23 MHz. The SV carrier frequency and clock rates -- as they would appear to an observer located in the SV -- are offset to compensate for relativistic effects. The clock rates are offset by Δ f/f = -4.4647E-10, equivalent to a change in the P-code chipping rate of 10.23 MHz offset by a Δ f = -4.5674E-3 Hz. This is equal to 10.2299999954326 MHz. The nominal carrier frequencies (f_0) shall be 1575.42 MHz, and 1227.6 MHz for L1 and L2, respectively.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-59 :

Section Number :
3.3.1.2.0-2

WAS :
The total allowable correlation loss due to SV modulation and filtering imperfections, which is a function of signal, shall be:

Code	Correlation Loss (IIF and prior SVs)	Correlation Loss (III SVs)
C/A & L2C	0.6 dB	0.3 dB
L1P(Y) & L2P(Y)	0.6 dB	0.6 dB

Redlines :
The total allowable correlation loss due to SV modulation and filtering imperfections, which is a function of signal, shall be:

Code	Correlation Loss (IIF and prior SVs)	Correlation Loss (GPS III/IIIF SVs)
C/A & L2C	0.6 dB	0.3 dB
L1P(Y) & L2P(Y)	0.6 dB	0.6 dB

IS :
The total allowable correlation loss due to SV modulation and filtering imperfections, which is a function of signal, shall be:

Code	Correlation Loss (IIF and prior SVs)	Correlation Loss (GPS III/IIIF SVs)
C/A & L2C	0.6 dB	0.3 dB
L1P(Y) & L2P(Y)	0.6 dB	0.6 dB

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-75 :

Section Number :
3.3.1.6.0-3

WAS :
The GPS III SV shall provide L1 and L2 signals with the following characteristic: the L1 off-axis relative power (referenced to peak transmitted power) shall not decrease by more than 2 dB from the Edge-of-Earth (EOE) to nadir; the L2 off-axis power gain shall not decrease by more than 2 dB from EOE to nadir; the power drop off between EOE and ±26 degrees shall be in a monotonically decreasing fashion. Additional related data is provided as supporting material in paragraph 6.3.1.

Redlines :
The GPS III and GPS IIIF SV shall provide L1 and L2 signals with the following characteristic: the L1 off-axis relative power (referenced to peak transmitted power) shall not decrease by more than 2 dB from the Edge-of-Earth (EOE) to nadir; the L2 off-axis power gain shall not decrease by more than 2 dB from EOE to nadir; the power drop off between EOE and ±26 degrees shall be in a monotonically decreasing fashion. Additional related data is provided as supporting material in paragraph 6.3.1.

IS :
The GPS III and GPS IIIF SV shall provide L1 and L2 signals with the following characteristic: the L1 off-axis relative power (referenced to peak transmitted power) shall not decrease by more than 2 dB from the Edge-of-Earth (EOE) to nadir; the L2 off-axis power gain shall not decrease by more than 2 dB from EOE to nadir; the power drop off between EOE and ±26 degrees shall be in a monotonically decreasing fashion. Additional related data is provided as supporting material in paragraph 6.3.1.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1524 :

Section Number :
3.3.1.6.0-6

WAS :
Table 3-Va. Received Minimum RF Signal Strength for Block IIA, IIR, IIR-M, IIF and III Satellites
(20.46 MHz Bandwidth)

Redlines :
Table 3-Va. Received Minimum RF Signal Strength for Block IIA, IIR, IIR-M, IIF, ~~and~~GPS III, and GPS IIIF Satellites

(20.46 MHz Bandwidth)

IS :
Table 3-Va. Received Minimum RF Signal Strength for Block IIA, IIR, IIR-M, IIF, GPS III, and GPS IIIF Satellites

(20.46 MHz Bandwidth)

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-77 :

Section Number :
3.3.1.6.0-7

WAS :
Table 3-Va.

SV Blocks	Channel	Signal	
		P(Y)	C/A or L2C
IIA/IIR	L1	-161.5 dBW	-158.5 dBW
	L2	-164.5 dBW	-164.5 dBW
IIR-M/IIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-160.0 dBW
III	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-158.5 dBW

Redlines :
Table 3-Va.

SV Blocks	Channel	Signal	
		P(Y)	C/A or L2C
IIA/IIR	L1	-161.5 dBW	-158.5 dBW
	L2	-164.5 dBW	-164.5 dBW
IIR-M/IIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-160.0 dBW
GPS III/IIIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-158.5 dBW

IS :
Table 3-Va.

SV Blocks	Channel	Signal	
		P(Y)	C/A or L2C
IIA/IIR	L1	-161.5 dBW	-158.5 dBW
	L2	-164.5 dBW	-164.5 dBW
IIR-M/IIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-160.0 dBW
GPS III/IIIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-158.5 dBW

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1525 :

Section Number :
3.3.1.6.0-8

WAS :
Table 3-Vb. Received Minimum RF Signal Strength for GPS III (30.69 MHz Bandwidth)

Redlines :
Table 3-Vb. Received Minimum RF Signal Strength for GPS III and GPS IIIF (30.69 MHz Bandwidth)

IS :
Table 3-Vb. Received Minimum RF Signal Strength for GPS III and GPS IIIF (30.69 MHz Bandwidth)

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-78 :

Section Number :
3.3.1.6.0-9

WAS :
Table 3-Vb.

SV Blocks	Channel	Signal	
		P(Y)	C/A or L2C
III	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-158.5 dBW

Redlines :
Table 3-Vb.

SV Blocks	Channel	Signal	
		P(Y)	C/A or L2C
GPS III/ IIIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-158.5 dBW

IS :
Table 3-Vb.

SV Blocks	Channel	Signal	
		P(Y)	C/A or L2C
GPS III/ IIIF	L1	-161.5 dBW	-158.5 dBW
	L2	-161.5 dBW	-158.5 dBW

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1526 :

Section Number :
3.3.1.6.1.0-2

WAS :
Table 3-Vc. Space Service Volume (SSV) Received Minimum RF Signal Strength for GPS III and Subsequent Satellites over the Bandwidth Specified in 3.3.1.1 – GEO Based Antennas

Redlines :
Table 3-Vc. Space Service Volume (SSV) Received Minimum RF Signal Strength for GPS III, GPS IIIF, and Subsequent Satellites over the Bandwidth Specified in 3.3.1.1 – GEO Based Antennas

IS :
Table 3-Vc. Space Service Volume (SSV) Received Minimum RF Signal Strength for GPS III, GPS IIIF, and Subsequent Satellites over the Bandwidth Specified in 3.3.1.1 – GEO Based Antennas

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-93 :

Section Number :
3.3.1.9.0-1

WAS :
The transmitted signal shall be right-hand circularly polarized (RHCP). For the angular range of ±13.8 degrees from nadir, L1 ellipticity shall be no worse than 1.2 dB for Block IIA and shall be no worse than 1.8 dB for Block IIR/IIR-M/IIF/GPS III SVs. L2 ellipticity shall be no worse than 3.2 dB for Block II/IIA SVs and shall be no worse than 2.2 dB for Block IIR/IIR-M/IIF and GPS III SVs over the angular range of ±13.8 degrees from nadir.

Redlines :
The transmitted signal shall be right-hand circularly polarized (RHCP). For the angular range of ±13.8 degrees from nadir, L1 ellipticity shall be no worse than 1.2 dB for Block IIA and shall be no worse than 1.8 dB for Block IIR/IIR-M/~~GPS~~ III/IIIF SVs. L2 ellipticity shall be no worse than 3.2 dB for Block II/IIA SVs and shall be no worse than 2.2 dB for Block IIR/IIR-M/IIF and GPS III/IIIF SVs over the angular range of ±13.8 degrees from nadir.

IS :
The transmitted signal shall be right-hand circularly polarized (RHCP). For the angular range of ±13.8 degrees from nadir, L1 ellipticity shall be no worse than 1.2 dB for Block IIA and shall be no worse than 1.8 dB for Block IIR/IIR-M/IIF/III/IIIF SVs. L2 ellipticity shall be no worse than 3.2 dB for Block II/IIA SVs and shall be no worse than 2.2 dB for Block IIR/IIR-M/IIF and GPS III/IIIF SVs over the angular range of ±13.8 degrees from nadir.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1488 :

Section Number :
6.1.0-1

WAS :

AI	-	Availability Indicator
AODO	-	Age of Data Offset
A-S	-	Anti-Spoofing
Autonav	-	Autonomous Navigation
BPSK	-	Bi-Phase Shift Key
CDC	-	Clock Differential Correction
CEI	-	Clock, Ephemeris, Integrity
CNAV	-	Civil Navigation
cps	-	cycles per second
CRC	-	Cyclic Redundancy Check
CS	-	Control Segment
DC	-	Differential Correction
dBc	-	Power ratio of a signal to a (unmodulated) carrier signal, expressed in decibels
dBi	-	Decibel with respect to isotropic antenna
dBW	-	Decibel with respect to 1 W
DN	-	Day Number
EAROM	-	Electrically Alterable Read-Only Memory
ECEF	-	Earth-Centered, Earth-Fixed
ECI	-	Earth-Centered, Inertial
EDC	-	Ephemeris Differential Correction
EOE	-	Edge-of-Earth
EOL	-	End of Life

ERD	-	Estimated Range Deviation
FEC	-	Forward Error Correction
GGTO	-	GPS/GNSS Time Offset
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GPSW	-	Global Positioning System Wing
HOW	-	Hand-Over Word
ICC	-	Interface Control Contractor
ID	-	Identification
IERS	-	International Earth Rotation and Reference Systems Service
IODC	-	Issue of Data, Clock
IODE	-	Issue of Data, Ephemeris
IRM	-	IERS Reference Meridian
IRP	-	IERS Reference Pole
IS	-	Interface Specification
ISC	-	Inter-Signal Correction
LNAV	-	Legacy Navigation
LSB	-	Least Significant Bit
LSF	-	Leap Seconds Future
L2C	-	L2 Civil Signal
L2 CL	-	L2 Civil-Long Code
L2 CM	-	L2 Civil-Moderate Code
MCS	-	Master Control Station
MSB	-	Most Significant Bit
NAV	-	Navigation
NDUS	-	NUDET Detection User Segment
NMCT	-	Navigation Message Correction Table
NSC	-	Non-Standard C/A-Code

NSCL	-	Non-Standard L2 CL-Code
NSCM	-	Non-Standard L2 CM-Code
NSY	-	Non-Standard Y-Code
OBCP	-	On-Board Computer Program
OCS	-	Operational Control System
PPS	-	Precise Positioning Service
PRN	-	Pseudo-Random Noise
RF	-	Radio Frequency
RMS	-	Root Mean Square
SA	-	Selective Availability
SEP	-	Spherical Error Probable
SPS	-	Standard Positioning Service
sps	-	symbols per second
SS	-	Space Segment
SSV	-	Space Service Volume
SV	-	Space Vehicle
SVN	-	Space Vehicle Number
TBD	-	To Be Determined
TBS	-	To Be Supplied
TLM	-	Telemetry
TOW	-	Time Of Week
UE	-	User Equipment
URA	-	User Range Accuracy
URE	-	User Range Error
US	-	User Segment
USNO	-	U.S. Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984

WN	-	Data Sequence Propagation Week Number
WN_e	-	Extended Week Number

Redlines :

AI	-	Availability Indicator
AODO	-	Age of Data Offset
A-S	-	Anti-Spoofing
~~Autonav~~	~~-~~	~~Autonomous Navigation~~
BPSK	-	Bi-Phase Shift Key
CDC	-	Clock Differential Correction
CEI	-	Clock, Ephemeris, Integrity
CNAV	-	Civil Navigation
cps	-	cycles per second
CRC	-	Cyclic Redundancy Check
CS	-	Control Segment
DC	-	Differential Correction
dBc	-	Power ratio of a signal to a (unmodulated) carrier signal, expressed in decibels
dBi	-	Decibel with respect to isotropic antenna
dBW	-	Decibel with respect to 1 W
DN	-	Day Number
EAROM	-	Electrically Alterable Read-Only Memory
ECEF	-	Earth-Centered, Earth-Fixed
ECI	-	Earth-Centered, Inertial
EDC	-	Ephemeris Differential Correction
EOE	-	Edge-of-Earth
EOL	-	End of Life

ERD	-	Estimated Range Deviation
FEC	-	Forward Error Correction
GGTO	-	GPS/GNSS Time Offset
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GPSW	-	Global Positioning System Wing
HOW	-	Hand-Over Word
ICC	-	Interface Control Contractor
ID	-	Identification
IERS	-	International Earth Rotation and Reference Systems Service
IODC	-	Issue of Data, Clock
IODE	-	Issue of Data, Ephemeris
IRM	-	IERS Reference Meridian
IRP	-	IERS Reference Pole
IS	-	Interface Specification
ISC	-	Inter-Signal Correction
LNAV	-	Legacy Navigation
LSB	-	Least Significant Bit
LSF	-	Leap Seconds Future
L2C	-	L2 Civil Signal
L2 CL	-	L2 Civil-Long Code
L2 CM	-	L2 Civil-Moderate Code
MCS	-	Master Control Station
MSB	-	Most Significant Bit
NAV	-	Navigation
NDUS	-	NUDET Detection User Segment
NMCT	-	Navigation Message Correction Table
NSC	-	Non-Standard C/A-Code

NSCL	-	Non-Standard L2 CL-Code
NSCM	-	Non-Standard L2 CM-Code
NSY	-	Non-Standard Y-Code
OBCP	-	On-Board Computer Program
OCS	-	Operational Control System
PPS	-	Precise Positioning Service
PRN	-	Pseudo-Random Noise
RF	-	Radio Frequency
RMS	-	Root Mean Square
SA	-	Selective Availability
SEP	-	Spherical Error Probable
SPS	-	Standard Positioning Service
sps	-	symbols per second
SS	-	Space Segment
SSV	-	Space Service Volume
SV	-	Space Vehicle
SVN	-	Space Vehicle Number
TBD	-	To Be Determined
TBS	-	To Be Supplied
TLM	-	Telemetry
TOW	-	Time Of Week
UE	-	User Equipment
URA	-	User Range Accuracy
URE	-	User Range Error
US	-	User Segment
USNO	-	U.S. Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984

WN	-	Data Sequence Propagation Week Number
WN_e	-	Extended Week Number

IS :

AI	-	Availability Indicator
AODO	-	Age of Data Offset
A-S	-	Anti-Spoofing
BPSK	-	Bi-Phase Shift Key
CDC	-	Clock Differential Correction
CEI	-	Clock, Ephemeris, Integrity
CNAV	-	Civil Navigation
cps	-	cycles per second
CRC	-	Cyclic Redundancy Check
CS	-	Control Segment
DC	-	Differential Correction
dBc	-	Power ratio of a signal to a (unmodulated) carrier signal, expressed in decibels
dBi	-	Decibel with respect to isotropic antenna
dBW	-	Decibel with respect to 1 W
DN	-	Day Number
EAROM	-	Electrically Alterable Read-Only Memory
ECEF	-	Earth-Centered, Earth-Fixed
ECI	-	Earth-Centered, Inertial
EDC	-	Ephemeris Differential Correction
EOE	-	Edge-of-Earth
EOL	-	End of Life
ERD	-	Estimated Range Deviation

FEC	-	Forward Error Correction
GGTO	-	GPS/GNSS Time Offset
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GPSW	-	Global Positioning System Wing
HOW	-	Hand-Over Word
ICC	-	Interface Control Contractor
ID	-	Identification
IERS	-	International Earth Rotation and Reference Systems Service
IODC	-	Issue of Data, Clock
IODE	-	Issue of Data, Ephemeris
IRM	-	IERS Reference Meridian
IRP	-	IERS Reference Pole
IS	-	Interface Specification
ISC	-	Inter-Signal Correction
LNAV	-	Legacy Navigation
LSB	-	Least Significant Bit
LSF	-	Leap Seconds Future
L2C	-	L2 Civil Signal
L2 CL	-	L2 Civil-Long Code
L2 CM	-	L2 Civil-Moderate Code
MCS	-	Master Control Station
MSB	-	Most Significant Bit
NAV	-	Navigation
NDUS	-	NUDET Detection User Segment
NMCT	-	Navigation Message Correction Table
NSC	-	Non-Standard C/A-Code
NSCL	-	Non-Standard L2 CL-Code

NSCM	-	Non-Standard L2 CM-Code
NSY	-	Non-Standard Y-Code
OBCP	-	On-Board Computer Program
OCS	-	Operational Control System
PPS	-	Precise Positioning Service
PRN	-	Pseudo-Random Noise
RF	-	Radio Frequency
RMS	-	Root Mean Square
SA	-	Selective Availability
SEP	-	Spherical Error Probable
SPS	-	Standard Positioning Service
sps	-	symbols per second
SS	-	Space Segment
SSV	-	Space Service Volume
SV	-	Space Vehicle
SVN	-	Space Vehicle Number
TBD	-	To Be Determined
TBS	-	To Be Supplied
TLM	-	Telemetry
TOW	-	Time Of Week
UE	-	User Equipment
URA	-	User Range Accuracy
URE	-	User Range Error
US	-	User Segment
USNO	-	U.S. Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984
WN	-	Data Sequence Propagation Week Number

WN_e	-	Extended Week Number

Rationale :
Autonav is not present in current SV nor will it be in GPS IIIF. Removing autonav

IS200-169 :

Section Number :
6.2.2.2.0-1

WAS :
The operational satellites are designated Block II, Block IIA, Block IIR, Block IIR-M, Block IIF and GPS III SVs. Characteristics of these SVs are provided below. Modes of operation for these SVs and accuracy of positioning services provided are described in paragraphs 6.3.2 through 6.3.4. These SVs transmit configuration codes as specified in paragraph 20.3.3.5.1.4. The navigation signal provides no direct indication of the type of the transmitting SV.

Redlines :
The operational satellites are designated Block II, Block IIA, Block IIR, Block IIR-M, Block IIF, GPS III, and GPS ~~III~~IIIF SVs. Characteristics of these SVs are provided below. Modes of operation for these SVs and accuracy of positioning services provided are described in paragraphs 6.3.2 through 6.3.4. These SVs transmit configuration codes as specified in paragraph 20.3.3.5.1.4. The navigation signal provides no direct indication of the type of the transmitting SV.

IS :
The operational satellites are designated Block II, Block IIA, Block IIR, Block IIR-M, Block IIF, GPS III, and GPS IIIF SVs. Characteristics of these SVs are provided below. Modes of operation for these SVs and accuracy of positioning services provided are described in paragraphs 6.3.2 through 6.3.4. These SVs transmit configuration codes as specified in paragraph 20.3.3.5.1.4. The navigation signal provides no direct indication of the type of the transmitting SV.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-175 :

Section Number :
6.2.2.2.3.0-1

WAS :
The block of operational replenishment SVs developed by Lockheed Martin are designated as SVNs 41-61 and are termed "Block IIR" SVs. These SVs have the capability of storing at least 60 days of navigation data with current memory margins, while operating in a IIA mode, to provide positioning service without contact from the CS for that period. (Contractual requirements for these SVs specify transmission of correct data for only 14 days to support short-term extended operations while in IIA mode.) The IIR SV will provide a minimum of 60 days of positioning service without contact from the CS when operating in autonomous navigation (Autonav) mode.

Redlines :
The block of operational replenishment SVs developed by Lockheed Martin are designated as SVNs 41-61 and are termed "Block IIR" SVs. These SVs have the capability of storing at least 60 days of navigation data with current memory margins, while operating in a IIA mode, to provide positioning service without contact from the CS for that period. (Contractual requirements for these SVs specify transmission of correct data for only 14 days to support short-term extended operations while in IIA mode.)~~ The IIR SV will provide a minimum of 60 days of positioning service without contact from the CS when operating in autonomous navigation (Autonav) mode.~~

IS :
The block of operational replenishment SVs developed by Lockheed Martin are designated as SVNs 41-61 and are termed "Block IIR" SVs. These SVs have the capability of storing at least 60 days of navigation data with current memory margins, while operating in a IIA mode, to provide positioning service without contact from the CS for that period. (Contractual requirements for these SVs specify transmission of correct data for only 14 days to support short-term extended operations while in IIA mode.)

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-1639 :

Section Number :
6.2.9.1-2

WAS :
Table 6-I-1

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	Data Sequence Propagation Week Number	1	N/A
WN_n	Week Number	N/A	10
T_{GD}	Group Delay Differential	1	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_{rs}	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_{us}	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	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, i_{0-n}-DOT	Rate of Inclination Angle	3	11

Symbol	Parameter Name	Subframe	Message
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	3	11
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	N/A	30
ISC_{L2C}	Inter-signal Correction	N/A	30
ISC_{L5I5}	Inter-signal Correction	N/A	30
ISC_{L5Q5}	Inter-signal Correction	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
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.			

Redlines :
Table 6-I-1

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	Data Sequence Propagation Week Number	1	~~N/A~~10
~~WN_n~~	~~Week Number~~	~~N/A~~	~~10~~
T_{GD}	Group Delay Differential	1	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_{rs}	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_{us}	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	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, i_{0-n}-DOT	Rate of Inclination Angle	3	11
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	3	11
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	3	11

Symbol	Parameter Name	Subframe	Message
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	N/A	30
ISC_{L2C}	Inter-signal Correction	N/A	30
ISC_{L5I5}	Inter-signal Correction	N/A	30
ISC_{L5Q5}	Inter-signal Correction	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
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 :
Table 6-I-1

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	Data Sequence Propagation Week Number	1	10
T_{GD}	Group Delay Differential	1	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

Symbol	Parameter Name	Subframe	Message
$\sqrt{A}$	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_{rs}	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_{us}	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	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, i_{0-n}-DOT	Rate of Inclination Angle	3	11
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	3	11
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	N/A	30
ISC_{L2C}	Inter-signal Correction	N/A	30
ISC_{L5I5}	Inter-signal Correction	N/A	30
ISC_{L5Q5}	Inter-signal Correction	N/A	30
t_{op}	CEI Data Sequence Propagation Time of Week	N/A	10, 30-37

Symbol	Parameter Name	Subframe	Message
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
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.			

Rationale :
WNn is not consistently used throughout the document. Remove subscript n from WNn from Table 6-I-1 and Figure 30-1 to maintain consistency.

IS200-204 :

Section Number :
6.3.4.0-1

WAS :
The GPS III SVs shall be capable of being uploaded by the CS with a minimum of 60 days of data to support a 60 day positioning service. Under normal conditions, the CS will provide daily uploads to each SV, which will allow the SV to maintain normal operations as defined in paragraph 6.2.3.1 and described within this IS.

Redlines :
The GPS III and GPS IIIF SVs shall be capable of being uploaded by the CS with a minimum of 60 days of data to support a 60 day positioning service. Under normal conditions, the CS will provide daily uploads to each SV, which will allow the SV to maintain normal operations as defined in paragraph 6.2.3.1 and described within this IS.

IS :
The GPS III and GPS IIIF SVs shall be capable of being uploaded by the CS with a minimum of 60 days of data to support a 60 day positioning service. Under normal conditions, the CS will provide daily uploads to each SV, which will allow the SV to maintain normal operations as defined in paragraph 6.2.3.1 and described within this IS.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-209 :

Section Number :
6.3.5

WAS :
Autonomous Navigation Mode.

Redlines :
~~Autonomous Navigation Mode.~~ <RESERVED>

IS :
<RESERVED>

Rationale :
Autonav isn't in any current SV nor will it be in GPS IIIF. Recommend replacing with <RESERVED>

IS200-210 :

Section Number :
6.3.5.0-1

WAS :
The Block IIR/IIR-M, Block IIF, and directional crosslink-capable GPS III SV in conjunction with a sufficient number of other Block IIR/IIR-M, Block IIF or directional crosslink-capable GPS III SVs, operates in an Autonav mode when commanded by the CS. Each Block IIR/IIR-M/IIF/directional crosslink-capable GPS III SV in the constellation determines its own ephemeris and clock correction parameters via SV-to-SV ranging, communication of data, and on-board data processing which updates data uploaded by the CS.

Redlines :
~~The Block IIR/IIR-M, Block IIF, and directional crosslink-capable GPS III SV in conjunction with a sufficient number of other Block IIR/IIR-M, Block IIF or directional crosslink-capable GPS III SVs, operates in an Autonav mode when commanded by the CS. Each Block IIR/IIR-M/IIF/directional crosslink-capable GPS III SV in the constellation determines its own ephemeris and clock correction parameters via SV-to-SV ranging, communication of data, and on-board data processing which updates data uploaded by the CS.~~<RESERVED>

IS :
<RESERVED>

Rationale :
Autonav does not exist in any current SV or will in GPS IIIF

IS200-1003 :

Section Number :
6.3.5.0-2

WAS :
In the Autonav mode the Block IIR/IIR-M/IIF/directional crosslink-capable GPS III SV will maintain normal operations as defined in paragraph 6.2.3.1 and as further described within this IS, and will have a URE of no larger than 6 meters, one sigma for Block IIR/IIR-M. URE of 6 meters, one sigma, is expected to support 16 meter SEP accuracy under a nominal position dilution of precision. If the CS is unable to upload the SVs, the Block IIR/IIR-M/IIF/directional crosslink-capable GPS III SVs will maintain normal operations for period of at least 60 days after the last upload.

Redlines :
~~In the Autonav mode the Block IIR/IIR-M/IIF/directional crosslink-capable GPS III SV will maintain normal operations as defined in paragraph 6.2.3.1 and as further described within this IS, and will have a URE of no larger than 6 meters, one sigma for Block IIR/IIR-M. URE of 6 meters, one sigma, is expected to support 16 meter SEP accuracy under a nominal position dilution of precision. If the CS is unable to upload the SVs, the Block IIR/IIR-M/IIF/directional crosslink-capable GPS III SVs will maintain normal operations for period of at least 60 days after the last upload.~~<RESERVED>

IS :
<RESERVED>

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-211 :

Section Number :
6.3.5.0-3

WAS :
In the Autonav mode, the almanac data, UTC parameters and ionospheric data are still calculated and maintained current by the CS and uploaded to the SV as required. If the CS is unable to upload the SVs, the almanac data, UTC parameters and ionospheric data will not be maintained current and will degrade in accuracy from the time of the last upload.

Redlines :
~~In the Autonav mode, the almanac data, UTC parameters and ionospheric data are still calculated and maintained current by the CS and uploaded to the SV as required. If the CS is unable to upload the SVs, the almanac data, UTC parameters and ionospheric data will not be maintained current and will degrade in accuracy from the time of the last upload.~~<RESERVED>

IS :
<RESERVED>

Rationale :
Autonav does not exist in any current SV nor will it exist in GPS IIIF

IS200-281 :

Section Number :
20.3.2.0-3

WAS :
Block II and IIA SVs are designed with sufficient memory capacity for storing at least 60 days of uploaded LNAV data. However, the memory retention of these SVs will determine the duration of data transmission. Block IIR SVs have the capability, with current memory margin, to store at least 60 days of uploaded LNAV data in the Block IIA mode and to store at least 60 days of CS data needed to generate LNAV data on-board in the Autonav mode. GPS III SVs have the capability to support operation for at least 60 days without contact from the CS. Alternating ones and zeros will be transmitted in words 3 through 10 in place of the normal LNAV data whenever the SV cannot locate the requisite valid control or data element in its on-board computer memory. The following specifics apply to this default action: (a) the parity of the affected words will be invalid, (b) the two trailing bits of word 10 will be zeros (to allow the parity of subsequent subframes to be valid -- reference paragraph 20.3.5), (c) if the problem is the lack of a data element, only the directly related subframe(s) will be treated in this manner, (d) if a control element cannot be located, this default action will be applied to all subframes and all subframes will indicate ID = 1 (Block II/IIA only) (i.e., an ID-code of 001) in the HOW (reference paragraph 20.3.3.2) (Block IIR/IIR-M, IIF, and GPS III SVs indicate the proper subframe ID for all subframes). Certain failures of control elements which may occur in the SV memory or during an upload will cause the SV to transmit in non-standard codes (NSC and NSY) which would preclude normal use by the US. Normal LNAV data transmission will be resumed by the SV whenever a valid set of elements becomes available.

Redlines :
Block II and IIA SVs are designed with sufficient memory capacity for storing at least 60 days of uploaded LNAV data. However, the memory retention of these SVs will determine the duration of data transmission. ~~Block IIR SVs have the capability, with current~~The memory~~ margin, to store at least 60 days of uploaded LNAV data in the Block IIA mode~~retentivity ~~and~~is ~~to~~guaranteed ~~store~~for at least 60 days~~ of CS~~ for ~~data~~SVs ~~needed~~subsequent to~~ generate LNAV data on-board~~ ~~in~~Block ~~the~~IIA. ~~Autonav~~GPS ~~mode.~~III and GPS ~~III~~IIIF SVs have the capability to support operation for at least 60 days without contact from the CS. Alternating ones and zeros will be transmitted in words 3 through 10 in place of the normal LNAV data whenever the SV cannot locate the requisite valid control or data element in its on-board computer memory. The following specifics apply to this default action: (a) the parity of the affected words will be invalid, (b) the two trailing bits of word 10 will be zeros (to allow the parity of subsequent subframes to be valid -- reference paragraph 20.3.5), (c) if the problem is the lack of a data element, only the directly related subframe(s) will be treated in this manner, (d) if a control element cannot be located, this default action will be applied to all subframes and all subframes will indicate ID = 1 (Block II/IIA only) (i.e., an ID-code of 001) in the HOW (reference paragraph 20.3.3.2) (Block IIR/IIR-M, IIF, and GPS III/IIIF SVs indicate the proper subframe ID for all subframes). Certain failures of control elements which may occur in the SV memory or during an upload will cause the SV to transmit in non-standard codes (NSC and NSY) which would preclude normal use by the US. Normal LNAV data transmission will be resumed by the SV whenever a valid set of elements becomes available.

IS :
Block II and IIA SVs are designed with sufficient memory capacity for storing at least 60 days of uploaded LNAV data. However, the memory retention of these SVs will determine the duration of data transmission. The memory retentivity is guaranteed for at least 60 days for SVs subsequent to Block IIA. GPS III and GPS IIIF SVs have the capability to support operation for at least 60 days without contact from the CS. Alternating ones and zeros will be transmitted in words 3 through 10 in place of the normal LNAV data whenever the SV cannot locate the requisite valid control or data element in its on-board computer memory. The following specifics apply to this default action: (a) the parity of the affected words will be invalid, (b) the two trailing bits of word 10 will be zeros (to allow the parity of subsequent subframes to be valid -- reference paragraph 20.3.5), (c) if the problem is the lack of a data element, only the directly related subframe(s) will be treated in this manner, (d) if a control element cannot be located, this default action will be applied to all subframes and all subframes will indicate ID = 1 (Block II/IIA only) (i.e., an ID-code of 001) in the HOW (reference paragraph 20.3.3.2) (Block IIR/IIR-M, IIF, and GPS III/IIIF SVs indicate the proper subframe ID for all subframes). Certain failures of control elements which may occur in the SV memory or during an upload will cause the SV to transmit in non-standard codes (NSC and NSY) which would preclude normal use by the US. Normal LNAV data transmission will be resumed by the SV whenever a valid set of elements becomes available.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF. Removing Autonav sentence. Autonav does not exist in any current SV nor will it be in GPS IIIF. Since the removal of the sentence takes out Block IIR, will add 283 to have a generic sentence so it references Block IIR.

IS200-283 :

Section Number :
20.3.2.0-5

WAS :
The memory retentivity is guaranteed for at least 60 days for SVs subsequent to Block IIA.

Redlines :
<DELETED OBJECT>

IS :
<DELETED OBJECT>

Rationale :
Moved to 281

IS200-318 :

Section Number :
20.3.3.3.1.3.0-1

WAS :
Bits 13 through 16 of word three shall give the URA index of the SV (reference paragraph 6.2.1) for the standard positioning service user. While the URA may vary over the ephemeris curve fit interval, the URA index (N) in the LNAV message shall correspond to the maximum URA expected over the entire ephemeris curve fit interval. Except for Block IIR/IIR-M SVs in the Autonav mode, the URA index (N) is an integer in the range of 0 through 15 and has the following relationship to the URA of the SV:

Redlines :
Bits 13 through 16 of word three shall give the URA index of the SV (reference paragraph 6.2.1) for the standard positioning service user. While the URA may vary over the ephemeris curve fit interval, the URA index (N) in the LNAV message shall correspond to the maximum URA expected over the entire ephemeris curve fit interval. ~~Except for Block IIR/IIR-M SVs in the Autonav mode, the~~The URA index (N) is an integer in the range of 0 through 15 and has the following relationship to the URA of the SV:

IS :
Bits 13 through 16 of word three shall give the URA index of the SV (reference paragraph 6.2.1) for the standard positioning service user. While the URA may vary over the ephemeris curve fit interval, the URA index (N) in the LNAV message shall correspond to the maximum URA expected over the entire ephemeris curve fit interval. The URA index (N) is an integer in the range of 0 through 15 and has the following relationship to the URA of the SV:

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-320 :

Section Number :
20.3.3.3.1.3.0-3

WAS :
For each URA index (N), users may compute a nominal URA value (X) as given by:

- If the value of N is 6 or less, $X = 2^{(1 + N/2)}$,

- If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$,

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

For Block IIR/IIR-M SVs in the Autonav mode, the URA shall be defined to mean "no better than X meters", with "X" as defined above for each URA index.

The nominal URA value (X) is suitable for use as a conservative prediction of the RMS signal-in-space (SIS) range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting, receiver autonomous integrity monitoring (RAIM), figure of merit (FOM) computations). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the URA index (see 20.3.3.1).

URA accounts for SIS contributions to user range error which include, but are not limited to, the following: LNAV LSB representation/truncation error; the net effect of LNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A, L1P(Y), L2P(Y), or dual-frequency P(Y) users who correct the code phase as described in Section 20.3.3.3.3; LNAV ephemeris error; anisotropic antenna errors; and signal deformation error. URA does 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.

Redlines :
For each URA index (N), users may compute a nominal URA value (X) as given by:

- If the value of N is 6 or less, $X = 2^{(1 + N/2)}$,

- If the value of N is 6 or more, but less than 15, $X = 2^{(N - 2)}$,

- 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 = 1, 3, and 5, X should be rounded to 2.8, 5.7, and 11.3 meters, respectively~~.~~

~~For Block IIR/IIR-M SVs in the Autonav mode, the URA shall be defined to mean "no better than X meters", with "X" as defined above for each URA index.~~

The nominal URA value (X) is suitable for use as a conservative prediction of the RMS signal-in-space (SIS) range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting, receiver autonomous integrity monitoring (RAIM), figure of merit (FOM) computations). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the URA index (see 20.3.3.1).

URA accounts for SIS contributions to user range error which include, but are not limited to, the following: LNAV LSB representation/truncation error; the net effect of LNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A, L1P(Y), L2P(Y), or dual-frequency P(Y) users who correct the code phase as described in Section 20.3.3.3.3; LNAV ephemeris error; anisotropic antenna errors; and signal deformation error. URA does 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 :
For each URA index (N), users may compute a nominal URA value (X) as given by:

- If the value of N is 6 or less, X = 2(1 + N/2),
- If the value of N is 6 or more, but less than 15, X = 2(N - 2),
- 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 = 1, 3, and 5, X should be rounded to 2.8, 5.7, and 11.3 meters, respectively.

The nominal URA value (X) is suitable for use as a conservative prediction of the RMS signal-in-space (SIS) range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting, receiver autonomous integrity monitoring (RAIM), figure of merit (FOM) computations). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the URA index (see 20.3.3.1).

URA accounts for SIS contributions to user range error which include, but are not limited to, the following: LNAV LSB representation/truncation error; the net effect of LNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A, L1P(Y), L2P(Y), or dual-frequency P(Y) users who correct the code phase as described in Section 20.3.3.3.3; LNAV ephemeris error; anisotropic antenna errors; and signal deformation error. URA does 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.

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-355 :

Section Number :
20.3.3.4.1.0-4

WAS :
Any change in the subframe 2 and 3 core CEI data will be accomplished with a simultaneous change in both IODE words. The CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III) shall assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted for the prior CEI data sequence propagation (reference paragraph 20.3.4.5).

Redlines :
Any change in the subframe 2 and 3 core CEI data will be accomplished with a simultaneous change in both IODE words. The CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III/IIIF) shall assure that the toe value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted for the prior CEI data sequence propagation (reference paragraph 20.3.4.5).

IS :
Any change in the subframe 2 and 3 core CEI data will be accomplished with a simultaneous change in both IODE words. The CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III/IIIF) shall assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted for the prior CEI data sequence propagation (reference paragraph 20.3.4.5).

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-363 :

Section Number :
20.3.3.4.3.0-1

WAS :
The user shall compute the ECEF coordinates of position for the phase center of the SVs' antennas utilizing a variation of the equations shown in Table 20-IV. Subframes 2 and 3 parameters are Keplerian in appearance; the values of these parameters, however, are produced by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III) via a least squares curve fit of the propagated ephemeris of the phase center of the SVs' antennas (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the periods of the curve fit, the resultant accuracy, and the applicable coordinate system are given in the following subparagraphs.

Redlines :
The user shall compute the ECEF coordinates of position for the phase center of the SVs' antennas utilizing a variation of the equations shown in Table 20-IV. Subframes 2 and 3 parameters are Keplerian in appearance; the values of these parameters, however, are produced by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III/IIIF) via a least squares curve fit of the propagated ephemeris of the phase center of the SVs' antennas (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the periods of the curve fit, the resultant accuracy, and the applicable coordinate system are given in the following subparagraphs.

IS :
The user shall compute the ECEF coordinates of position for the phase center of the SVs' antennas utilizing a variation of the equations shown in Table 20-IV. Subframes 2 and 3 parameters are Keplerian in appearance; the values of these parameters, however, are produced by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III/IIIF) via a least squares curve fit of the propagated ephemeris of the phase center of the SVs' antennas (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the periods of the curve fit, the resultant accuracy, and the applicable coordinate system are given in the following subparagraphs.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1743 :
Insertion after object IS200-363

The user shall compute the ECEF coordinates of position for the phase center of the SVs' antennas utilizing a variation of the equations shown in Table 20-IV. Subframes 2 and 3 parameters are Keplerian in appearance; the values of these parameters, however, are produced by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III) via a least squares curve fit of the propagated ephemeris of the phase center of the SVs' antennas (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the periods of the curve fit, the resultant accuracy, and the applicable coordinate system are given in the following subparagraphs.

Section Number :
20.3.3.4.3.1

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
The user can compute velocity and acceleration for the SV, if required, utilizing a variation of the equations shown in Table 20- IV Part 3 and 4.

Rationale :
Adding an explanation that the new velocity and acceleration equations are optional for the users.

IS200-365 :

Section Number :
20.3.3.4.3.2.0-1

WAS :
Bit 17 in word 10 of subframe 2 is a "fit interval" flag which indicates the curve-fit interval used by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III) in determining the ephemeris parameters, as follows:

0 = 4 hours,

1 = greater than 4 hours.

The relationship of the curve-fit interval to transmission time and the timing of the curve-fit intervals is covered in section 20.3.4.

Redlines :
Bit 17 in word 10 of subframe 2 is a "fit interval" flag which indicates the curve-fit interval used by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III and GPS IIIF) in determining the ephemeris parameters, as follows:

0 = 4 hours,

1 = greater than 4 hours.

The relationship of the curve-fit interval to transmission time and the timing of the curve-fit intervals is covered in section 20.3.4.

IS :
Bit 17 in word 10 of subframe 2 is a "fit interval" flag which indicates the curve-fit interval used by the CS (Block II/Block IIA/IIR/IIR-M/IIF) and SS (GPS III and GPS IIIF) in determining the ephemeris parameters, as follows:

0 = 4 hours,

1 = greater than 4 hours.

The relationship of the curve-fit interval to transmission time and the timing of the curve-fit intervals is covered in section 20.3.4.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-1577 :

Section Number :
20.3.3.4.3.2.0-4

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

Redlines :
Table 20-IV. ~~Elements of~~Broadcast ~~Coordinate~~Navigation ~~Systems~~User Equations (sheet 1 of ~~2~~4)

IS :
Table 20-IV. Broadcast Navigation User Equations (sheet 1 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-367 :

Section Number :
20.3.3.4.3.2.0-5

WAS :
Table 20-IV

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

Redlines :

Table 20-IV

μ = 3.986005 x 10^{14} meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e$ = 7.2921151467 x 10^{-5} rad/sec	WGS 84 value of the earth's rotation rate
$A = \left(\sqrt{A}\right)^2$	Semi-major axis
$n_0 = \sqrt{\frac{\mu}{A^3}}$	Computed mean motion (rad/sec)
$t_k = t - t_{oe}$*	Time from ephemeris reference epoch
$n = n_0 + \Delta n$	Corrected mean motion
$M_k = M_0 + nt_k$	Mean anomaly
~~$M_k = E_k - e_n \sin E_k$~~	~~Kepler's equation for Eccentric Anomaly (radians) (may be solved by iteration)~~
	Kepler's equation ($M_k = E_k - e \sin E_k$) 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, three iterations, (j=1,2,3)
$E_k = E_3$	– Final Value (radians)
~~$\nu_k = \tan^{-1}\left\{\frac{\sin \nu_k}{\cos \nu_k}\right\}$~~	~~True Anomaly~~
~~$= \tan^{-1}\left\{\frac{\sqrt{1-e_n^2}\sin E_k / (1 - e_n \cos E_k)}{(\cos E_k - e_n)/(1 - e_n \cos E_k)}\right\}$~~	
$\nu_k = 2\tan^{-1}\left(\sqrt{\frac{1+e}{1-e}}\tan\frac{E_k}{2}\right)$	True Anomaly (unambiguous quadrant)
~~$E_k = \cos^{-1}\left\{\frac{e_n + \cos \nu_k}{1 + e_n \cos \nu_k}\right\}$~~	~~Eccentric Anomaly~~

* 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.

IS :

$\mu = 3.986005 \times 10^{14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A = \left(\sqrt{A}\right)^2$	Semi-major axis
$n_0 = \sqrt{\frac{\mu}{A^3}}$	Computed mean motion (rad/sec)
$t_k = t - t_{oe}$*	Time from ephemeris reference epoch
$n = n_0 + \Delta n$	Corrected mean motion
$M_k = M_0 + nt_k$	Mean anomaly
	Kepler's equation ($M_k = E_k - e \sin E_k$) 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, three iterations, (j=1,2,3)
$E_k = E_3$	– Final Value (radians)
$\nu_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\frac{E_k}{2}\right)$	True Anomaly (unambiguous quadrant)

* 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.

Rationale :
RFC 395: Implement and replace with improved Kepler equations for True and Eccentric Anomaly.

IS200-1578 :

Section Number :
20.3.3.4.3.2.0-6

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

Redlines :
Table 20-IV. ~~Elements~~Broadcast ~~of~~Navigation ~~Coordinate~~User ~~Systems~~Equations (sheet 2 of ~~2~~4)

IS :
Table 20-IV. Broadcast Navigation User Equations (sheet 2 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-368 :

Section Number :
20.3.3.4.3.2.0-7

WAS :
Table 20- IV part 2

$E_k = \cos^{-1}\left\{\frac{e+\cos\nu_k}{1+e\cos\nu_k}\right\}$	Eccentric Anomaly
$\Phi_k = \nu_k + \omega$	Argument of Latitude
$\delta u_k = c_{us}\sin 2\Phi_k + c_{uc}\cos 2\Phi_k$ Argument of Latitude Correction $\delta r_k = c_{rs}\sin 2\Phi_k + c_{rc}\cos 2\Phi_k$ Radius Correction $\delta i_k = c_{is}\sin 2\Phi_k + c_{ic}\cos 2\Phi_k$ Inclination Correction	} Second Harmonic
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A(1 - e\cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_0 + \delta i_k + (IDOT)\, t_k$	Corrected Inclination
$x_k' = r_k\cos u_k$ $y_k' = r_k\sin u_k$ }	Positions in orbital
$\Omega_k = \Omega_0 + (\dot{\Omega} - \dot{\Omega}_e)\, t_k - \dot{\Omega}_e\, t_{oe}$	Corrected longitude of ascending node.
$x_k = x_k'\cos\Omega_k - y_k'\cos i_k\sin\Omega_k$ $y_k = x_k'\sin\Omega_k + y_k'\cos i_k\cos\Omega_k$ $z_k = y_k'\sin i_k$ }	Earth-fixed

Redlines :

Table 20-IV part 2

~~$E_k = \cos^{-1}\left\{\frac{e_n + \cos \nu_k}{1 + e_n \cos \nu_k}\right\}$~~		~~Eccentric Anomaly~~
$\Phi_k = \nu_k + \omega$		Argument of Latitude
$\delta u_k = c_{us}\sin 2\Phi_k + c_{uc}\cos 2\Phi_k$	Argument of Latitude Correction	Second Harmonic
$\delta r_k = c_{rs}\sin 2\Phi_k + c_{rc}\cos 2\Phi_k$	Radius Correction	
$\delta i_k = c_{is}\sin 2\Phi_k + c_{ic}\cos 2\Phi_k$	Inclination Correction	
$u_k = \Phi_k + \delta u_k$		Corrected Argument of Latitude
$r_k = A(1 - e\cos E_k) + \delta r_k$		Corrected Radius
$i_k = i_0 + \delta i_k + (IDOT)\, t_k$		Corrected Inclination
$x_k' = r_k \cos u_k$		Positions in orbital
$y_k' = r_k \sin u_k$		
$\Omega_k = \Omega_0 + (\dot{\Omega} - \dot{\Omega}_e)\, t_k - \dot{\Omega}_e\, t_{oe}$		Corrected longitude of ascending node.
$x_k = x_k'\cos\Omega_k - y_k'\cos i_k \sin\Omega_k$		Earth-fixed
$y_k = x_k'\sin\Omega_k + y_k'\cos i_k \cos\Omega_k$		
$z_k = y_k'\sin i_k$		

IS :
Table 20-VI part 2

$\Phi_k = \nu_k + \omega$		Argument of Latitude
$\delta u_k = c_{us}\sin 2\Phi_k + c_{uc}\cos 2\Phi_k$	Argument of Latitude Correction	Second Harmonic
$\delta r_k = c_{rs}\sin 2\Phi_k + c_{rc}\cos 2\Phi_k$	Radius Correction	
$\delta i_k = c_{is}\sin 2\Phi_k + c_{ic}\cos 2\Phi_k$	Inclination Correction	
$u_k = \Phi_k + \delta u_k$		Corrected Argument of Latitude
$r_k = A(1 - e\cos E_k) + \delta r_k$		Corrected Radius
$i_k = i_0 + \delta i_k + (IDOT)\, t_k$		Corrected Inclination
$x_k' = r_k \cos u_k$ $y_k' = r_k \sin u_k$		Positions in orbital
$\Omega_k = \Omega_0 + (\dot{\Omega} - \dot{\Omega}_e)\, t_k - \dot{\Omega}_e\, t_{oe}$		Corrected longitude of ascending node.
$x_k = x_k'\cos\Omega_k - y_k'\cos i_k \sin\Omega_k$ $y_k = x_k'\sin\Omega_k + y_k'\cos i_k \cos\Omega_k$ $z_k = y_k'\sin i_k$		Earth-fixed

Rationale :
RFC 395: Implement and replace with improved Kepler equations for True and Eccentric Anomaly.

IS200-1725 :
Insertion after object IS200-368

Table 20-VI part 2

$E_k = \cos^{-1}\left\{\frac{e + \cos\nu_k}{1 + e\cos\nu_k}\right\}$	Eccentric Anomaly
$\Phi_k = \nu_k + \omega$	Argument of Latitude
$\delta u_k = c_{us}\sin 2\Phi_k + c_{uc}\cos 2\Phi_k$ — Argument of Latitude Correction $\delta r_k = c_{rs}\sin 2\Phi_k + c_{rc}\cos 2\Phi_k$ — Radius Correction $\delta i_k = c_{is}\sin 2\Phi_k + c_{ic}\cos 2\Phi_k$ — Inclination Correction	} Second Harmonic
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A(1 - e\cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_0 + \delta i_k + (IDOT)\, t_k$	Corrected Inclination
$x_k' = r_k\cos u_k$ $y_k' = r_k\sin u_k$	Positions in orbital
$\Omega_k = \Omega_0 + (\dot{\Omega} - \dot{\Omega}_e)\, t_k - \dot{\Omega}_e\, t_{oe}$	Corrected longitude of ascending node.
$x_k = x_k'\cos\Omega_k - y_k'\cos i_k\sin\Omega_k$ $y_k = x_k'\sin\Omega_k + y_k'\cos i_k\cos\Omega_k$ $z_k = y_k'\sin i_k$	Earth-fixed

Section Number :
20.3.3.4.3.2.0-8

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 20- IV. Broadcast Navigation User Equations (sheet 3 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-1726 :
Insertion after object IS200-1725 (See previous)

Section Number :
20.3.3.4.3.2.0-9

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 20-VI part 3

Element/Equation	Description
SV Velocity	
$\dot{E}_k = n / (1 - e \cos E_k)$	Eccentric Anomaly Rate
$\dot{v}_k = \dot{E}_k \sqrt{1 - e^2} / (1 - e \cos E_k)$	True Anomaly Rate
$(di_k / dt) = (IDOT) + 2\, \dot{v}_k (c_{is} \cos 2\phi_k - c_{ic} \sin 2\phi_k)$	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 Rate
$\dot{r}_k = eA\dot{E}_k \sin Ek + 2\dot{v}_k (c_{rs} \cos 2\phi_k - c_{rc} \sin 2\phi_k)$	Corrected Radius Rate
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	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)

Rationale :
RFC 395: Add new and improved velocity and acceleration equation tables

IS200-1723 :
Insertion after object IS200-1726 (See Previous)

Section Number :
20.3.3.4.3.2.0-10

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 20-IV. Broadcast Navigation User Equations (sheet 4 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-1724 :
Insertion after object IS200-1723 (See Previous)

Section Number :
20.3.3.4.3.2.0-11

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 20-VI part 4

Element/Equation	Description
SV Acceleration	
R_E = 6378137.0 meters	WGS 84 Earth Equatorial Radius
J_2 = 0.0010826262	Oblate Earth Gravity Coefficient
$F = - (3/2)\ J_2\ (\mu / r_k^2)\ (R_E / r_k)^2$	Oblate Earth acceleration Factor
$\ddot{x}_k = - \mu\ (x_k / r_k^3) + F\ [(1 - 5\ (z_k / r_k)^2)(x_k / r_k)] + 2\dot{y}_k\dot{\Omega}_e + x_k\dot{\Omega}_e^2$	Earth- Fixed *x* acceleration (m/s^2)
$\ddot{y}_k = - \mu\ (y_k / r_k^3) + F\ [(1 - 5\ (z_k / r_k)^2)(y_k / r_k)] - 2\dot{x}_k\dot{\Omega}_e + y_k\dot{\Omega}_e^2$	Earth- Fixed y Acceleration (m/s^2)
$\ddot{z}_k = - \mu\ (z_k / r_k^3) + F\ [(3 - 5\ (z_k / r_k)^2)(z_k / r_k)]$	Earth- Fixed *z* Acceleration (m/s^2)

Rationale :
RFC 395: Add new and improved velocity and acceleration equation tables

IS200-380 :

Section Number :
20.3.3.4.4.0-2

WAS :
It should be noted that the NMCT information shall be supported by the Block IIR SV only when operating in the IIA like mode of operation including the Autonav Test mode.

Redlines :
It should be noted that the NMCT information shall be supported by the Block IIR SV~~ only when operating in the IIA like mode of operation including the Autonav Test mode~~.

IS :
It should be noted that the NMCT information shall be supported by the Block IIR SV.

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-391 :

Section Number :
20.3.3.5.1.1.0-6

WAS :
Table 20-V

Page	Subframe 4		Subframe 5	
	Data ID	SV ID*	Data ID	SV ID*
1	Note(2)	57	Note(1)	1
2	Note(1)	25	Note(1)	2
3	Note(1)	26	Note(1)	3
4	Note(1)	27	Note(1)	4
5	Note(1)	28	Note(1)	5
6	Note(2)	57	Note(1)	6
7	Note(1)	29	Note(1)	7
8	Note(1)	30	Note(1)	8
9	Note(1)	31	Note(1)	9
10	Note(1)	32	Note(1)	10
11	Note(2)	57	Note(1)	11
12	Note(2)	62	Note(1)	12
13	Note(2)	52	Note(1)	13
14	Note(2)	53	Note(1)	14
15	Note(2)	54	Note(1)	15
16	Note(2)	57	Note(1)	16
17	Note(2)	55	Note(1)	17
18	Note(2)	56	Note(1)	18
19	Note(2)	58 Note(3)	Note(1)	19
20	Note(2)	59 Note(3)	Note(1)	20
21	Note(2)	57	Note(1)	21
22	Note(2)	60 Note(3)	Note(1)	22
23	Note(2)	61 Note(3)	Note(1)	23
24	Note(2)	62	Note(1)	24
25	Note(2)	63	Note(2)	51

* Use "0" to indicate "dummy" SV. When using "0" to indicate dummy SV, use the data ID of the transmitting SV.

Note 1: Data ID of that SV whose SV ID appears in that page.
Note 2: Data ID of transmitting SV.
Note 3: SV ID may vary (except for IIR/IIR-M/IIF/GPS III SVs).

Redlines :

Table 20-V

Page	Subframe 4		Subframe 5	
	Data ID	SV ID*	Data ID	SV ID*
1	Note(2)	57	Note(1)	1
2	Note(1)	25	Note(1)	2
3	Note(1)	26	Note(1)	3
4	Note(1)	27	Note(1)	4
5	Note(1)	28	Note(1)	5
6	Note(2)	57	Note(1)	6
7	Note(1)	29	Note(1)	7
8	Note(1)	30	Note(1)	8
9	Note(1)	31	Note(1)	9
10	Note(1)	32	Note(1)	10
11	Note(2)	57	Note(1)	11
12	Note(2)	62	Note(1)	12
13	Note(2)	52	Note(1)	13
14	Note(2)	53	Note(1)	14
15	Note(2)	54	Note(1)	15
16	Note(2)	57	Note(1)	16
17	Note(2)	55	Note(1)	17
18	Note(2)	56	Note(1)	18
19	Note(2)	58 Note(3)	Note(1)	19
20	Note(2)	59 Note(3)	Note(1)	20
21	Note(2)	57	Note(1)	21
22	Note(2)	60 Note(3)	Note(1)	22
23	Note(2)	61 Note(3)	Note(1)	23
24	Note(2)	62	Note(1)	24
25	Note(2)	63	Note(2)	51

* Use "0" to indicate "dummy" SV. When using "0" to indicate dummy SV, use the data ID of the transmitting SV.

Note 1: Data ID of that SV whose SV ID appears in that page.
Note 2: Data ID of transmitting SV.
Note 3: SV ID may vary (except for IIR/IIR-M/IIF/GPS III/ GPS IIIF SVs).

IS :
Table 20-V

Page	Subframe 4		Subframe 5	
	Data ID	SV ID*	Data ID	SV ID*
1	Note(2)	57	Note(1)	1
2	Note(1)	25	Note(1)	2
3	Note(1)	26	Note(1)	3
4	Note(1)	27	Note(1)	4
5	Note(1)	28	Note(1)	5
6	Note(2)	57	Note(1)	6
7	Note(1)	29	Note(1)	7
8	Note(1)	30	Note(1)	8
9	Note(1)	31	Note(1)	9
10	Note(1)	32	Note(1)	10
11	Note(2)	57	Note(1)	11
12	Note(2)	62	Note(1)	12
13	Note(2)	52	Note(1)	13
14	Note(2)	53	Note(1)	14
15	Note(2)	54	Note(1)	15
16	Note(2)	57	Note(1)	16
17	Note(2)	55	Note(1)	17
18	Note(2)	56	Note(1)	18
19	Note(2)	58 Note(3)	Note(1)	19
20	Note(2)	59 Note(3)	Note(1)	20
21	Note(2)	57	Note(1)	21
22	Note(2)	60 Note(3)	Note(1)	22
23	Note(2)	61 Note(3)	Note(1)	23
24	Note(2)	62	Note(1)	24
25	Note(2)	63	Note(2)	51

* Use "0" to indicate "dummy" SV. When using "0" to indicate dummy SV, use the data ID of the transmitting SV.

Note 1: Data ID of that SV whose SV ID appears in that page.
Note 2: Data ID of transmitting SV.
Note 3: SV ID may vary (except for IIR/IIR-M/IIF/GPS III/ GPS IIIF SVs).

Rationale :
Comment made addressing to make distinctions between GPS III and GPS IIIF

IS200-1418 :

Section Number :
20.3.3.5.1.2.0-6

WAS :
For Block IIR/IIR-M, IIF, and GPS III SVs, five sets of almanac shall be used to span at least 60 days. The first, second, and third sets will be transmitted for up to six days each; the fourth and fifth sets will be transmitted for up to 32 days; the fifth set is intended to be transmitted for the remainder of the 60 days minimum, but the actual duration of transmission will depend on the individual SV's capability to retain data in memory.

The first, second, and third sets are based on six day curve fits. The fourth and fifth sets are based on 32 day curve fits.

Redlines :
For Block IIR/IIR-M, IIF, GPS III, and GPS ~~III~~IIIF SVs, five sets of almanac shall be used to span at least 60 days. The first, second, and third sets will be transmitted for up to six days each; the fourth and fifth sets will be transmitted for up to 32 days; the fifth set is intended to be transmitted for the remainder of the 60 days minimum, but the actual duration of transmission will depend on the individual SV's capability to retain data in memory.

The first, second, and third sets are based on six day curve fits. The fourth and fifth sets are based on 32 day curve fits.

IS :
For Block IIR/IIR-M, IIF, GPS III, and GPS IIIF SVs, five sets of almanac shall be used to span at least 60 days. The first, second, and third sets will be transmitted for up to six days each; the fourth and fifth sets will be transmitted for up to 32 days; the fifth set is intended to be transmitted for the remainder of the 60 days minimum, but the actual duration of transmission will depend on the individual SV's capability to retain data in memory.

The first, second, and third sets are based on six day curve fits. The fourth and fifth sets are based on 32 day curve fits.

Rationale :
Comment to make distinctions between GPS III and GPS IIIF

IS200-425 :

Section Number :
20.3.3.5.1.9.0-4

WAS :
Each one of the 30 six-bit ERD slots in bits 11 through 24 of word three, bits 1 through 24 of words four through nine, and bits 1 through 22 of word ten of page 13 of subframe 4 will correspond to an ERD value for a particular SV ID. There are 31 possible SV IDs that these ERD slots may correspond to, ranging from SV ID 1 to SV ID 31. SV ID 32 is not a valid SV ID for any of the slots in an NMCT. The correspondence between the 30 ERD slots and the 31 possible SV IDs depends on the SV ID of the particular transmitting SV in accordance with the following two rules: 1) the CS shall ensure via upload that no SV shall transmit an NMCT containing an ERD value which applies to its own SV ID, and 2) the CS shall ensure via upload that all ERD values shall be transmitted in ascending numerical slot order of the corresponding SV ID. To illustrate: the SV operating as SV ID 1 will transmit (in order) ERD values which correspond to SV ID 2 through SV ID 31 in ERD slots 1 through 30 respectively, while the SV operating as SV ID 31 will transmit ERD values which correspond to SV ID 1 through SV ID 30 in ERD slots 1 through 30 respectively.

Redlines :
Each one of the 30 six-bit ERD slots in bits 11 through 24 of word three, bits 1 through 24 of words four through nine, and bits 1 through 22 of word ten of page 13 of subframe 4 will correspond to an ERD value for a particular SV ID. There are 31 possible SV IDs that these ERD slots may correspond to, ranging from SV ID 1 to SV ID 31. SV ID 32 is not a valid SV ID for any of the slots in an NMCT.~~ The correspondence between the 30 ERD slots and the 31 possible SV IDs depends on the SV ID of the particular transmitting SV in accordance with the following two rules: 1) the CS shall ensure via upload that no SV shall transmit an NMCT containing an ERD value which applies to its own SV ID, and 2) the CS shall ensure via upload that all ERD values shall be transmitted in ascending numerical slot order of the corresponding SV ID. To illustrate: the SV operating as SV ID 1 will transmit (in order) ERD values which correspond to SV ID 2 through SV ID 31 in ERD slots 1 through 30 respectively, while the SV operating as SV ID 31 will transmit ERD values which correspond to SV ID 1 through SV ID 30 in ERD slots 1 through 30 respectively.~~

IS :
Each one of the 30 six-bit ERD slots in bits 11 through 24 of word three, bits 1 through 24 of words four through nine, and bits 1 through 22 of word ten of page 13 of subframe 4 will correspond to an ERD value for a particular SV ID. There are 31 possible SV IDs that these ERD slots may correspond to, ranging from SV ID 1 to SV ID 31. SV ID 32 is not a valid SV ID for any of the slots in an NMCT.

Rationale :
Split shall statements for better requirements readability.

IS200-1737 :
Insertion after object IS200-425 (see Previous)

Section Number :
20.3.3.5.1.9.0-5

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
The correspondence between the 30 ERD slots and the 31 possible SV IDs depends on the SV ID of the particular transmitting SV in accordance with the following two rules:

Rationale :
Split shall statements for better requirements readability.

IS200-1738 :
Insertion after object IS200-1737 (See Previous)

Section Number :
20.3.3.5.1.9.0-6

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
1) The CS shall ensure via upload that no SV shall transmit an NMCT containing an ERD value which applies to its own SV ID.

Rationale :
Split shall statements for better requirements readability.

IS200-1739 :
Insertion after object IS200-1738 (see Previous)

Section Number :
20.3.3.5.1.9.0-7

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
2) The CS shall ensure via upload that all ERD values shall be transmitted in ascending numerical slot order of the corresponding SV ID.

Rationale :
Split shall statements for better requirements readability.

IS200-1740 :
Insertion after object IS200-1739 (See Previous)

Section Number :
20.3.3.5.1.9.0-8

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
To illustrate: the SV operating as SV ID 1 will transmit (in order) ERD values which correspond to SV ID 2 through SV ID 31 in ERD slots 1 through 30 respectively, while the SV operating as SV ID 31 will transmit ERD values which correspond to SV ID 1 through SV ID 30 in ERD slots 1 through 30 respectively.

Rationale :
Split shall statements for better requirements readability.

IS200-1741 :
Insertion after object IS200-1740 (See Previous)

Section Number :
20.3.3.5.1.9.0-9

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
In addition, the CS shall ensure that the SV operating as SV ID 32 transmits an NMCT containing an AI setting equal to "10" or "11."

Rationale :
Add new CS requirement to clarify what is transmitted in the NMCT for SV ID 32.

IS200-431 :

Section Number :
20.3.3.5.2.1.0-2

WAS :
The user is cautioned that the sensitivity to small perturbations in the parameters is even greater for the almanac than for the ephemeris, with the sensitivity of the angular rate terms over the interval of applicability on the order of 10^{14} meters/(semicircle/second). An indication of the URE provided by a given almanac during each of the operational intervals is as follows:

Operational Interval	Almanac Ephemeris URE (estimated by analysis) 1 sigma (meters)
Normal	900*,†
Short-term Extended	900 - 3,600*
Long-term Extended	3600 - 300,000*
* URE values generally tend to degrade quadratically over time. Larger errors may be encountered during eclipse seasons and whenever a propulsive event has occurred.	
† After the CS is unable to upload the SVs, URE values for the SVs operating in the Autonav mode	

Redlines :
The user is cautioned that the sensitivity to small perturbations in the parameters is even greater for the almanac than for the ephemeris, with the sensitivity of the angular rate terms over the interval of applicability on the order of 10^{14} meters/(semicircle/second). An indication of the URE provided by a given almanac during each of the operational intervals is as follows:

Operational Interval	Almanac Ephemeris URE (estimated by analysis) 1 sigma (meters)
Normal	900*~~,†~~
Short-term Extended	900 - 3,600*
Long-term Extended	3600 - 300,000*
* URE values generally tend to degrade quadratically over time. Larger errors may be encountered during eclipse seasons and whenever a propulsive event has occurred.	
~~† After the CS is unable to upload the SVs, URE values for the SVs operating in the Autonav mode~~	

IS :
The user is cautioned that the sensitivity to small perturbations in the parameters is even greater for the almanac than for the ephemeris, with the sensitivity of the angular rate terms over the interval of applicability on the order of 10^{14} meters/(semicircle/second). An indication of the URE provided by a given almanac during each of the operational intervals is as follows:

Operational Interval	Almanac Ephemeris URE (estimated by analysis) 1 sigma (meters)
Normal	900*
Short-term Extended	900 - 3,600*
Long-term Extended	3600 - 300,000*
* URE values generally tend to degrade quadratically over time. Larger errors may be encountered during eclipse seasons and whenever a propulsive event has occurred.	

Rationale :
Autonav is not present in any current SV nor will it be in GPS IIIF. Removing Autonav.

IS200-447 :

Section Number :
20.3.3.5.2.5.0-1

WAS :
The "dual-frequency" (L1 and L2) user shall correct the time received from the SV for ionospheric effect by utilizing the time delay differential between L1 and L2 (reference paragraph 20.3.3.3.3.3). The "single-frequency" user, however, may use the model given in Figure 20-4 to make this correction. It is estimated that the use of this model will provide at least a 50 percent reduction in the single - frequency user's RMS error due to ionospheric propagation effects. During extended operations, or for the SVs in the Autonav mode if the CS is unable to upload the SVs, the use of this model will yield unpredictable results.

Redlines :
The "dual-frequency" (L1 and L2) user shall correct the time received from the SV for ionospheric effect by utilizing the time delay differential between L1 and L2 (reference paragraph 20.3.3.3.3.3). The "single-frequency" user, however, may use the model given in Figure 20-4 to make this correction. It is estimated that the use of this model will provide at least a 50 percent reduction in the single - frequency user's RMS error due to ionospheric propagation effects. During extended operations, ~~or for the SVs in the Autonav mode if the CS is unable to upload the SVs,~~ the use of this model will yield unpredictable results.

IS :
The "dual-frequency" (L1 and L2) user shall correct the time received from the SV for ionospheric effect by utilizing the time delay differential between L1 and L2 (reference paragraph 20.3.3.3.3.3). The "single-frequency" user, however, may use the model given in Figure 20-4 to make this correction. It is estimated that the use of this model will provide at

least a 50 percent reduction in the single - frequency user's RMS error due to ionospheric propagation effects. During extended operations, the use of this model will yield unpredictable results.

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-462 :

Section Number :
20.3.4.4.0-1

WAS :
The IODE is an 8 bit number equal to the 8 LSBs of the 10 bit IODC of the same CEI data set. The following rules govern the transmission of IODC and IODE values in different CEI data sets: (1) The transmitted IODC will be different from any value transmitted by the SV during the preceding seven days; (2) The transmitted IODE will be different from any value transmitted by the SV during the preceding six hours. The range of IODC will be as given in Table 20-XI for Block II/IIA SVs and Table 20-XII for Block IIR/IIR-M/IIF and GPS III SVs.

Redlines :
The IODE is an 8 bit number equal to the 8 LSBs of the 10 bit IODC of the same CEI data set. The following rules govern the transmission of IODC and IODE values in different CEI data sets: (1) The transmitted IODC will be different from any value transmitted by the SV during the preceding seven days; (2) The transmitted IODE will be different from any value transmitted by the SV during the preceding six hours. The range of IODC will be as given in Table 20-XI for Block II/IIA SVs and Table 20-XII for Block IIR/IIR-M/IIF and GPS III/IIIF SVs.

IS :
The IODE is an 8 bit number equal to the 8 LSBs of the 10 bit IODC of the same CEI data set. The following rules govern the transmission of IODC and IODE values in different CEI data sets: (1) The transmitted IODC will be different from any value transmitted by the SV during the preceding seven days; (2) The transmitted IODE will be different from any value transmitted by the SV during the preceding six hours. The range of IODC will be as given in Table 20-XI for Block II/IIA SVs and Table 20-XII for Block IIR/IIR-M/IIF and GPS III/IIIF SVs.

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-686 :

Section Number :
20.3.4.4.0-7

WAS :
The subframe 1, 2, and 3 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is four hours. SVs operating in the Autonav mode will deviate. They will transmit subframe 1, 2, and 3 CEI data sets for periods of one hour. The corresponding curve-fit interval will be four hours.

Redlines :
The subframe 1, 2, and 3 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is four hours. ~~SVs operating in the Autonav mode will deviate. They will transmit subframe 1, 2, and 3 CEI data sets for periods of one hour. The corresponding curve-fit interval will be four hours.~~

IS :
The subframe 1, 2, and 3 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is four hours.

Rationale :
Autonav does not exist in any current SV nor will it be in GPS IIIF

IS200-1589 :

Section Number :
20.3.4.4.0-12

WAS :
Table 20-XII. IODC Values and Data Set Lengths (Block IIR/IIR-M/IIF & GPS III)

Redlines :
Table 20-XII. IODC Values and Data Set Lengths (Block IIR/IIR-M/IIF & GPS III/ IIIF)

IS :
Table 20-XII. IODC Values and Data Set Lengths (Block IIR/IIR-M/IIF & GPS III/ IIIF)

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-468 :

Section Number :
20.3.4.4.0-13

WAS :
Table 20- XII.

Days Spanned	Transmission Interval (hours) (Note 5)	Curve Fit Interval (hours)	IODC Range
1	2 (Note 4)	4	(Note 2)
2-14	4	6	(Note 2)
15-16	6	8	240-247 (Note 1)
17-20	12	14	248-255, 496 (Note 1) (Note 3)
21-62	24	26	497-503, 1021-1023

Note 1: For transmission intervals of 6 and 12 hours, the IODC values shown will be transmitted in increasing order.

Note 2: IODC values for blocks with 1-, 2- or 4-hour transmission intervals (at least the first 14 days after a new CEI data sequence propagation) shall be any number in the range 0 to 1023 excluding those values of IODC that correspond to IODE values in the range 240-255, subject to the constraints on re-transmission given in paragraph 20.3.4.4. The CS can define the GPS III SV time of transition from the 4 hour curve fits into extended navigation (beyond 4 hour curve fits). Following the transition time, the SV will follow the timeframes defined in the table, including appropriately setting IODC values.

Note 3: The ninth 12-hour data set may not be transmitted.

Note 4: SVs operating in the Autonav mode will have transmission intervals of 1 hour per paragraph 20.3.4.4.

Note 5: The first CEI data set of a new CEI data sequence propagation may be cut-in at any time and therefore the transmission interval may be less than the specified value.

Redlines :

Table 20- XII.

Days Spanned	Transmission Interval (hours) (Note 5)	Curve Fit Interval (hours)	IODC Range
1	2 (Note 4)	4	(Note 2)
2-14	4	6	(Note 2)
15-16	6	8	240-247 (Note 1)
17-20	12	14	248-255, 496 (Note 1) (Note 3)
21-62	24	26	497-503, 1021-1023

Note 1: For transmission intervals of 6 and 12 hours, the IODC values shown will be transmitted in increasing order.

Note 2: IODC values for blocks with 1-, 2- or 4-hour transmission intervals (at least the first 14 days after a new CEI data sequence propagation) shall be any number in the range 0 to 1023 excluding those values of IODC that correspond to IODE values in the range 240-255, subject to the constraints on re-transmission given in paragraph 20.3.4.4. The CS can define the GPS III and GPS IIIF SV time of transition from the 4 hour curve fits into extended navigation (beyond 4 hour curve fits). Following the transition time, the SV will follow the timeframes defined in the table, including appropriately setting IODC values.

Note 3: The ninth 12-hour data set may not be transmitted.

~~Note 4: SVs operating in the Autonav mode will have transmission intervals of 1 hour per paragraph 20.3.4.4.~~

Note ~~5~~4: The first CEI data set of a new CEI data sequence propagation may be cut-in at any time and therefore the transmission interval may be less than the specified value.

IS :
Table 20- XII.

Days Spanned	Transmission Interval (hours) (Note 5)	Curve Fit Interval (hours)	IODC Range
1	2 (Note 4)	4	(Note 2)
2-14	4	6	(Note 2)
15-16	6	8	240-247 (Note 1)
17-20	12	14	248-255, 496 (Note 1) (Note 3)
21-62	24	26	497-503, 1021-1023

Note 1: For transmission intervals of 6 and 12 hours, the IODC values shown will be transmitted in increasing order.

Note 2: IODC values for blocks with 1-, 2- or 4-hour transmission intervals (at least the first 14 days after a new CEI data sequence propagation) shall be any number in the range 0 to 1023 excluding those values of IODC that correspond to IODE values in the range 240-255, subject to the constraints on re-transmission given in paragraph 20.3.4.4. The CS can define the GPS III and GPS IIIF SV time of transition from the 4 hour curve fits into extended navigation (beyond 4 hour curve fits). Following the transition time, the SV will follow the timeframes defined in the table, including appropriately setting IODC values.

Note 3: The ninth 12-hour data set may not be transmitted.

Note 4: The first CEI data set of a new CEI data sequence propagation may be cut-in at any time and therefore the transmission interval may be less than the specified value.

Rationale :
make distinctions between GPS III and GPS IIIF.

Autonav is not present in any current SV nor will it be in GPS IIIF. Removing Autonav.

IS200-474 :

Section Number :
20.3.4.5.0-5

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

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

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

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-475 :

Section Number :
20.3.4.5.0-6

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

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

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

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-1280 :

Section Number :
30.3.2.0-2

WAS :
Block IIR-M and IIF SVs have the capability of storing at least 48 hours of CNAV navigation data, with current memory margins, to provide CNAV positioning service without contact from the CS for that period. GPS III SVs have the capability of providing up to 60 days of CNAV positioning service without contact from the CS. The timeframe is defined by the CS.

Redlines :
Block IIR-M and IIF SVs have the capability of storing at least 48 hours of CNAV navigation data, with current memory margins, to provide CNAV positioning service without contact from the CS for that period. GPS III and GPS IIIF SVs have the capability of providing up to 60 days of CNAV positioning service without contact from the CS. The timeframe is defined by the CS.

IS :
Block IIR-M and IIF SVs have the capability of storing at least 48 hours of CNAV navigation data, with current memory margins, to provide CNAV positioning service without contact from the CS for that period. GPS III and GPS IIIF SVs have the capability of providing up to 60 days of CNAV positioning service without contact from the CS. The timeframe is defined by the CS.

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-516 :

Section Number :
30.3.3.0-2

WAS :

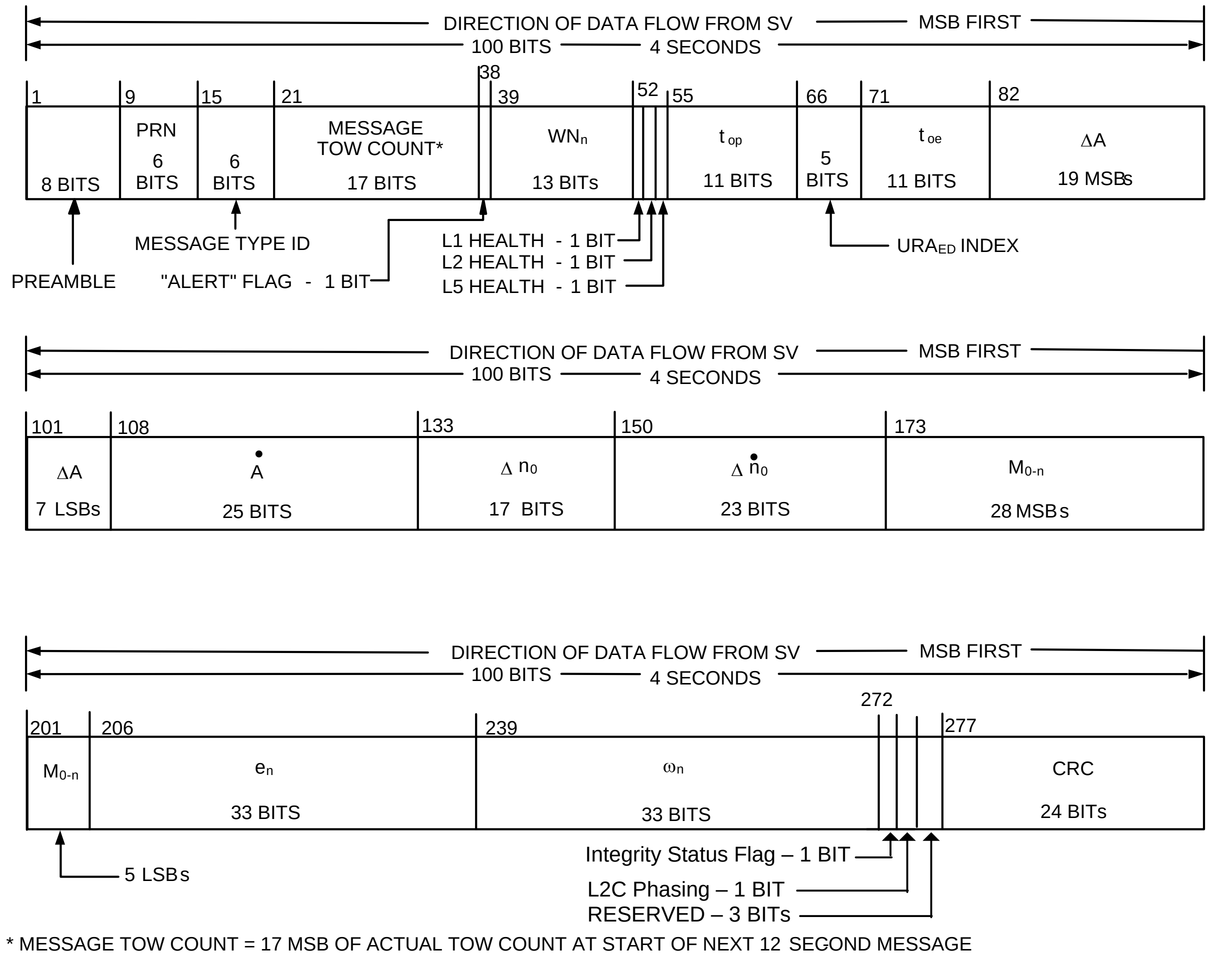

Figure 30-1. Message Type 10 - Ephemeris 1

Redlines :

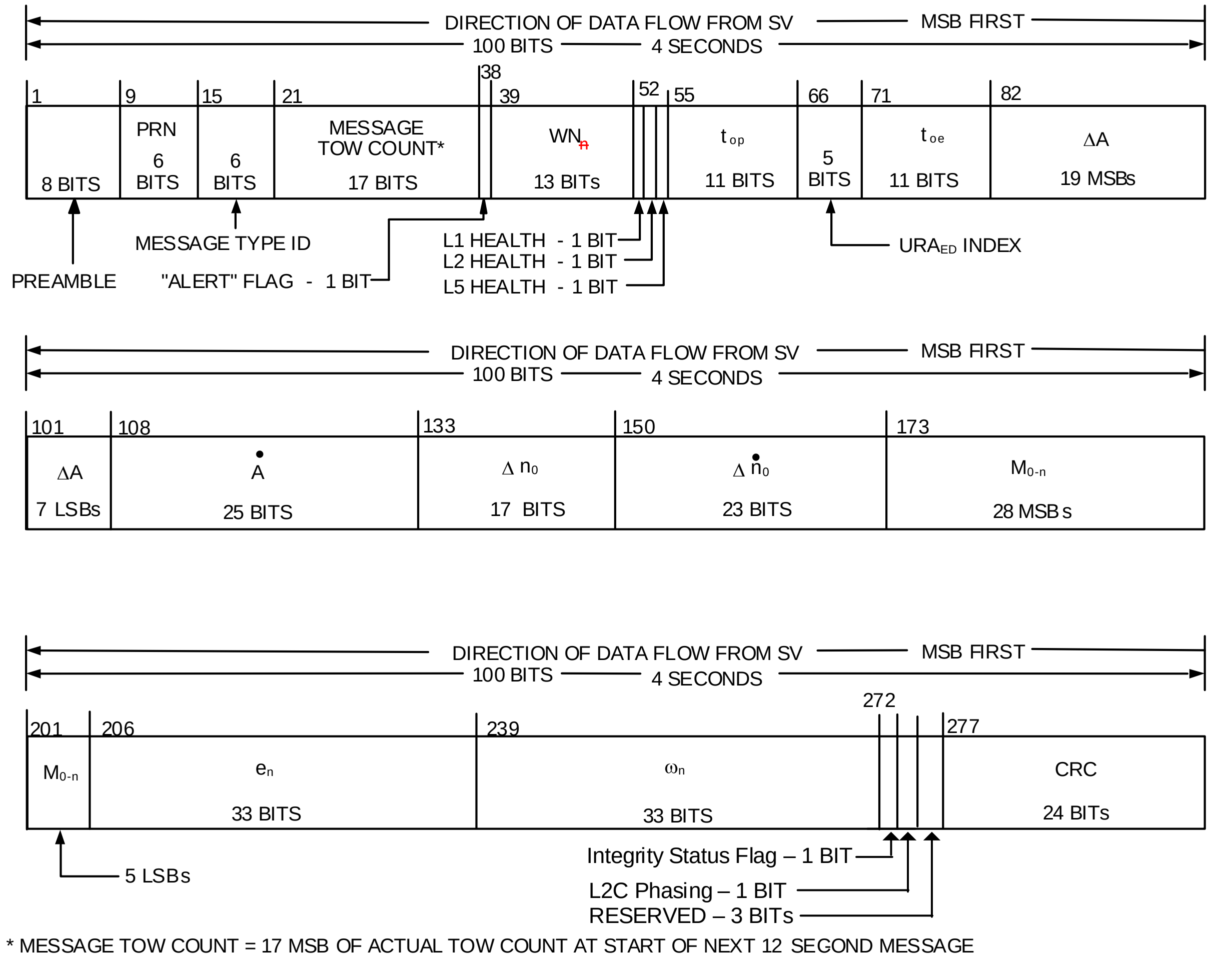

Figure 30-1. Message Type 10 - Ephemeris 1

IS :

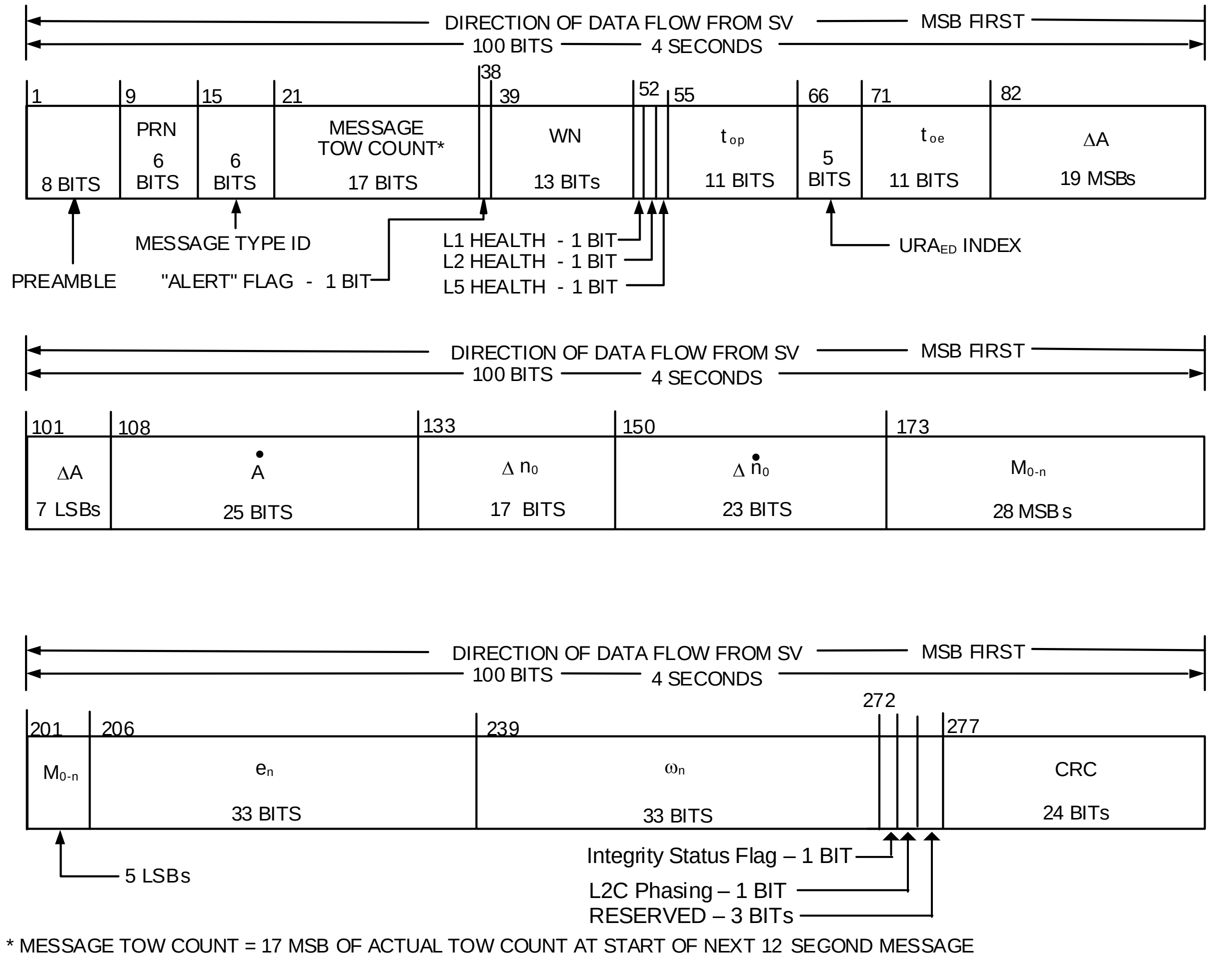

Figure 30-1. Message Type 10 - Ephemeris 1

Rationale :

WNn is not consistently used throughout the document. Remove subscript n from WNn from Table 6-I-1 and Figure 30-1 to maintain consistency.

IS200-535 :

Section Number :
30.3.3.1.1.0-4

WAS :
Any change in the Message Type 10 and 11 ephemeris data will be accomplished with a simultaneous change in the t_{oe} value. The CS (Block IIR-M/IIF) and SS (GPS III) will assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted from the prior CEI data sequence propagation (reference paragraph 30.3.4.5 for additional information regarding t_{oe}).

The CNAV messages contain information that allows users to take advantage of situations when integrity is assured to the enhanced level. This is accomplished using a composite integrity assured URA value in conjunction with an integrity status flag. The composite integrity assured URA (IAURA) value is the RSS of an elevation-dependent function of the upper bound value of the URA_{ED} component and the upper bound value of the URA_{NED} component. The composite IAURA value is assured to the enhanced level only when the integrity status flag is “1”; otherwise the IAURA value is assured to the legacy level.

Bit 272 of Message Type 10 is the Integrity Status Flag (ISF). A "0" in bit position 272 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the current broadcast IAURA value, for more than 5.2 seconds, without an accompanying alert, is less than 1E-5 per hour. A "1" in bit-position 272 indicates that the conveying signal is provided with an enhanced level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the current broadcast IAURA value, for more than 5.2 seconds, without an accompanying alert, is less than 1E-8 per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA_{ED} index, URA_{NED} indexes, and related URA values are not defined.

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.

Redlines :
Any change in the Message Type 10 and 11 ephemeris data will be accomplished with a simultaneous change in the t_{oe} value. The CS (Block IIR-M/IIF) and SS (GPS III and GPS IIIF) will assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted from the prior CEI data sequence propagation (reference paragraph 30.3.4.5 for additional information regarding t_{oe}).

The CNAV messages contain information that allows users to take advantage of situations when integrity is assured to the enhanced level. This is accomplished using a composite integrity assured URA value in conjunction with an integrity status flag. The composite integrity assured URA (IAURA) value is the RSS of an elevation-dependent function of the upper bound value of the URA_{ED} component and the upper bound value of the URA_{NED} component. The composite

IAURA value is assured to the enhanced level only when the integrity status flag is “1”; otherwise the IAURA value is assured to the legacy level.

Bit 272 of Message Type 10 is the Integrity Status Flag (ISF). A "0" in bit position 272 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the current broadcast IAURA value, for more than 5.2 seconds, without an accompanying alert, is less than 1E-5 per hour. A "1" in bit-position 272 indicates that the conveying signal is provided with an enhanced level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the current broadcast IAURA value, for more than 5.2 seconds, without an accompanying alert, is less than 1E-8 per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA_{ED} index, URA_{NED} indexes, and related URA values are not defined.

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.

IS :

Any change in the Message Type 10 and 11 ephemeris data will be accomplished with a simultaneous change in the t_{oe} value. The CS (Block IIR-M/IIF) and SS (GPS III and GPS IIIF) will assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted from the prior CEI data sequence propagation (reference paragraph 30.3.4.5 for additional information regarding t_{oe}).

The CNAV messages contain information that allows users to take advantage of situations when integrity is assured to the enhanced level. This is accomplished using a composite integrity assured URA value in conjunction with an integrity status flag. The composite integrity assured URA (IAURA) value is the RSS of an elevation-dependent function of the upper bound value of the URA_{ED} component and the upper bound value of the URA_{NED} component. The composite IAURA value is assured to the enhanced level only when the integrity status flag is “1”; otherwise the IAURA value is assured to the legacy level.

Bit 272 of Message Type 10 is the Integrity Status Flag (ISF). A "0" in bit position 272 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the current broadcast IAURA value, for more than 5.2 seconds, without an accompanying alert, is less than 1E-5 per hour. A "1" in bit-position 272 indicates that the conveying signal is provided with an enhanced level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the current broadcast IAURA value, for more than 5.2 seconds, without an accompanying alert, is less than 1E-8 per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA_{ED} index, URA_{NED} indexes, and related URA values are not defined.

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.

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-550 :

Section Number :
30.3.3.1.3.0-1

WAS :
The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 30-II. The ephemeris parameters are Keplerian in appearance; however, the values of these parameters are produced by the CS (Block IIR-M/IIF) and SS (GPS III) via a least squares curve fit of the propagated ephemeris of the SV APC (time-position quadruples: t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4.

Redlines :
The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 30-II. The ephemeris parameters are Keplerian in appearance; however, the values of these parameters are produced by the CS (Block IIR-M/IIF) and SS (GPS III and GPS IIIF) via a least squares curve fit of the propagated ephemeris of the SV APC (time-position quadruples: t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4.

IS :
The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 30-II. The ephemeris parameters are Keplerian in appearance; however, the values of these parameters are produced by the CS (Block IIR-M/IIF) and SS (GPS III and GPS IIIF) via a least squares curve fit of the propagated ephemeris of the SV APC (time-position quadruples: t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4.

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-1744 :
Insertion after object IS200-550

The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 30-II. The ephemeris parameters are Keplerian in appearance; however, the values of these parameters are produced by the CS (Block IIR-M/IIF) and SS (GPS III) via a least squares curve fit of the propagated ephemeris of the SV APC (time-position quadruples: t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4.

Section Number :
30.3.3.1.3.1

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
The user can compute velocity and acceleration for the SV, if required, utilizing a variation of the equations shown in Table 30-II Part 3 and 4.

Rationale :
Adding statement to tell the users that the new velocity and acceleration equations are optional.

IS200-1611 :

Section Number :
30.3.3.1.3.1-6

WAS :
Table 30-II. Elements of Coordinate System (part 1 of 2)

Redlines :
Table 30-II. ~~Elements of Coordinate~~Broadcast ~~System~~Navigation User Equations (~~part~~sheet 1 of ~~2~~4)

IS :
Table 30-II. Broadcast Navigation User Equations (sheet 1 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-554 :

Section Number :
30.3.3.1.3.1-7

WAS :
Table 30-II.

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
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion (rad/sec)
$t_k = t - t_{oe}$ **	Time from ephemeris reference time
$\Delta n_A = \Delta n_0 + ½\, \Delta \dot{n}_0\, t_k$	Mean motion difference from computed value
$n_A = n_0 + \Delta n_A$	Corrected Mean Motion
$M_k = M_0 + n_A t_k$	Mean Anomaly
$M_k = E_k - e_n \sin E_k$	Kepler's equation for Eccentric Anomaly (radians) (may be solved by iteration)
$\nu_k = \tan^{-1}\left\{\frac{\sin \nu_k}{\cos \nu_k}\right\}$	True Anomaly
$= \tan^{-1}\left\{\frac{\sqrt{1-e_n^2}\,\sin E_k / (1 - e_n \cos E_k)}{(\cos E_k - e_n)/(1 - e_n \cos E_k)}\right\}$	
$E_k = \cos^{-1}\left\{\frac{e_n + \cos \nu_k}{1 + e_n \cos \nu_k}\right\}$	Eccentric Anomaly

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

** **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.

Redlines :
Table 30-II.

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
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n_0 = \sqrt{\frac{\mu}{A_0^{\,3}}}$	Computed Mean Motion (rad/sec)
$t_k = t - t_{oe}$ **	Time from ephemeris reference time
$\Delta n_A = \Delta n_0 + ½\, \Delta\dot{n}_0\, t_k$	Mean motion difference from computed value
$n_A = n_0 + \Delta n_A$	Corrected Mean Motion
$M_k = M_0 + n_A t_k$	Mean Anomaly
~~$M_k = E_k - e_n \sin E_k$~~	~~Kepler's equation for Eccentric Anomaly (radians) (may be solved by iteration)~~
	Kepler's equation $(M_k = E_k - e \sin E_k)$ 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, three iterations, (j=1,2,3)
$E_k = E_3$	–Final Value (radians)
~~$\nu_k = \tan^{-1}\left\{\frac{\sin \nu_k}{\cos \nu_k}\right\}$ $= \tan^{-1}\left\{\frac{\sqrt{1-e_n^2}\sin E_k / (1 - e_n \cos E_k)}{(\cos E_k - e_n)/(1 - e_n \cos E_k)}\right\}$~~	~~True Anomaly~~
$\nu_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan \frac{E_k}{2}\right)$	True Anomaly (unambiguous quadrant)
~~$E_k = \cos^{-1}\left\{\frac{e_n + \cos \nu_k}{1 + e_n \cos \nu_k}\right\}$~~	~~Eccentric Anomaly~~

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

IS :

Table 30-II.

Element/Equation	Description
μ = 3.986005 x 10^{14} meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e$ = 7.2921151467 x 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
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n_0 = \sqrt{\dfrac{\mu}{A_0^{\,3}}}$	Computed Mean Motion (rad/sec)
$t_k = t - t_{oe}$ **	Time from ephemeris reference time
$\Delta n_A = \Delta n_0 + ½\, \Delta \dot{n}_0\, t_k$	Mean motion difference from computed value
$n_A = n_0 + \Delta n_A$	Corrected Mean Motion
$M_k = M_0 + n_A\, t_k$	Mean Anomaly
	Kepler's equation ($M_k = E_k - e \sin E_k$) solved for Eccentric Anomaly (E_k) by iteration:
$E_0 = M_k$	– Initial Value (radians)
$E_j = E_{j-1} + \dfrac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	– Refined Value, three iterations, (j=1,2,3)
$E_k = E_3$	–Final Value (radians)
$\nu_k = 2 \tan^{-1}\left(\sqrt{\dfrac{1+e}{1-e}} \tan \dfrac{E_k}{2} \right)$	True Anomaly (unambiguous quadrant)

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

Rationale :
RFC 395: Implement and replace with improved Kepler equations for True and Eccentric Anomaly.

IS200-1612 :

Section Number :
30.3.3.1.3.1-8

WAS :
Table 30-II. Elements of Coordinate System (part 2 of 2)

Redlines :
Table 30-II. ~~Elements of~~Broadcast ~~Coordinate~~Navigation ~~System~~User Equations (~~part~~sheet 2 of ~~2~~4)

IS :
Table 30-II. Broadcast Navigation User Equations (sheet 2 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-1729 :
Insertion after object IS200-555

Table 30-II. part 2

Element/Equation *	Description
$\Phi_k = \nu_k + \omega_n$	Argument of Latitude
$\delta u_k = C_{us-n}\sin 2\Phi_k + C_{uc-n}\cos 2\Phi_k$	Argument of Latitude Correction (Second Harmonic Perturbations)
$\delta r_k = C_{rs-n}\sin 2\Phi_k + C_{rc-n}\cos 2\Phi_k$	Radial Correction (Second Harmonic Perturbations)
$\delta i_k = C_{is-n}\sin 2\Phi_k + C_{ic-n}\cos 2\Phi_k$	Inclination Correction (Second Harmonic Perturbations)
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A_k(1 - e_n \cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_{o-n} + (i_{o-n}\text{-DOT})t_k + \delta i_k$	Corrected Inclination
$x_k' = r_k \cos u_k$ $y_k' = r_k \sin u_k$	Positions in orbital plane
$\dot{\Omega} = \dot{\Omega}_{REF} + \Delta\dot{\Omega}$ ***	Rate of Right Ascension
$\Omega_k = \Omega_{0-n} + (\dot{\Omega} - \dot{\Omega}_e)\, t_k - \dot{\Omega}_e\, t_{oe}$	Corrected Longitude of Ascending Node
$x_k = x_k' \cos\Omega_k - y_k' \cos i_k \sin\Omega_k$ $y_k = x_k' \sin\Omega_k + y_k' \cos i_k \cos\Omega_k$ $z_k = y_k' \sin i_k$	Earth-fixed coordinates of SV antenna phase center

Section Number :
30.3.3.1.3.1-10

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 30- II. Broadcast Navigation User Equations (sheet 3 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-1730 :
Insertion after object IS200-1729 (See Previous)

Section Number :
30.3.3.1.3.1-11

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 30-II. Part 3

Element/Equation	Description
SV Velocity	
$\dot{E}_k = n / (1 - e \cos E_k)$	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 Rate
$\dot{r}_k = eA\dot{E}_k \sin Ek + 2\dot{v}_k (c_{rs} \cos 2\phi_k - c_{rc} \sin 2\phi_k)$	Corrected Radius Rate
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	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)

Rationale :
RFC 395: Add new and improved velocity and acceleration equation tables

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IS200-1727 :
Insertion after object IS200-1730 (See Previous)

Section Number :
30.3.3.1.3.1-12

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 30-II. Broadcast Navigation User Equations (sheet 4 of 4)

Rationale :
RFC 395: Change title to reflect the new change of equations

IS200-1728 :
Insertion after object IS200-1727 (See Previous)

Section Number :
30.3.3.1.3.1-13

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
Table 30-II. Part 4

Element/Equation	Description
SV Acceleration	
R_E = 6378137.0 meters	WGS 84 Earth Equatorial Radius
J_2 = 0.0010826262	Oblate Earth Gravity Coefficient
$F = - (3/2)\ J_2\ (\mu / r_k^2)\ (R_E / r_k)^2$	Oblate Earth acceleration Factor
$\ddot{x}_k = - \mu\ (x_k / r_k^3) + F\ [(1 - 5\ (z_k / r_k)^2)(x_k / r_k)] + 2\dot{y}_k \dot{\Omega}_e + x_k \dot{\Omega}_e^2$	Earth- Fixed x acceleration (m/s^2)
$\ddot{y}_k = - \mu\ (y_k / r_k^3) + F\ [(1 - 5\ (z_k / r_k)^2)(y_k / r_k)] - 2\dot{x}_k \dot{\Omega}_e + y_k \dot{\Omega}_e^2$	Earth- Fixed *y* Acceleration (m/s^2)
$\ddot{z}_k = - \mu\ (z_k / r_k^3) + F\ [(3 - 5\ (z_k / r_k)^2)(z_k / r_k)]$	Earth- Fixed *z* Acceleration (m/s^2)

Rationale :
RFC 395: Add new and improved velocity and acceleration equation tables

IS200-1496 :

Section Number :
30.3.4.5.0-6

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

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

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

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-1497 :

Section Number :
30.3.4.5.0-7

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

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

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

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-1372 :

Section Number :
40.3.3.5.1.1-1

WAS :
Table 40-V.

Page	Subframe 4		Subframe 5	
	Data ID	SV ID* (Note 4)	Data ID	SV ID* (Note 4)
1	Note(2)	121	Note(1)	65
2	Note(1)	89	Note(1)	66
3	Note(1)	90	Note(1)	67
4	Note(1)	91	Note(1)	68
5	Note(1)	92	Note(1)	69
6	Note(2)	121	Note(1)	70
7	Note(1)	93	Note(1)	71
8	Note(1)	94	Note(1)	72
9	Note(1)	95	Note(1)	73
10	Note(2)	0	Note(1)	74
11	Note(2)	121	Note(1)	75
12	Note(2)	126	Note(1)	76
13	Note(2)	116	Note(1)	77
14	Note(2)	117	Note(1)	78
15	Note(2)	118	Note(1)	79
16	Note(2)	121	Note(1)	80
17	Note(2)	119	Note(1)	81
18	Note(2)	120	Note(1)	82
19	Note(2)	122 Note(3)	Note(1)	83
20	Note(2)	123 Note(3)	Note(1)	84
21	Note(2)	121	Note(1)	85
22	Note(2)	124 Note(3)	Note(1)	86
23	Note(2)	125 Note(3)	Note(1)	87
24	Note(2)	126	Note(1)	88
25	Note(2)	127	Note(2)	115

* Use "0" to indicate "dummy" SV. When using "0" to indicate dummy SV, use the data ID of the transmitting SV.
Note 1: Data ID of that SV whose SV ID appears in that page.
Note 2: Data ID of transmitting SV.
Note 3: SV ID may vary (except for IIR/IIR-M/IIF / and GPS III SVs).
Note 4: For almanac data pages, the SV ID relationship to PRN ID is defined in Table 3-Ia and Table 3-Ib

Redlines :
Table 40-V.

Page	Subframe 4		Subframe 5	
	Data ID	SV ID* (Note 4)	Data ID	SV ID* (Note 4)
1	Note(2)	121	Note(1)	65
2	Note(1)	89	Note(1)	66
3	Note(1)	90	Note(1)	67
4	Note(1)	91	Note(1)	68
5	Note(1)	92	Note(1)	69
6	Note(2)	121	Note(1)	70
7	Note(1)	93	Note(1)	71
8	Note(1)	94	Note(1)	72
9	Note(1)	95	Note(1)	73
10	Note(2)	0	Note(1)	74
11	Note(2)	121	Note(1)	75
12	Note(2)	126	Note(1)	76
13	Note(2)	116	Note(1)	77
14	Note(2)	117	Note(1)	78
15	Note(2)	118	Note(1)	79
16	Note(2)	121	Note(1)	80
17	Note(2)	119	Note(1)	81
18	Note(2)	120	Note(1)	82
19	Note(2)	122 Note(3)	Note(1)	83
20	Note(2)	123 Note(3)	Note(1)	84
21	Note(2)	121	Note(1)	85
22	Note(2)	124 Note(3)	Note(1)	86
23	Note(2)	125 Note(3)	Note(1)	87
24	Note(2)	126	Note(1)	88
25	Note(2)	127	Note(2)	115

* Use "0" to indicate "dummy" SV. When using "0" to indicate dummy SV, use the data ID of the transmitting SV.
Note 1: Data ID of that SV whose SV ID appears in that page.
Note 2: Data ID of transmitting SV.
Note 3: SV ID may vary (except for IIR/IIR-M/IIF/~~and~~GPS III/ GPS IIIF SVs).
Note 4: For almanac data pages, the SV ID relationship to PRN ID is defined in Table 3-Ia and Table 3-Ib

IS :
Table 40-V.

Page	Subframe 4		Subframe 5	
	Data ID	SV ID* (Note 4)	Data ID	SV ID* (Note 4)
1	Note(2)	121	Note(1)	65
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3	Note(1)	90	Note(1)	67
4	Note(1)	91	Note(1)	68
5	Note(1)	92	Note(1)	69
6	Note(2)	121	Note(1)	70
7	Note(1)	93	Note(1)	71
8	Note(1)	94	Note(1)	72
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17	Note(2)	119	Note(1)	81
18	Note(2)	120	Note(1)	82
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20	Note(2)	123 Note(3)	Note(1)	84
21	Note(2)	121	Note(1)	85
22	Note(2)	124 Note(3)	Note(1)	86
23	Note(2)	125 Note(3)	Note(1)	87
24	Note(2)	126	Note(1)	88
25	Note(2)	127	Note(2)	115

* Use "0" to indicate "dummy" SV. When using "0" to indicate dummy SV, use the data ID of the transmitting SV.
Note 1: Data ID of that SV whose SV ID appears in that page.
Note 2: Data ID of transmitting SV.
Note 3: SV ID may vary (except for IIR/IIR-M/IIF/GPS III/GPS IIIF SVs).
Note 4: For almanac data pages, the SV ID relationship to PRN ID is defined in Table 3-Ia and Table 3-Ib

Rationale :
make distinctions between GPS III and GPS IIIF

IS200-1375 :

Section Number :
40.3.3.5.1.2.0-1

WAS :
Pages 1 through 24 of subframe 5, as well as pages 2 through 5 and 7 through 9 of subframe 4 contain the almanac data and a SV health word for up to 31 SVs (the health word is discussed in paragraph 40.3.3.5.1.3). The almanac data are a reduced-precision subset of the clock and ephemeris parameters. The data occupy all bits of words three through ten of each page except the eight MSBs of word three (data ID and SV ID), bits 17 through 24 of word five (SV health), and the 50 bits devoted to parity. The number of bits, the scale factor (LSB), the range, and the units of the almanac parameters are given in Table 20-VI. The algorithms and other material related to the use of the almanac data are given in paragraph 40.3.3.5.2.

The almanac message for any dummy SVs shall contain alternating ones and zeros with valid parity.

The almanac parameters shall be updated by the CS at least once every 6 days while the CS is able to upload the SVs. If the CS is unable to upload the SVs, the accuracy of the almanac parameters transmitted by the SVs will degrade over time.

For Block IIA SVs, three sets of almanac shall be used to span at least 60 days. The first and second sets will be transmitted for up to six days each; the third set is intended to be transmitted for the remainder of the 60 days minimum, but the actual duration of transmission will depend on the individual SV's capability to retain data in memory. All three sets are based on six-day curve fits that correspond to the first six days of the transmission interval. For Block IIR/IIR-M, IIF and GPS III SVs, multiple sets of almanac parameters shall be uploaded to span at least 60 days.

Redlines :
Pages 1 through 24 of subframe 5, as well as pages 2 through 5 and 7 through 9 of subframe 4 contain the almanac data and a SV health word for up to 31 SVs (the health word is discussed in paragraph 40.3.3.5.1.3). The almanac data are a reduced-precision subset of the clock and ephemeris parameters. The data occupy all bits of words three through ten of each page except the eight MSBs of word three (data ID and SV ID), bits 17 through 24 of word five (SV health), and the 50 bits devoted to parity. The number of bits, the scale factor (LSB), the range, and the units of the almanac parameters are given in Table 20-VI. The algorithms and other material related to the use of the almanac data are given in paragraph 40.3.3.5.2.

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IS :
Pages 1 through 24 of subframe 5, as well as pages 2 through 5 and 7 through 9 of subframe 4 contain the almanac data and a SV health word for up to 31 SVs (the health word is discussed in paragraph 40.3.3.5.1.3). The almanac data are a reduced-precision subset of the clock and ephemeris parameters. The data occupy all bits of words three through ten of each page except the eight MSBs of word three (data ID and SV ID), bits 17 through 24 of word five (SV health), and the 50 bits devoted to parity. The number of bits, the scale factor (LSB), the range, and the units of the almanac parameters are given in Table 20-VI. The algorithms and other material related to the use of the almanac data are given in paragraph 40.3.3.5.2.

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Rationale :
make distinctions between GPS III and GPS IIIF