PROPOSED CHANGE NOTICE

Affected Document:	IRN/SCN Number	Date:
IS-GPS-200J	XXX-XXXX-XXX	DD-MMM-YYYY
Authority:	**Proposed Change Notice**	**Date:**
RFC-00374	IS200J_RFC374	01-MAY-2018

CLASSIFIED BY: N/A
DECLASSIFY ON: N/A

Document Title: NAVSTAR GPS Space Segment / Navigation User Interface

RFC Title: 2018 Proposed Changes to the Public Documents

Reason For Change (Driver):

The following 2 topics were deferred from the 2017 Public ICWG and will now be resolved by this RFC.

1. Currently the 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. The OA does not have the capability to correctly publish information regarding fore/aft position since moving to the 24+3 constellation with three expanded slots. In addition, the Points of Contact of the OA are not represented in a way that allows for efficient updates. This is a continuation of RFC-351, which was CCB-approved on 8-Jan-2018.
2. The linkage between different timing systems is not properly captured in the current technical baseline. With the current documentation, MNAV and CNAV users will calculate the wrong UT1 time immediately following a leap second change. This affects user applications that require high precision pointing, which may include optical telescopes or any military system with this requirement. Documents affected: IS-GPS-200, IS-GPS-705, and IS-GPS-800. The topic was part of RFC-354, which will be superseded due to the inclusion of this topic in this RFC.

The following topic resolves 3 document clean-up related activities:

3. a) Signal-in-space topics need clarification, as identified by the public in past Public ICWGs. Documents affected: IS-GPS-200 and IS-GPS-705. b) There were some administrative errors found during the UpRev process of the public documents. c) Contractor signatories are required for government-controlled documents.

(Pre-RFCs 718, 819, 861)

Description of Change:

1. Modify the OA as agreed to in ICD-GPS-240 and ICD-GPS-870.
2. The proposed changes to the impacted technical baseline documents would correctly calculate UT1 during a leap second transition.
3. a) Provide clarity for the list of signal-in-space topics identified by the public in documents IS-GPS-200 and IS-GPS-705. b) Clean up identified administrative changes in all public documents. c) Remove required contractor signatories from government-controlled documents.

Authored By: Philip Kwan **Checked By: Perry Chang, Philip Kwan, Amit Patel**

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

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Interface Control Contractor:
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CODE IDENT 66RP1

PROPOSED CHANGE NOTICE

Note: Repeat this Signature Page for each document signatory.

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RFC-00374	IS200J_RFC374	01-MAY-2018

RFC Title: 2018 Proposed Changes to the Public Documents

APPROVED BY:

With Comments: Yes ☐ No ☐

With Exceptions: Yes ☐ No ☐

Name of Approving Organization	Authorized Signature	Date

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Interface Control Contractor:
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El Segundo, CA 90245

CODE IDENT 66RP1

RFC-374 Leap Second and Earth Orientation Parameters Proposed Changes

IS200-621 :

Section Number :
30.3.3.5.1.1.0-5

WAS :

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
$\Delta UT1$ †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\Delta \dot{U}T1$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

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

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

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

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

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

††† With zonal tides restored.

Redlines :

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$PM\dot{X}$	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$PM\dot{Y}$	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\Delta\dot{U}T1$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

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

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

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

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

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

††† With zonal tides restored.

IS :

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$PM\dot{X}$	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$PM\dot{Y}$	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}		seconds
$\Delta\dot{U}T1$ †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}		seconds/day

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

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

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

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

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

††† With zonal tides restored.

Rationale :

RFC-374 nomenclature update to place the dot over the letter X for PMX, Y for PMY, and U for Delta UT1

IS200-623 :

Section Number :
30.3.3.5.1.1.0-7

WAS :

Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = UTC + \Delta UT1 + \Delta \dot{UT1}\ (t - t_{EOP})^{*}$	Compute Universal Time at time t
$x_p = PM\_X + PM\ \dot{X}\ \ (t - t_{EOP})^{*}$	Polar Motion in the x-axis
$y_p = PM\_Y + PM\ \dot{Y}\ \ (t - t_{EOP})^{*}$	Polar Motion in the y-axis
*t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, the quantity ($t-t_{EOP}$) shall be the actual total time difference between the time t and the epoch time t_{EOP}, and must account for beginning or end of week crossovers. That is, if ($t-t_{EOP}$) is greater than 302,400 seconds, subtract 604,800 seconds from ($t-t_{EOP}$). If ($t-t_{EOP}$) is less than -302,400 seconds, add 604,800 seconds to ($t-t_{EOP}$).	

Redlines :

Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = UTC + \Delta UT1 + \Delta \dot{UT1}\ (t - t_{EOP})^{*}$ $x_p = PM\_X + PM\ \dot{X}\ \ (t - t_{EOP})^{*}$ $y_p = PM\_Y + PM\ \dot{Y}\ \ (t - t_{EOP})^{*}$	
$UT1 = t_{UTC\_EOP} + \Delta UT1 + \Delta\dot{U}T1\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Compute Universal Time at time t
$x_p = PM\_X + PM\dot{X}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the x-axis
$y_p = PM\_Y + PM\dot{Y}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the y-axis
~~*t is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, the quantity ($t-t_{EOP}$) shall be the actual total time difference between the time t and the epoch time t_{EOP}, and must account for beginning or end of week crossovers. That is, if ($t-t_{EOP}$) is greater than 302,400 seconds, subtract 604,800 seconds from ($t-t_{EOP}$). If ($t-t_{EOP}$) is less than -302,400 seconds, add 604,800 seconds to ($t-t_{EOP}$)~~ GPS system time of transmission (t) shall be in seconds relative to end/start of week Note: Users should use caution when performing the calculations in Table 30-VIII for data where $\|(WN_{ot} - WN*604800) + (t- t_{EOP})\|< 259200$ s (3 days) as this is outside the EOP curve fit interval.	

IS :

Table 30-VIII. Application of EOP Parameters

Element/Equation	Description
$UT1 = t_{UTC\_EOP} + \Delta UT1 + \Delta \dot{U}T1\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Compute Universal Time at time t
$x_p = PM\_X + PM\dot{X}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the x-axis
$y_p = PM\_Y + PM\dot{Y}\ (t - t_{ot} + 604800\ (WN - WN_{ot}))$	Polar Motion in the y-axis
GPS system time of transmission (t) shall be in seconds relative to end/start of week Note: Users should use caution when performing the calculations in Table 30-VIII for data where $\|(WN_{ot} - WN*604800) + (t- t_{EOP})\| < 259200$ s (3 days) as this is outside the EOP curve fit interval.	

Rationale :

-Fix the equations to correctly calculate UT1 during a leap second transition

-Replace “UTC” with “t_{UTC_EOP}” in the first equation. Rationale: Define a specific variable for use in this section.

-Also italicized equation reverted back to standard text format

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IS200-1662 :

Section Number :
30.3.3.5.1.1.0-8

WAS :
N/A

Redlines :
When implementing the first equation in Table 30-VIII, WN_{ot} and t_{UTC_EOP} are derived from data contained in message type 33 (see Section 30.3.3.6). The Control Segment shall ensure the ΔUT1 and Δ$\dot{U}$T1 values in a message type 32 can be used with the UTC parameters (WN_{ot}, and Δt_{LS}) in message type 33 to calculate the correct UT1 time, provided the t_{EOP} in message type 32 is identical to the t_{ot} in message type 33 and the two message types are transmitted within a continuous 4-hour period.

IS :
When implementing the first equation in Table 30-VIII, WN_{ot} and t_{UTC_EOP} are derived from data contained in message type 33 (see Section 30.3.3.6). The Control Segment shall ensure the ΔUT1 and Δ$\dot{U}$T1 values in a message type 32 can be used with the UTC parameters (WN_{ot}, and Δt_{LS}) in message type 33 to calculate the correct UT1 time, provided the t_{EOP} in message type 32 is identical to the t_{ot} in message type 33 and the two message types are transmitted within a continuous 4-hour period.

Rationale :
Originally created as a part of RFC-354. This change explicitly specifies the relationship between message type 32 and message type 33, and the necessary conditions for the parameters within the messages to ensure a correct UT1 time calculation.

IS200-1671 :

Section Number :
30.3.3.5.1.1.0-9

WAS :
N/A

Redlines :
When calculating t_{UTC_EOP} for Table 30-VIII the user shall only use data from a message type 33 with the same t_{ot} as the t_{EOP} of the message type 32 containing ΔUT1 and $\Delta\dot{U}T1$ where both messages were received within a continuous 4-hour window.

IS :
When calculating t_{UTC_EOP} for Table 30-VIII the user shall only use data from a message type 33 with the same t_{ot} as the t_{EOP} of the message type 32 containing ΔUT1 and $\Delta\dot{U}T1$ where both messages were received within a continuous 4-hour window.

Rationale :
Provide detailed instructions on how MT 32 and MT 33 shall only be used within a continuous 4-hour window

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IS200-1672 :

Section Number :
30.3.3.5.1.1.0-10

WAS :
N/A

Redlines :
The following definition of t_{UTC_EOP} shall be used.

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

where

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

IS :
The following definition of t_{UTC_EOP} shall be used.

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

where

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

Rationale :
Define explicit equations on how t_{UTC_EOP} and Δt_{UTC_EOP} are calculated

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IS200-1673 :

Section Number :
30.3.3.5.1.1.0-11

WAS :
N/A

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

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

Rationale :
Originally inserted as a part of RFC-354. This change explicitly specifies the relationship between message type 32 and message type 33. It requires the user to use Δt_{LS} in the t_{UTC_EOP} calculation for UT1 in all cases. It does so in a manner that explicitly warns the user of the possible leap second problem.

RFC-374 Cleanup Proposed Changes

IS200-1403 :

Section Number :
3.2.1.1.1.0-1

WAS :
An expanded set of 26 P-code PRN sequences are generated by circularly shifting 26 of the original 37 sequences (over one week) by an amount corresponding to 1 day. These expanded sequences are therefore time shifted (i.e. offset) versions of 26 of the original sequences. Assignment of these expanded code phase segments by SV ID number is given in Table 3-Ib. Additional PRN P-code sequences with assigned PRN numbers are provided in Section 6.3.6, Table 6-I.

Redlines :
An expanded set of 26 P-code PRN sequences are generated by circularly shifting 26 of the original 37 sequences (over one week) by an amount corresponding to 1 day. These expanded sequences are therefore time shifted (i.e. offset) versions of 26 of the original sequences. Assignment of these expanded code phase segments by SV ID number is given in Table 3-Ib. Additional PRN P-code sequences with assigned PRN numbers are provided in Section 6.3.6.2.1, Table 6-I.

IS :
An expanded set of 26 P-code PRN sequences are generated by circularly shifting 26 of the original 37 sequences (over one week) by an amount corresponding to 1 day. These expanded sequences are therefore time shifted (i.e. offset) versions of 26 of the original sequences. Assignment of these expanded code phase segments by SV ID number is given in Table 3-Ib. Additional PRN P-code sequences with assigned PRN numbers are provided in Section 6.3.6.2.1, Table 6-I.

Rationale :
3/19/2018 - Administrative change as a result of two-party review. Update the reference number of Table 6-1 from 6.3.6 to 6.3.6.2.1 (where it is currently found).

IS200-1316 :

Section Number :
3.2.1.3.1.0-1

WAS :
An expanded set of 26 C/A-code PRN sequences are identified in Table 3-Ib using “G2 Delay” and “Initial G2 Setting” which is not the same as the method used in Table 3-Ia. The two-tap coder implementation method referenced and used in Table 3-Ia is not used in Table 3-Ib due to its limitation in generating C/A-code sequences. The “G2 Delay” specified in Table 3-Ib may be accomplished by using the “Initial G2 Setting” as the initialization vector for the G2 shift register of Figure 3-9. Assignment of these expanded code phase segments by SV ID number is given in Table 3-Ib. Additional PRN C/A-code sequences with assigned PRN numbers are provided in Section 6.3.6.1, Table 6-I.

Redlines :
An expanded set of 26 C/A-code PRN sequences are identified in Table 3-Ib using “G2 Delay” and “Initial G2 Setting” which is not the same as the method used in Table 3-Ia. The two-tap coder implementation method referenced and used in Table 3-Ia is not used in Table 3-Ib due to its limitation in generating C/A-code sequences. The “G2 Delay” specified in Table 3-Ib may be accomplished by using the “Initial G2 Setting” as the initialization vector for the G2 shift register of Figure 3-9. Assignment of these expanded code phase segments by SV ID number is given in Table 3-Ib. Additional PRN C/A-code sequences with assigned PRN numbers are provided in Section 6.3.6.2.1, Table 6-I.

IS :
An expanded set of 26 C/A-code PRN sequences are identified in Table 3-Ib using “G2 Delay” and “Initial G2 Setting” which is not the same as the method used in Table 3-Ia. The two-tap coder implementation method referenced and used in Table 3-Ia is not used in Table 3-Ib due to its limitation in generating C/A-code sequences. The “G2 Delay” specified in Table 3-Ib may be accomplished by using the “Initial G2 Setting” as the initialization vector for the G2 shift register of Figure 3-9. Assignment of these expanded code phase segments by SV ID number is given in Table 3-Ib. Additional PRN C/A-code sequences with assigned PRN numbers are provided in Section 6.3.6.2.1, Table 6-I.

Rationale :
3/19/2018 - Administrative change as a result of two-party review. Update the reference number of Table 6-1 from 6.3.6 to 6.3.6.2.1 (where it is currently found).

IS200-34 :

Section Number :
3.2.1.5.1.0-3

WAS :

Table 3-Ia. Code Phase Assignments (sheet 1 of 2)

SV ID No.	GPS PRN Signal No.	Code Phase Selection		Code Delay Chips		First 10 Chips Octal* C/A	First 12 Chips Octal P
		C/A($G2_i$)***	($X2_i$)	C/A	P		
1	1	2 ⊕ 6	1	5	1	1440	4444
2	2	3 ⊕ 7	2	6	2	1620	4000
3	3	4 ⊕ 8	3	7	3	1710	4222
4	4	5 ⊕ 9	4	8	4	1744	4333
5	5	1 ⊕ 9	5	17	5	1133	4377
6	6	2 ⊕ 10	6	18	6	1455	4355
7	7	1 ⊕ 8	7	139	7	1131	4344
8	8	2 ⊕ 9	8	140	8	1454	4340
9	9	3 ⊕ 10	9	141	9	1626	4342
10	10	2 ⊕ 3	10	251	10	1504	4343
11	11	3 ⊕ 4	11	252	11	1642	
12	12	5 ⊕ 6	12	254	12	1750	
13	13	6 ⊕ 7	13	255	13	1764	
14	14	7 ⊕ 8	14	256	14	1772	
15	15	8 ⊕ 9	15	257	15	1775	
16	16	9 ⊕ 10	16	258	16	1776	
17	17	1 ⊕ 4	17	469	17	1156	
18	18	2 ⊕ 5	18	470	18	1467	
19	19	3 ⊕ 6	19	471	19	1633	4343

* In the octal notation for the first 10 chips of the C/A-code as shown in this column, the first digit (1) represents a "1" for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A-code for PRN Signal Assembly No. 1 are: 1100100000).

** C/A-codes for 34 and 37 are identical.

*** The two-tap coder utilized here is only an example implementation that generates a limited set of valid C/A-codes.

⊕ = "exclusive or"

NOTE #1: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

Redlines :

Table 3-Ia. Code Phase Assignments (sheet 1 of 2)

SV ID No.	GPS PRN Signal No.	Code Phase Selection		Code Delay Chips		First 10 Chips Octal* C/A	First 12 Chips Octal P
		C/A($G2_i$)**	($X2_i$)	C/A	P		
1	1	2 ⊕ 6	1	5	1	1440	4444
2	2	3 ⊕ 7	2	6	2	1620	4000
3	3	4 ⊕ 8	3	7	3	1710	4222
4	4	5 ⊕ 9	4	8	4	1744	4333
5	5	1 ⊕ 9	5	17	5	1133	4377
6	6	2 ⊕ 10	6	18	6	1455	4355
7	7	1 ⊕ 8	7	139	7	1131	4344
8	8	2 ⊕ 9	8	140	8	1454	4340
9	9	3 ⊕ 10	9	141	9	1626	4342
10	10	2 ⊕ 3	10	251	10	1504	4343
11	11	3 ⊕ 4	11	252	11	1642	
12	12	5 ⊕ 6	12	254	12	1750	
13	13	6 ⊕ 7	13	255	13	1764	
14	14	7 ⊕ 8	14	256	14	1772	
15	15	8 ⊕ 9	15	257	15	1775	
16	16	9 ⊕ 10	16	258	16	1776	
17	17	1 ⊕ 4	17	469	17	1156	
18	18	2 ⊕ 5	18	470	18	1467	
19	19	3 ⊕ 6	19	471	19	1633	4343

* In the octal notation for the first 10 chips of the C/A code as shown in this column, the first digit (1) represents a "1" for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A code for PRN Signal Assembly No. 1 are: 1100100000).

~~** C/A codes for 34 and 37 are identical.~~

*** The two-tap coder utilized here is only an example implementation that generates a limited set of valid C/A codes.

⊕ = "exclusive or"

NOTE #1: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

IS :

Table 3-Ia. Code Phase Assignments (sheet 1 of 2)

SV ID No.	GPS PRN Signal No.	Code Phase Selection		Code Delay Chips		First 10 Chips Octal* C/A	First 12 Chips Octal P
		C/A($G2_i$)**	($X2_i$)	C/A	P		
1	1	2 ⊕ 6	1	5	1	1440	4444
2	2	3 ⊕ 7	2	6	2	1620	4000
3	3	4 ⊕ 8	3	7	3	1710	4222
4	4	5 ⊕ 9	4	8	4	1744	4333
5	5	1 ⊕ 9	5	17	5	1133	4377
6	6	2 ⊕ 10	6	18	6	1455	4355
7	7	1 ⊕ 8	7	139	7	1131	4344
8	8	2 ⊕ 9	8	140	8	1454	4340
9	9	3 ⊕ 10	9	141	9	1626	4342
10	10	2 ⊕ 3	10	251	10	1504	4343
11	11	3 ⊕ 4	11	252	11	1642	
12	12	5 ⊕ 6	12	254	12	1750	
13	13	6 ⊕ 7	13	255	13	1764	
14	14	7 ⊕ 8	14	256	14	1772	
15	15	8 ⊕ 9	15	257	15	1775	
16	16	9 ⊕ 10	16	258	16	1776	
17	17	1 ⊕ 4	17	469	17	1156	
18	18	2 ⊕ 5	18	470	18	1467	
19	19	3 ⊕ 6	19	471	19	1633	4343

* In the octal notation for the first 10 chips of the C/A code as shown in this column, the first digit (1) represents a "1" for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A code for PRN Signal Assembly No. 1 are: 1100100000).

** The two-tap coder utilized here is only an example implementation that generates a limited set of valid C/A codes.

⊕ = "exclusive or"

NOTE #1: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

Rationale :
3/19/18: Update the tables to include asterisks that only pertain to each part of the table (it was suggested alternatively to update the tables so that all the asterisk notes were the same even if they were not mentioned in a part).

IS200-35 :

Section Number :
3.2.1.5.1.0-5

WAS :

Table 3-Ia. Code Phase Assignments (sheet 2 of 2)

SV ID No.	GPS PRN Signal No.	Code Phase Selection		Code Delay Chips		First 10 Chips Octal* C/A	First 12 Chips Octal P
		C/A($G2_i$)****	($X2_i$)	C/A	P		
20	20	4 ⊕ 7	20	472	20	1715	4343
21	21	5 ⊕ 8	21	473	21	1746	
22	22	6 ⊕ 9	22	474	22	1763	
23	23	1 ⊕ 3	23	509	23	1063	
24	24	4 ⊕ 6	24	512	24	1706	
25	25	5 ⊕ 7	25	513	25	1743	
26	26	6 ⊕ 8	26	514	26	1761	
27	27	7 ⊕ 9	27	515	27	1770	
28	28	8 ⊕ 10	28	516	28	1774	
29	29	1 ⊕ 6	29	859	29	1127	
30	30	2 ⊕ 7	30	860	30	1453	
31	31	3 ⊕ 8	31	861	31	1625	
32	32	4 ⊕ 9	32	862	32	1712	
65	33***	5 ⊕ 10	33	863	33	1745	
66	34**	4 ⊕ 10	34	950	34	1713	
67	35	1 ⊕ 7	35	947	35	1134	
68	36	2 ⊕ 8	36	948	36	1456	
69	37**	4 ⊕ 10	37	950	37	1713	4343

* In the octal notation for the first 10 chips of the C/A-code as shown in this column, the first digit (1) represents a "1" for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A-code for PRN Signal Assembly No. 1 are: 1100100000).

** C/A-codes 34 and 37are identical.

*** PRN sequence 33 is reserved for other uses (e.g. ground transmitters).

**** The two-tap coder utilized here is only an example implementation that generates a limited set of valid C/A-codes.

⊕ = "exclusive or"

NOTE #1: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

Redlines :

Table 3-Ia. Code Phase Assignments (sheet 2 of 2)

SV ID No.	GPS PRN Signal No.	Code Phase Selection C/A($G2_i$)****	Code Phase Selection ($X2_i$)	Code Delay Chips C/A	Code Delay Chips P	First 10 Chips Octal* C/A	First 12 Chips Octal P
20	20	4 ⊕ 7	20	472	20	1715	4343
21	21	5 ⊕ 8	21	473	21	1746	│
22	22	6 ⊕ 9	22	474	22	1763	│
23	23	1 ⊕ 3	23	509	23	1063	│
24	24	4 ⊕ 6	24	512	24	1706	│
25	25	5 ⊕ 7	25	513	25	1743	│
26	26	6 ⊕ 8	26	514	26	1761	│
27	27	7 ⊕ 9	27	515	27	1770	│
28	28	8 ⊕ 10	28	516	28	1774	│
29	29	1 ⊕ 6	29	859	29	1127	│
30	30	2 ⊕ 7	30	860	30	1453	│
31	31	3 ⊕ 8	31	861	31	1625	│
32	32	4 ⊕ 9	32	862	32	1712	│
65	33***	5 ⊕ 10	33	863	33	1745	│
66	34**	4 ⊕ 10	34	950	34	1713	│
67	35	1 ⊕ 7	35	947	35	1134	│
68	36	2 ⊕ 8	36	948	36	1456	│
69	37**	4 ⊕ 10	37	950	37	1713	4343

* In the octal notation for the first 10 chips of the C/A code as shown in this column, the first digit (1) represents a "1" for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A code for PRN Signal Assembly No. 1 are: 1100100000).

** C/A codes-34 and 37 are identical.

*** PRN sequence 33 is reserved for other uses (e.g. ground transmitters).

**** The two-tap coder utilized here is only an example implementation that generates a limited set of valid C/A codes.

⊕ = "exclusive or"

NOTE #1: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

IS :

Table 3-Ia. Code Phase Assignments (sheet 2 of 2)

SV ID No.	GPS PRN Signal No.	Code Phase Selection		Code Delay Chips		First 10 Chips Octal* C/A	First 12 Chips Octal P
		C/A($G2_i$)****	($X2_i$)	C/A	P		
20	20	4 ⊕ 7	20	472	20	1715	4343
21	21	5 ⊕ 8	21	473	21	1746	
22	22	6 ⊕ 9	22	474	22	1763	
23	23	1 ⊕ 3	23	509	23	1063	
24	24	4 ⊕ 6	24	512	24	1706	
25	25	5 ⊕ 7	25	513	25	1743	
26	26	6 ⊕ 8	26	514	26	1761	
27	27	7 ⊕ 9	27	515	27	1770	
28	28	8 ⊕ 10	28	516	28	1774	
29	29	1 ⊕ 6	29	859	29	1127	
30	30	2 ⊕ 7	30	860	30	1453	
31	31	3 ⊕ 8	31	861	31	1625	
32	32	4 ⊕ 9	32	862	32	1712	
65	33***	5 ⊕ 10	33	863	33	1745	
66	34**	4 ⊕ 10	34	950	34	1713	
67	35	1 ⊕ 7	35	947	35	1134	
68	36	2 ⊕ 8	36	948	36	1456	
69	37**	4 ⊕ 10	37	950	37	1713	4343

* In the octal notation for the first 10 chips of the C/A code as shown in this column, the first digit (1) represents a "1" for the first chip and the last three digits are the conventional octal representation of the remaining 9 chips. (For example, the first 10 chips of the C/A code for PRN Signal Assembly No. 1 are: 1100100000).

** C/A codes 34 and 37 are identical.

*** PRN sequence 33 is reserved for other uses (e.g. ground transmitters).

**** The two-tap coder utilized here is only an example implementation that generates a limited set of valid C/A codes.

⊕ = "exclusive or"

NOTE #1: The code phase assignments constitute inseparable pairs, each consisting of a specific C/A and a specific P-code phase, as shown above.

Rationale :

3/19/18: Grammar. Correct lack of spacing at the ** note.

IS200-1282 :
Section Number :
6.3.6.2.1.0-4

WAS :

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

PRN Signal No.	C/A			P		
	G2 Delay (Chips)	Initial G2 Setting (Octal)*	First 10 Chips (Octal)**	X2 Delay (Chips)	P-code Relative Advance (Hours) **	First 12 Chips (Octal)
64	729	0254	1523	27	P_{27}(t+24)	5112
65	695	1602	0175	28	P_{28}(t+24)	0667
66	780	1160	0617	29	P_{29}(t+24)	6111
67	801	1114	0663	30	P_{30}(t+24)	5266
68	788	1342	0435	31	P_{31}(t+24)	4711
69	732	0025	1752	32	P_{32}(t+24)	0166
70	34	1523	0254	33	P_{33}(t+24)	6251
71	320	1046	0731	34	P_{34}(t+24)	5306
72	327	0404	1373	35	P_{35}(t+24)	0761
73	389	1445	0332	36	P_{36}(t+24)	6152
74	407	1054	0723	37	P_{37}(t+24)	1247
75	525	0072	1705	1	P_{1}(t+48)	1736
76	405	0262	1515	2	P_{2}(t+48)	2575
77	221	0077	1700	3	P_{3}(t+48)	3054
78	761	0521	1256	4	P_{4}(t+48)	3604
79	260	1400	0377	5	P_{5}(t+48)	7520
80	326	1010	0767	6	P_{6}(t+48)	5472
81	955	1441	0336	7	P_{7}(t+48)	0417
82	653	0365	1412	8	P_{8}(t+48)	2025
83	699	0270	1507	9	P_{9}(t+48)	7230
84	422	0263	1514	10	P_{10}(t+48)	5736
85	188	0613	1164	11	P_{11}(t+48)	0575
86	438	0277	1500	12	P_{12}(t+48)	2054
87	959	1562	0215	13	P_{13}(t+48)	3204
88	539	1674	0103	14	P_{14}(t+48)	7720
89	879	1113	0664	15	P_{15}(t+48)	5572
90	677	1245	0532	16	P_{16}(t+48)	4457
91	586	0606	1171	17	P_{17}(t+48)	0005
92	153	0136	1641	18	P_{18}(t+48)	2220
93	792	0256	1521	19	P_{19}(t+48)	3332
94	814	1550	0227	20	P_{20}(t+48)	3777
95	446	1234	0543	21	P_{21}(t+48)	3555

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

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

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

Redlines :

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

PRN Signal No.	C/A			P		
	G2 Delay (Chips)	Initial G2 Setting (Octal)*	First 10 Chips (Octal)~~*~~*	X2 Delay (Chips)	P-code Relative Advance (Hours) **	First 12 Chips (Octal)
64	729	0254	1523	27	P_{27}(t+24)	5112
65	695	1602	0175	28	P_{28}(t+24)	0667
66	780	1160	0617	29	P_{29}(t+24)	6111
67	801	1114	0663	30	P_{30}(t+24)	5266
68	788	1342	0435	31	P_{31}(t+24)	4711
69	732	0025	1752	32	P_{32}(t+24)	0166
70	34	1523	0254	33	P_{33}(t+24)	6251
71	320	1046	0731	34	P_{34}(t+24)	5306
72	327	0404	1373	35	P_{35}(t+24)	0761
73	389	1445	0332	36	P_{36}(t+24)	6152
74	407	1054	0723	37	P_{37}(t+24)	1247
75	525	0072	1705	1	P_{1}(t+48)	1736
76	405	0262	1515	2	P_{2}(t+48)	2575
77	221	0077	1700	3	P_{3}(t+48)	3054
78	761	0521	1256	4	P_{4}(t+48)	3604
79	260	1400	0377	5	P_{5}(t+48)	7520
80	326	1010	0767	6	P_{6}(t+48)	5472
81	955	1441	0336	7	P_{7}(t+48)	0417
82	653	0365	1412	8	P_{8}(t+48)	2025
83	699	0270	1507	9	P_{9}(t+48)	7230
84	422	0263	1514	10	P_{10}(t+48)	5736
85	188	0613	1164	11	P_{11}(t+48)	0575
86	438	0277	1500	12	P_{12}(t+48)	2054
87	959	1562	0215	13	P_{13}(t+48)	3204
88	539	1674	0103	14	P_{14}(t+48)	7720
89	879	1113	0664	15	P_{15}(t+48)	5572
90	677	1245	0532	16	P_{16}(t+48)	4457
91	586	0606	1171	17	P_{17}(t+48)	0005
92	153	0136	1641	18	P_{18}(t+48)	2220
93	792	0256	1521	19	P_{19}(t+48)	3332
94	814	1550	0227	20	P_{20}(t+48)	3777
95	446	1234	0543	21	P_{21}(t+48)	3555

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

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

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

IS :

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

PRN Signal No.	C/A			P		
	G2 Delay (Chips)	Initial G2 Setting (Octal)*	First 10 Chips (Octal)*	X2 Delay (Chips)	P-code Relative Advance (Hours) **	First 12 Chips (Octal)
64	729	0254	1523	27	P_{27}(t+24)	5112
65	695	1602	0175	28	P_{28}(t+24)	0667
66	780	1160	0617	29	P_{29}(t+24)	6111
67	801	1114	0663	30	P_{30}(t+24)	5266
68	788	1342	0435	31	P_{31}(t+24)	4711
69	732	0025	1752	32	P_{32}(t+24)	0166
70	34	1523	0254	33	P_{33}(t+24)	6251
71	320	1046	0731	34	P_{34}(t+24)	5306
72	327	0404	1373	35	P_{35}(t+24)	0761
73	389	1445	0332	36	P_{36}(t+24)	6152
74	407	1054	0723	37	P_{37}(t+24)	1247
75	525	0072	1705	1	P_{1}(t+48)	1736
76	405	0262	1515	2	P_{2}(t+48)	2575
77	221	0077	1700	3	P_{3}(t+48)	3054
78	761	0521	1256	4	P_{4}(t+48)	3604
79	260	1400	0377	5	P_{5}(t+48)	7520
80	326	1010	0767	6	P_{6}(t+48)	5472
81	955	1441	0336	7	P_{7}(t+48)	0417
82	653	0365	1412	8	P_{8}(t+48)	2025
83	699	0270	1507	9	P_{9}(t+48)	7230
84	422	0263	1514	10	P_{10}(t+48)	5736
85	188	0613	1164	11	P_{11}(t+48)	0575
86	438	0277	1500	12	P_{12}(t+48)	2054
87	959	1562	0215	13	P_{13}(t+48)	3204
88	539	1674	0103	14	P_{14}(t+48)	7720
89	879	1113	0664	15	P_{15}(t+48)	5572
90	677	1245	0532	16	P_{16}(t+48)	4457
91	586	0606	1171	17	P_{17}(t+48)	0005
92	153	0136	1641	18	P_{18}(t+48)	2220
93	792	0256	1521	19	P_{19}(t+48)	3332
94	814	1550	0227	20	P_{20}(t+48)	3777
95	446	1234	0543	21	P_{21}(t+48)	3555

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

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

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

Rationale :

3/19/18: In Table 6-1, sheet 1 of 5, the "First 10 Chips (Octal)**" column header is inconsistent with the 4 other sheets. This one has two asterisks, but the other 4 have one asterisk - which is the correct note (talks about octal notations).

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: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A or single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1/L2 and L1/L5 users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; 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 clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A~~ or single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter~~, ~~code phase~~L1P(Y), ~~and inter-signal correction error~~L2P(Y), ~~for~~or dual-frequency ~~L1/L2 and L1/L5~~P(Y) users who correct ~~for group delay and~~the ~~ionospheric~~code ~~effects~~phase as described in Section ~~30~~20.3.3.3~~.1.1~~.~~2~~3; 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.

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 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; 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 :
3/29/2018: URA wording is not completely clear - call out LNAV representation error. LNAV is not applicable for single-frequency L2C users because LNAV is available on L1C/A, L1P(Y), or L2P(Y) (including single-frequency and dual-frequency users). LNAV can apply to dual-frequency L1/L2 (L1C/A and L2C) users since users can utilize L2C for dual-frequency ionospheric correction without utilizing CNAV, but unaccounted for ISC terms can cause excessive URE -- so we'll exclude this statement. L1/L5 does not belong in IS-GPS-200. The section reference should be changed because this section is only applicable to LNAV users; they shouldn't need to refer to CNAV -- this is a proper backward compatibility model.

IS200-342 :

Section Number :
20.3.3.3.3.2

WAS :
L1 or L2 Correction.

Redlines :
L1 ~~-~~or L2 Correction.

IS :
L1 or L2 Correction.

Rationale :
3/29/2018: Update the section heading because the text describes the benefit of group delay for single-frequency L1 or L2 users.

IS200-343 :

Section Number :
20.3.3.3.3.2.0-1

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

$$(\Delta t_{SV})_{L1P(Y)} = \Delta t_{SV} - T_{GD}$$

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

$$(\Delta t_{SV})_{L2P(Y)} = \Delta t_{SV} - \gamma T_{GD}$$

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

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

Redlines :

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

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

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

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

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

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

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

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

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

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

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

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

Rationale :
3/29/2018: Due to the clarity on LNAV URA wording in IS200-320, the text here has to be updated to account for L1 and L2 signals (all configurations).

IS200-464 :

Section Number :
20.3.4.4.0-3

WAS :
The start of the transmission interval for each CEI data set corresponds to the beginning of the curve fit interval for the CEI data set. Each CEI data set nominally remains valid for the duration of its curve fit interval. A CEI data set may be rendered invalid before the end of its curve fit interval when it is superseded by the SV cutting over to new data.

Redlines :
The start of the transmission interval for each CEI data set corresponds to the beginning of the curve fit interval for the CEI data set. Each CEI data set nominally remains valid for the duration of its curve fit interval. A CEI data set may be rendered ~~invalid~~obsolete before the end of its curve fit interval when it is superseded by the SV cutting over to new data.

IS :
The start of the transmission interval for each CEI data set corresponds to the beginning of the curve fit interval for the CEI data set. Each CEI data set nominally remains valid for the duration of its curve fit interval. A CEI data set may be rendered obsolete before the end of its curve fit interval when it is superseded by the SV cutting over to new data.

Rationale :
4/19/2018: Update "invalid" to "obsolete" because if the receiver interprets the data as invalid, then the receiver may stop using the data until it decodes new CEI data. Rather than do that, tell the user that the data is obsolete because it will be superseded by new data, but to continue using the old data until the receiver fully decodes the new CEI data.

IS200-540 :

Section Number :
30.3.3.1.1.2.0-2

WAS :
The predicted health data will be updated at the time of upload when a new CEI data set has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV.

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

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

Rationale :
4/3/2018: Input health bit clarifications to distinguish between interpreting a health bit for SVs with legacy (L1 C/A) vs modernized (L1C) signals. This also resolves a health bit clarity item regarding the L5 signal capability for SVs that do not have the L5 signal capability.

IS200-546 :

Section Number :
30.3.3.1.1.4.0-2

WAS :
The URA_{ED} index is a signed, two's complement integer in the range of +15 to -16 and has the following relationship to the ED URA:

URA_{ED} Index	URA_{ED} (meters)			
15	6144.00	< URA_{ED}		(or no accuracy prediction is available)
14	3072.00	< URA_{ED}	≤	6144.00
13	1536.00	< URA_{ED}	≤	3072.00
12	768.00	< URA_{ED}	≤	1536.00
11	384.00	< URA_{ED}	≤	768.00
10	192.00	< URA_{ED}	≤	384.00
9	96.00	< URA_{ED}	≤	192.00
8	48.00	< URA_{ED}	≤	96.00
7	24.00	< URA_{ED}	≤	48.00
6	13.65	< URA_{ED}	≤	24.00
5	9.65	< URA_{ED}	≤	13.65
4	6.85	< URA_{ED}	≤	9.65
3	4.85	< URA_{ED}	≤	6.85
2	3.40	< URA_{ED}	≤	4.85
1	2.40	< URA_{ED}	≤	3.40
0	1.70	< URA_{ED}	≤	2.40
-1	1.20	< URA_{ED}	≤	1.70
-2	0.85	< URA_{ED}	≤	1.20
-3	0.60	< URA_{ED}	≤	0.85
-4	0.43	< URA_{ED}	≤	0.60
-5	0.30	< URA_{ED}	≤	0.43
-6	0.21	< URA_{ED}	≤	0.30
-7	0.15	< URA_{ED}	≤	0.21
-8	0.11	< URA_{ED}	≤	0.15

-9	0.08	< URA_{ED}	≤	0.11
-10	0.06	< URA_{ED}	≤	0.08
-11	0.04	< URA_{ED}	≤	0.06
-12	0.03	< URA_{ED}	≤	0.04
-13	0.02	< URA_{ED}	≤	0.03
-14	0.01	< URA_{ED}	≤	0.02
-15		URA_{ED}	≤	0.01
-16	No accuracy prediction available-use at own risk			

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

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

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

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

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

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

$$\text{Adjusted } IAURA_{ED} = IAURA_{ED} \left(\sin(E+90 \text{ degrees})\right)$$

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

Redlines :

The URA_{ED} index is a signed, two's complement integer in the range of +15 to -16 and has the following relationship to the ED URA:

URA_{ED} Index	URA_{ED} (meters)			
15	6144.00	$< URA_{ED}$		(or no accuracy prediction is available)
14	3072.00	$< URA_{ED}$	≤	6144.00
13	1536.00	$< URA_{ED}$	≤	3072.00
12	768.00	$< URA_{ED}$	≤	1536.00
11	384.00	$< URA_{ED}$	≤	768.00
10	192.00	$< URA_{ED}$	≤	384.00
9	96.00	$< URA_{ED}$	≤	192.00
8	48.00	$< URA_{ED}$	≤	96.00
7	24.00	$< URA_{ED}$	≤	48.00
6	13.65	$< URA_{ED}$	≤	24.00
5	9.65	$< URA_{ED}$	≤	13.65
4	6.85	$< URA_{ED}$	≤	9.65
3	4.85	$< URA_{ED}$	≤	6.85
2	3.40	$< URA_{ED}$	≤	4.85
1	2.40	$< URA_{ED}$	≤	3.40
0	1.70	$< URA_{ED}$	≤	2.40
-1	1.20	$< URA_{ED}$	≤	1.70
-2	0.85	$< URA_{ED}$	≤	1.20
-3	0.60	$< URA_{ED}$	≤	0.85
-4	0.43	$< URA_{ED}$	≤	0.60
-5	0.30	$< URA_{ED}$	≤	0.43
-6	0.21	$< URA_{ED}$	≤	0.30
-7	0.15	$< URA_{ED}$	≤	0.21
-8	0.11	$< URA_{ED}$	≤	0.15
-9	0.08	$< URA_{ED}$	≤	0.11
-10	0.06	$< URA_{ED}$	≤	0.08
-11	0.04	$< URA_{ED}$	≤	0.06
-12	0.03	$< URA_{ED}$	≤	0.04

-13	0.02	< URA_{ED}	≤	0.03
-14	0.01	< URA_{ED}	≤	0.02
-15		URA_{ED}	≤	0.01
-16	No accuracy prediction available-use at own risk			

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

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

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

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

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

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

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

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

IS :
The URA_{ED} index is a signed, two's complement integer in the range of +15 to -16 and has the following relationship to the ED URA:

URA_{ED} Index	URA_{ED} (meters)			
15	6144.00	$< URA_{ED}$		(or no accuracy prediction is available)
14	3072.00	$< URA_{ED}$	≤	6144.00
13	1536.00	$< URA_{ED}$	≤	3072.00
12	768.00	$< URA_{ED}$	≤	1536.00
11	384.00	$< URA_{ED}$	≤	768.00
10	192.00	$< URA_{ED}$	≤	384.00
9	96.00	$< URA_{ED}$	≤	192.00
8	48.00	$< URA_{ED}$	≤	96.00
7	24.00	$< URA_{ED}$	≤	48.00
6	13.65	$< URA_{ED}$	≤	24.00
5	9.65	$< URA_{ED}$	≤	13.65
4	6.85	$< URA_{ED}$	≤	9.65
3	4.85	$< URA_{ED}$	≤	6.85
2	3.40	$< URA_{ED}$	≤	4.85
1	2.40	$< URA_{ED}$	≤	3.40
0	1.70	$< URA_{ED}$	≤	2.40
-1	1.20	$< URA_{ED}$	≤	1.70
-2	0.85	$< URA_{ED}$	≤	1.20
-3	0.60	$< URA_{ED}$	≤	0.85
-4	0.43	$< URA_{ED}$	≤	0.60
-5	0.30	$< URA_{ED}$	≤	0.43
-6	0.21	$< URA_{ED}$	≤	0.30
-7	0.15	$< URA_{ED}$	≤	0.21
-8	0.11	$< URA_{ED}$	≤	0.15
-9	0.08	$< URA_{ED}$	≤	0.11
-10	0.06	$< URA_{ED}$	≤	0.08
-11	0.04	$< URA_{ED}$	≤	0.06
-12	0.03	$< URA_{ED}$	≤	0.04

-13	0.02	< URA_{ED}	≤	0.03
-14	0.01	< URA_{ED}	≤	0.02
-15		URA_{ED}	≤	0.01
-16	No accuracy prediction available-use at own risk			

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

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

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

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

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

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

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

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

Rationale :
3/29/2018: As proposed in the LNAV section, clarify that the errors here only come from CNAV.

IS200-576 :

Section Number :
30.3.3.2.4.0-6

WAS :
For each URA_{NED0} index (N), users may compute a nominal URA_{NED0} value (X) as given by:

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

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

The nominal URA_{NED0} value (X) shall be suitable for use as a conservative prediction of the RMS NED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting RAIM, FOM computations). Integrity properties of the $IAURA_{NED}$ are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the URA_{NED0} index, URA_{NED1} index, and URA_{NED2} index (see 30.3.3.1.1).

URA_{NED0} accounts for zeroth order SIS-contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A or single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1/L2 and L1/L5 users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

The transmitted URA_{NED1} index is an integer value in the range 0 to 7. The URA_{NED1} index has the following relationship to the URA_{NED1} value:

$URA_{NED1} = \frac{1}{2^N}$ (meters/second)

where

N = 14 + URA_{NED1} Index

The transmitted URA_{NED2} index is an integer value in the range 0 to 7. URA_{NED2} index has the following relationship to the URA_{NED2}:

$URA_{NED2} = \frac{1}{2^N}$ (meters/second^2)

where

N = 28 + URA_{NED2} Index.

Redlines :

For each URA_{NED0} index (N), users may compute a nominal URA_{NED0} value (X) as given by:

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

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

The nominal URA_{NED0} value (X) shall be suitable for use as a conservative prediction of the RMS NED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting RAIM, FOM computations). Integrity properties of the $IAURA_{NED}$ are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the URA_{NED0} index, URA_{NED1} index, and URA_{NED2} index (see 30.3.3.1.1).

URA_{NED0} accounts for zeroth order SIS-contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L1C/A or single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1/L2 ~~and L1/L5~~ users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED0} does not account for user range contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

The transmitted URA_{NED1} index is an integer value in the range 0 to 7. The URA_{NED1} index has the following relationship to the URA_{NED1} value:

$$URA_{NED1} = \frac{1}{2^N} \text{ (meters/second)}$$

where

$N = 14 + URA_{NED1}$ Index

The transmitted URA_{NED2} index is an integer value in the range 0 to 7. URA_{NED2} index has the following relationship to the URA_{NED2}:

$$URA_{NED2} = \frac{1}{2^N} \text{ (meters/second}^2\text{)}$$

where

$N = 28 + URA_{NED2}$ Index.

IS :
For each URA_{NED0} index (N), users may compute a nominal URA_{NED0} value (X) as given by:

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

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

The nominal URA_{NED0} value (X) shall be suitable for use as a conservative prediction of the RMS NED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement de-weighting RAIM, FOM computations). Integrity properties of the $IAURA_{NED}$ are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the URA_{NED0} index, URA_{NED1} index, and URA_{NED2} index (see 30.3.3.1.1).

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

The transmitted URA_{NED1} index is an integer value in the range 0 to 7. The URA_{NED1} index has the following relationship to the URA_{NED1} value:

$$URA_{NED1} = \frac{1}{2^N} \text{ (meters/second)}$$

where

N = 14 + URA_{NED1} Index

The transmitted URA_{NED2} index is an integer value in the range 0 to 7. URA_{NED2} index has the following relationship to the URA_{NED2}:

$$URA_{NED2} = \frac{1}{2^N} \text{ (meters/second}^2\text{)}$$

where

N = 28 + URA_{NED2} Index.

Rationale :
3/29/2018: Clear up that the errors here only come from CNAV and not LNAV. Remove L1/L5 references from the document as done in LNAV.

IS200-598 :

Section Number :
30.3.3.4.4.0-1

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

Redlines :
The three, one-bit, health indication in bits 155, 156, and 157 of Message Type 37 and bits 29, 30 and 31 of each packet of reduced almanac refers to the L1, L2, and L5 signals of the SV whose PRN number is specified in the message or in the packet. For each health indicator, a “0” signifies that all signals on the associated frequency are okay and “1” signifies that some or all signals on the associated frequency are bad. The health indication shall be given relative to the "as designed" capabilities of each SV (see paragraph 20.3.3.5.1.3). The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

IS :
The three, one-bit, health indication in bits 155, 156, and 157 of Message Type 37 and bits 29, 30 and 31 of each packet of reduced almanac refers to the L1, L2, and L5 signals of the SV whose PRN number is specified in the message or in the packet. For each health indicator, a “0” signifies that all signals on the associated frequency are okay and “1” signifies that some or all signals on the associated frequency are bad. The health indication shall be given relative to the "as designed" capabilities of each SV (see paragraph 20.3.3.5.1.3). The predicted health data will be updated at the time of upload when a new reduced almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

Rationale :
4/3/2018: Input health bit clarifications to distinguish between interpreting a health bit for SVs with legacy (L1 C/A) vs modernized (L1C) signals.

IS200-1399 :

Section Number :
30.3.4.4.0-1

WAS :
The t_{oe} shall be equal to the t_{oc} of the same CNAV CEI data set. t_{op} does not have to match t_{oe}/t_{oc}. As a redundant check, t_{op} in Message Type 10 and 11 will match with the t_{op} term in Message Type 30-37 for a valid CEI data set. The following rule governs the transmission of t_{oe} and t_{oc} values in different data sets: The transmitted t_{oe}/t_{oc} will be different from any value transmitted by the SV during the preceding six hours. Cutovers to new CEI data sets will occur only on hour boundaries except for the first data set of a new CEI data sequence propagation. The first CEI data set may be cut-in (reference paragraph 30.3.4.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

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

Normal Operations. The Message Type 10, 11, and 30-37 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.

Redlines :
The t_{oe} shall be equal to the t_{oc} of the same CNAV CEI data set. t_{op} does not have to match t_{oe}/t_{oc}. As a redundant check, t_{op} in Message Type 10 and 11 will match with the t_{op} term in Message Type 30-37 for a valid CEI data set. The following rule governs the transmission of t_{oe} and t_{oc} values in different data sets: The transmitted t_{oe}/t_{oc} will be different from any value transmitted by the SV during the preceding six hours. Cutovers to new CEI data sets will occur only on hour boundaries except for the first data set of a new CEI data sequence propagation. The first CEI data set may be cut-in (reference paragraph 30.3.4.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

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

Normal Operations. The Message Type 10, 11, and 30-37 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.

IS :
The t_{oe} shall be equal to the t_{oc} of the same CNAV CEI data set. t_{op} does not have to match t_{oe}/t_{oc}. As a redundant check, t_{op} in Message Type 10 and 11 will match with the t_{op} term in Message Type 30-37 for a valid CEI data set. The following rule governs the transmission of t_{oe} and t_{oc} values in different data sets: The transmitted t_{oe}/t_{oc} will be different from any value transmitted by the SV during the preceding six hours. Cutovers to new CEI data sets will occur only on hour boundaries except for the first data set of a new CEI data sequence propagation. The first CEI data set may be cut-in (reference paragraph 30.3.4.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

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

<u>Normal Operations.</u> The Message Type 10, 11, and 30-37 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.

Rationale :
4/19/2018: Update "invalid" to "obsolete" because if the receiver interprets the data as invalid, then the receiver may stop using the data until it decodes new CEI data. Rather than do that, tell the user that the data is obsolete because it will be superseded by new data, but to continue using the old data until the receiver fully decodes the new CEI data.

IS200-1377 :

Section Number :
40.3.3.5.1.3.0-1

WAS :
Subframes 4 and 5 contain two types of SV health data: (a) each of the 31 pages which contain the clock/ephemeris related almanac data provide an eight-bit SV health status word regarding the SV whose almanac data they carry, and (b) the 25th page of subframe 4 and of subframe 5 jointly contain six-bit health status data for up to 31 SVs.

The three MSBs of the eight-bit health words indicate health of the LNAV data in accordance with the code given in Table 20-VII. The six-bit words provide a one-bit summary of the LNAV data's health status in the MSB position in accordance with paragraph 40.3.3.3.1.4. The five LSBs of both the eight-bit and the six-bit words provide the health status of the SV's signal components in accordance with the code given in Table 20-VIII. A special meaning is assigned, however, to the "6 ones" combination of the six-bit health words in the 25th page of subframes 4 and 5: it indicates that "the SV which has that ID is not available and there may be no data regarding that SV in that page of subframes 4 and 5 that is assigned to normally contain the almanac data of that SV" (NOTE: this special meaning applies to the 25th page of subframes 4 and 5 only). The health indication shall be given relative to the "as designed" capabilities of each SV (as designated by the configuration code -- see paragraph 40.3.3.5.1.4). Accordingly, any SV which does not have a certain capability will be indicated as "healthy" if the lack of this capability is inherent in its design or it has been configured into a mode which is normal from a user standpoint and does not require that capability.

Additional SV health data are given in subframe 1. The data given in subframes 1, 4, and 5 of the other SVs may differ from that shown in subframes 4 and/or 5 since the latter may be updated at a different time.

The eight-bit health status words shall occupy bits 17 through 24 of word five in those 31 pages which contain almanac data for individual SVs. The six-bit health status words shall occupy the 24 MSBs of words four through nine in page 25 of subframe 5 plus bits 19 through 24 of word 8, the 24 MSBs of word 9, and the 12 MSBs of word 10 in page 25 of subframe 4.

The predicted health data will be updated at the time of upload when a new almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

Redlines :
Subframes 4 and 5 contain two types of SV health data: (a) each of the 31 pages which contain the clock/ephemeris related almanac data provide an eight-bit SV health status word regarding the SV whose almanac data they carry, and (b) the 25th page of subframe 4 and of subframe 5 jointly contain six-bit health status data for up to 31 SVs.

The three MSBs of the eight-bit health words indicate health of the LNAV data in accordance with the code given in Table 20-VII. The six-bit words provide a one-bit summary of the LNAV data's health status in the MSB position in accordance with paragraph ~~40~~20.3.3.3.1.4. The five LSBs of both the eight-bit and the six-bit words provide the health status of the SV's signal components in accordance with the code given in Table 20-VIII. A special meaning is assigned, however, to the "6 ones" combination of the six-bit health words in the 25th page of subframes 4 and 5: it indicates that "the SV which has that ID is not available and there may be no data regarding that SV in that page of subframes 4 and 5 that is assigned to normally contain the almanac data of that SV" (NOTE: this special meaning applies to the 25th page of subframes 4 and 5 only). The health indication shall be given relative to the "as designed" capabilities of each SV (as designated by the configuration code -- see paragraph 40.3.3.5.1.4). Accordingly, any SV which does not have a certain capability will be indicated as "healthy" if the lack of this capability is inherent in its design or it has been configured into a mode which is normal from a user standpoint and does not require that capability.

Additional SV health data are given in subframe 1. The data given in subframes 1, 4, and 5 of the other SVs may differ from that shown in subframes 4 and/or 5 since the latter may be updated at a different time.

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Additional SV health data are given in subframe 1. The data given in subframes 1, 4, and 5 of the other SVs may differ from that shown in subframes 4 and/or 5 since the latter may be updated at a different time.

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The predicted health data will be updated at the time of upload when a new almanac has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV or other SVs in the constellation.

Rationale :
3/29/2018: Comment from Nathan Damodaran of BAH. There's a reference to section 40.3.3.3.1.4 which does not exist. It is in fact supposed to refer to section 20.3.3.3.1.4, which discusses LNAV health bits.
