CHANGE NOTICE

Affected Document:	IRN/SCN Number	Date:
ICD-GPS-200 Rev L	XXXXXX-XXX	DD-MMM-YYYY
Authority:	**Proposed Change Notice**	**Date:**
RFC-00442	PCN-IS-200L_RFC442	09-JUN -2020

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

Document Title:
NAVSTAR GPS Space Segment / Navigation User Interfaces

RFC Title: 2020 Document Proposed Changes

Reason For Change (Driver): For the upcoming 2020 Public ICWG, there is an opportunity to clarify the documents for better understanding such as:

1. The public user community has expressed interest in adding a new clock error rate equation that aids in their calculations.
2. User equations involving time calculations need to be clarified.
3. To improve consistency in IS-GPS-200, clarify that a LNAV T_{GD} value of '10000000' means that the group delay value is unavailable, which aligns with the clarification of CNAV T_{GD}.
4. Administrative clarification and clean-up, identified in past Public ICWGs and as newly-identified changes of administrative nature.

Description of Change:

1. Recommend new SV Clock Relativistic Correction rate equation.
2. Clarify equations by recommending examples or clarifying instructions.
3. Delete the statement that clarifies whether a LNAV T_{GD} value of '10000000' indicates that the group delay value in unavailable.
4. Provide clarity and clean up identified administrative changes in all public documents.

Authored By: RE: Dylan Nicholas **Checked By: RE: Kevin Cano**

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

DISTRIBUTION STATEMENT A: Approved For Public Release; Distribution is Unlimited

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

IS200-562:

Section Number :

30.3.3.2.1.1

WAS :

Any one of Message Types 30 through 37, Figure 30-3 through Figure 30-10, contains the parameters needed by the users for apparent SV clock correction. Bits 61 to 71 contain t_{oc} , clock data reference time of week. Bits 72 to 127 contain SV clock correction coefficients. The related algorithm is given in paragraph 20.3.3.3.3.1.

Redlines :

Any one of Message Types 30 through 37, Figure 30-3 through Figure 30-10, contains the parameters needed by the users for apparent SV clock correction. Bits 61 to 71 contain t_{oc} , clock data reference time of week. Bits 72 to 127 contain SV clock correction coefficients. The related algorithm is given in paragraph 20.3.3.3.3.1. Refer to Section 20.3.3.3.3.1 for optional first and second derivative of the SV clock correction equation.

IS :

Any one of Message Types 30 through 37, Figure 30-3 through Figure 30-10, contains the parameters needed by the users for apparent SV clock correction. Bits 61 to 71 contain t_{oc} , clock data reference time of week. Bits 72 to 127 contain SV clock correction coefficients. The related algorithm is given in paragraph 20.3.3.3.3.1. Refer to IS-GPS-200, Section 20.3.3.3.3.1 for optional first and second derivative of the SV clock correction equation.

Rationale :

Adding references to the added SV clock correction equations for user clarifications.

IS200-441 :

Section Number :
20.3.3.5.2.4.0-1

WAS :
Page 18 of subframe 4 includes: (1) the parameters needed to relate GPS time to UTC, and (2) notice to the user regarding the scheduled future or recent past (relative to LNAV message upload) value of the delta time due to leap seconds (Δt_{LSF}), together with the week number (WN_{LSF}) and the day number (DN) at the end of which the leap second becomes effective. "Day one" is the first day relative to the end/start of week and the WN_{LSF} value consists of eight bits which shall be a modulo 256 binary representation of the GPS week number (see paragraph 6.2.4) to which the DN is referenced. The user must account for the truncated nature of this parameter as well as truncation of WN, WN_t, and WN_{LSF} due to rollover of full week number (see paragraph 3.3.4(b)). The CS shall manage these parameters such that, when Δt_{LS} and Δt_{LSF} differ, the absolute value of the difference between the untruncated WN and WN_{LSF} values shall not exceed 127.

Redlines :
Page 18 of subframe 4 includes: ~~-~~(1) the parameters needed to relate GPS time to UTC, and (2) notice to the user regarding the scheduled future or recent past (relative to LNAV message upload) value of the delta time due to leap seconds (Δt_{LSF}), together with the GPS week number (WN_{LSF}) and the GPS day number (DN) ~~at~~near the end of which ~~the leap second~~Δt_{LSF} becomes effective. "Day one" is the first day relative to the end/start of week and the WN_{LSF} value consists of eight bits which shall be a modulo 256 binary representation of the GPS week number (see paragraph 6.2.4) to which the DN is referenced. The user must account for the truncated nature of this parameter as well as truncation of WN, WN_t, and WN_{LSF} due to rollover of full week number (see paragraph 3.3.4(b)). The CS shall manage these parameters such that, when Δt_{LS} and Δt_{LSF} differ, the absolute value of the difference between the untruncated WN and WN_{LSF} values shall not exceed 127.

IS :
Page 18 of subframe 4 includes: (1) the parameters needed to relate GPS time to UTC, and (2) notice to the user regarding the scheduled future or recent past (relative to LNAV message upload) value of the delta time due to leap seconds (Δt_{LSF}), together with the GPS week number (WN_{LSF}) and the GPS day number (DN) near the end of which Δt_{LSF} becomes effective. "Day one" is the first day relative to the end/start of week and the WN_{LSF} value consists of eight bits which shall be a modulo 256 binary representation of the GPS week number (see paragraph 6.2.4) to which the DN is referenced. The user must account for the truncated nature of this parameter as well as truncation of WN, WN_t, and WN_{LSF} due to rollover of full week number (see paragraph 3.3.4(b)). The CS shall manage these parameters such that, when Δt_{LS} and Δt_{LSF} differ, the absolute value of the difference between the untruncated WN and WN_{LSF} values shall not exceed 127.

Rationale :
To clarify the time scale of WN_{LSF} and DN so that user equipment does not misplace the timing of the leap second.

IS200-442 :

Section Number :
20.3.3.5.2.4.0-4

WAS :
Depending upon the relationship of the effectivity date to the user's current GPS time, the following three different UTC/GPS-time relationships exist:

a. Whenever the effectivity time indicated by the WN_{LSF} and the DN values is not in the past (relative to the user's present time), and the user's present time does not fall in the time span which starts at six hours prior to the effectivity time and ends at six hours after the effectivity time, the UTC/GPS-time relationship is given by

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

where t_{UTC} is in seconds and

Δt_{UTC} = $\Delta t_{LS} + A_0 + A_1 (t_E - t_{ot} + 604800 (WN - WN_t))$, seconds;
t_E = GPS time as estimated by the user after correcting t_{SV} for factors described in

paragraph 20.3.3.3.3 as well as for selective availability (SA) (dither) effects;

Δt_{LS} = delta time due to leap seconds;
A_0 and A_1 = constant and first order terms of polynomial;

t_{ot} = reference time for UTC data (reference 20.3.4.5);

WN = current week number (derived from subframe 1);

WN_t = UTC reference week number.

Redlines :
Depending upon the relationship of the effectivity date to the user's current GPS time, the following three different UTC/GPS-time relationships exist:

NOTE: Whenever ($\Delta t_{LS} = \Delta t_{LSF}$), the determination of an effectivity time of Δt_{LSF}, as indicated by the WN_{LSF} and the DN, is not necessary, and in such a circumstance the user may assume a UTC/GPS-time relationship given by 20.3.3.5.2.4.a, below.

a. Whenever either:

(1) ($\Delta t_{LS} = \Delta t_{LSF}$), or

(2) the effectivity time indicated by the WN_{LSF} and the DN values is not in the past (relative to the user's present time), and the user's present time does not fall in the time span which starts at six hours prior to the effectivity time and ends at six hours after the effectivity time, the UTC/GPS-time relationship is given by

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

where t_{UTC} is in seconds and

Δt_{UTC} = $\Delta t_{LS} + A_0 + A_1 (t_E - t_{ot} + 604800 (WN - WN_t))$, seconds;
t_E = GPS time as estimated by the user after correcting t_{SV} for factors described in

paragraph 20.3.3.3.3 as well as for selective availability (SA) (dither) effects;

Δt_{LS} = delta time due to leap seconds;
A_0 and A_1 = constant and first order terms of polynomial;

t_{ot} = reference time for UTC data (reference 20.3.4.5);

WN = current week number (derived from subframe 1);

WN_t = UTC reference week number.

IS :
Depending upon the relationship of the effectivity date to the user's current GPS time, the following three different UTC/GPS-time relationships exist:

NOTE: Whenever ($\Delta t_{LS} = \Delta t_{LSF}$), the determination of an effectivity time of Δt_{LSF}, as indicated by the WN_{LSF} and the DN, is not necessary, and in such a circumstance the user may assume a UTC/GPS-time relationship given by 20.3.3.5.2.4.a, below.

a. Whenever either:

(1) ($\Delta t_{LS} = \Delta t_{LSF}$), or

(2) the effectivity time indicated by the WN_{LSF} and the DN values is not in the past (relative to the user's present time), and the user's present time does not fall in the time span which starts at six hours prior to the effectivity time and ends at six hours after the effectivity time, the UTC/GPS-time relationship is given by

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

where t_{UTC} is in seconds and

Δt_{UTC} = $\Delta t_{LS} + A_0 + A_1 (t_E - t_{ot} + 604800 (WN - WN_t))$, seconds;
t_E = GPS time as estimated by the user after correcting t_{SV} for factors described in

paragraph 20.3.3.3.3 as well as for selective availability (SA) (dither) effects;

Δt_{LS} = delta time due to leap seconds;
A_0 and A_1 = constant and first order terms of polynomial;

t_{ot} = reference time for UTC data (reference 20.3.4.5);

WN = current week number (derived from subframe 1);

WN_t = UTC reference week number.

Rationale :
To close a gap in the leap second algorithm within IS-GPS-200.

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 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.

Redlines :

Table 20- XII.

Days Spanned	Transmission Interval (hours) (Note ~~5~~ 4)	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.

IS :
Table 20- XII.

Days Spanned	Transmission Interval (hours) (Note 4)	Curve Fit Interval (hours)	IODC Range
1	2	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:

Note 4 was removed in RFC 395. Making Note 5 to be the new Note 4.

IS200-581 :

Section Number :
30.3.3.3.1.1.0-1

WAS :
The group delay differential correction terms, T_{GD}, $ISC_{L1C/A}$, ISC_{L2C} for the benefit of single frequency L1 P, L1 C/A, L2 P, L2C users and dual frequency L1/L2 users are contained in bits 128 through 166 of Message Type 30 (see Figure 30-3 for complete bit allocation). The bit length, scale factors, ranges, and units of these parameters are given in Table 30-IV. The bit string of "1000000000000" shall indicate that the group delay value is not available. The related algorithm is given in paragraphs 30.3.3.3.1.1.1 and 30.3.3.3.1.1.2.

Redlines :
The group delay differential correction terms, T_{GD}, $ISC_{L1C/A}$, ISC_{L2C} for the benefit of single frequency L1 P, L1 C/A, L2 P, L2C users and dual frequency L1/L2 users are contained in bits 128 through 166 of Message Type 30 (see Figure 30-3 for complete bit allocation). The bit length, scale factors, ranges, and units of these parameters are given in Table 30-IV. ~~The bit string of "1000000000000" shall indicate that the group delay value is not available.~~ The related algorithm is given in paragraphs 30.3.3.3.1.1.1 and 30.3.3.3.1.1.2.

IS :
The group delay differential correction terms, T_{GD}, $ISC_{L1C/A}$, ISC_{L2C} for the benefit of single frequency L1 P, L1 C/A, L2 P, L2C users and dual frequency L1/L2 users are contained in bits 128 through 166 of Message Type 30 (see Figure 30-3 for complete bit allocation). The bit length, scale factors, ranges, and units of these parameters are given in Table 30-IV. The related algorithm is given in paragraphs 30.3.3.3.1.1.1 and 30.3.3.3.1.1.2.

Rationale :
20200304: It was determined to delete this statement in order to make the CNAV section consistent with LNAV. As LNAV does not check for unavailable group delay value.

IS200-1379 :

Section Number :
40.3.3.5.1.4.0-1

WAS :
Page 25 of subframe 4 shall contain a four-bit-long term for each of up to 31 SVs to indicate the A-S status and the configuration code of each SV transmitting with a PRN number in the range of 33 through 63. The MSB of each four-bit term shall be the A-S flag with a "1" indicating that A-S is ON. The three LSBs shall indicate the configuration of each SV using the following code:

Code SV Configuration

000 Reserved in order to preserve future use of these values in a future revision of this IS. Until such a revision, the User Segment developing to this version of this IS should interpret these values as indicating that no information in this data field is presently usable as a means to identify the actual SV configuration.

001 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in paragraph 20.3.2 (e.g. Block II/Block IIA/IIR SV).

010 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in paragraph 20.3.2, M-code signal capability, L2C signal capability (e.g., Block IIR-M SV).

011 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in paragraph 20.3.2, M-code capability, L2C signal capability, L5 signal capability (e.g., Block IIF SV).

100 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in paragraph 20.3.2, M-code capability, L1C signal capability, L2C signal capability, L5 signal capability, no SA capability (e.g., GPS III SVs).

101, 110, 111 Reserved in order to preserve future use of these values in a future revision of this IS. Until such a revision, the User Segment developing to this version of this IS should interpret these values as indicating that no information in this data field is presently usable as a means to identify the actual SV configuration.

Redlines :
~~Page 25 of subframe 4 shall contain a four-bit-long term for each of up to 31 SVs to indicate the A-S status and the configuration code of each SV transmitting with a PRN number in the range of 33 through 63. The MSB of each four-bit term shall be the A-S flag with a "1" indicating that A-S is ON. The three LSBs shall indicate the configuration of each SV using the following code:~~

~~Code SV Configuration~~

~~000 Reserved in order to preserve future use of these values in a future revision of this IS. Until such a revision, the User Segment developing to this version of this IS should interpret these values as indicating that no information in this data field is presently usable as a means to identify the actual SV configuration.~~

~~001 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in~~See ~~paragraph~~Section 20.3~~.2 (e.g. Block II/Block IIA/IIR SV).~~

~~010 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in paragraph 20~~.3.~~2, M-code signal capability, L2C signal capability (e.~~.g5.~~, Block IIR-M SV)~~1.

~~011 A-S capability, plus flags~~4 for~~ A-S and "alert" in HOW; memory capacity as described in paragraph 20.3.2, M-code capability, L2C signal capability, L5 signal capability (e.g., Block IIF~~ SV~~).~~

~~100 A-S capability, plus flags for A-S and "alert" in HOW; memory capacity as described in paragraph 20.3.2, M-code capability, L1C signal capability, L2C signal capability, L5 signal capability, no SA capability (e.g., GPS III SVs).~~

~~101, 110, 111 Reserved in order to preserve future use of these values in a future revision of this IS. Until such a revision, the User Segment developing to this version of this IS should interpret these values as indicating that no information in this data field is presently usable as a means to identify the actual SV~~Configuration ~~configuration~~codes.

IS :
See Section 20.3.3.5.1.4 for SV Configuration codes.

Rationale :
We are removing this because there is a duplicate found in section 20 of IS-200.

IS200-1730 :

Section Number :
30.3.3.1.3.1-11

WAS :
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
$(di_k / dt) = (IDOT) + 2\, \dot{v}_k (c_{is} \cos 2\phi_k - c_{ic} \sin 2\phi_k)$	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)

Redlines :

Table 30-II. Part 3

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

IS :

Table 30-II. Part 3

Element/Equation	Description
<u>SV Velocity</u>	
$\dot{E}_k = n / (1 - e \cos E_k)$	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 Rat
$\dot{r}_k = \dot{A}(1 - e\cos(E_k)) + A\,e\sin(E_k)\,\dot{E}_k + 2(c_{rs}\cos(2\phi_k) - c_{rc}\sin(2\phi_k))\,\dot{v}_k$	Corrected Radius Rate for CNAV
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r}_k \cos u_k - r_k \dot{u}_k \sin u_k$	In- plane *x* velocity
$\dot{y}'_k = \dot{r}_k \sin u_k + r_k \dot{u}_k \cos u_k$	In- plane *y* velocity
$\dot{x}_k = -x'_k \dot{\Omega}_k \sin \Omega_k + \dot{x}'_k \cos \Omega_k - \dot{y}'_k \sin \Omega_k \cos i_k - y'_k(\dot{\Omega}_k \cos \Omega_k \cos i_k - (di_k / dt) \sin \Omega_k \sin i_k)$	Earth- Fixed *x* velocity (m/s)
$\dot{y}_k = x'_k \dot{\Omega}_k \cos \Omega_k + \dot{x}'_k \sin \Omega_k + \dot{y}'_k \cos \Omega_k \cos i_k - y'_k(\dot{\Omega}_k \sin \Omega_k \cos i_k + (di_k / dt) \cos \Omega_k \sin i_k)$	Earth- Fixed *y* velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k (di_k / dt) \cos i_k$	Earth- Fixed *z* velocity (m/s)

Rationale:

The Corrected Radius Rate was found to be different between CNAV and LNAV by a stakeholder. Since the semi-major axis is time dependent for CNAV his equation needs to be added to IS200, IS705, and IS800.

IS200-1812 :
Insertion below object IS200-341

The user shall correct the time received from the SV with the equation (in seconds)… It is immaterial whether the vectors $\vec{R}$ and $\vec{V}$ are expressed in earth-fixed, rotating coordinates or in earth-centered, inertial coordinates.

Section Number :

20.3.3.3.3.1.0-3

WAS :
<INSERTED OBJECT>

Redlines :
<INSERTED OBJECT>

IS :
The user can compute the first and second derivative of the clock error for the SV, if required, utilizing the two equations shown below. Additional parameters can be found in Table 20-IV.

Rationale :
20200312: This text is part of a recommendation from the user community that would add two equations regarding the SV clock corrections leading to more precise calculations.

IS200-1813 :
Insertion after object IS200-1812 (See previous)

Section Number :
20.3.3.3.3.1.0-4

WAS :
<INSERTED OBJECT>

Redlines :
<INSERTED OBJECT>

IS :

$$\Delta\dot{t}_{SV} = a_{f1} + 2\ a_{f2}\ (t - t_{oc}) + \frac{nFe\sqrt{A}\cos E}{1-e\cos E}\ \frac{Sec}{Sec}$$

$$\Delta\ddot{t}_{SV} = 2\ a_{f2} - \frac{n^2 Fe\ \sqrt{A}\sin E}{(1-e\cos E)^{\ 3}}\ \frac{sec}{sec^2}$$

Rationale :
20200312: The user community recommended adding these 2 equations for the first and second derivatives to the SV clock correction. Users that elect to use the equations for V(velocity) and A(acceleration) that were added in RFC 395 would benefit from including these 2 new time equations making calculations more precise.