CHANGE NOTICE

Affected Document: IS-GPS-800 Rev J	**IRN/SCN Number** XXX-XXXX-XXX	**Date:** DD-MMM-YYYY
Authority: RFC-000544	**Proposed Change Notice** PCN_IS-800J-RFC544	**Date:** 30-SEP-2025

Document Title: NAVSTAR GPS Space Segment/Navigation User Segment L1C Interfaces

RFC Title: Eccentric Anomaly Rate Fix and No Cost Items

Reason For Change (Driver):

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

Description of Change:

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

Authored By: RE: Tony Anthony **Checked By: RE:** Vincent Quan

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	PNT Technical Director, MilComm & PNT Directorate, Space Systems Command (SSC)	

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

IS800-8:

Section Number:
1.3.0-2

WAS:
The Interface Control Contractor (ICC), designated by the government, is responsible for the basic preparation, obtaining approval, distribution, retention, and Interface Control Working Group (ICWG) coordination of this IS in accordance with GP-03-001A.

Redlines:
The Interface Control Contractor (ICC), designated by the government, is responsible for the basic preparation, obtaining approval, distribution, retention, and Interface Control Working Group (ICWG) coordination of this IS in accordance with ~~GP~~PNT -03-~~001A~~001.

IS:
The Interface Control Contractor (ICC), designated by the government, is responsible for the basic preparation, obtaining approval, distribution, retention, and Interface Control Working Group (ICWG) coordination of this IS in accordance with PNT-03-001.

Rationale:
9/2/2025: Administrative Vetted Change. Changes reflect updates to AWG charter PNT-03-001 and OI 63-1101. (T. Anthony)

IS800-1122:

Section Number:
2.1.0-7

WAS:

IS-GPS-200 (current issue) Navstar GPS Space Segment/Navigation User Interfaces

Redlines:

IS-GPS-200 (current issue) Navstar GPS Space Segment/Navigation User Interfaces

IS:

IS-GPS-200 (current issue) Navstar GPS Space Segment/Navigation User Interfaces

Rationale:
CRM #87 11/23/2022 This table entry was changed to use a hanging indent, the same as the following paragraph that makes up this Documents table. (T. Anthony)

IS800-1123:

Section Number:
2.1.0-8

WAS:

GP-03-001A (Current Issue) GPS Adjudication Working Group (AWG) and Rough Order of Magnitude (ROM)/ Impact Assessment (IA) Charter

Redlines:

GP-03-001 (current issue) GPS Adjudication Working Group (AWG) and Rough Order of Magnitude (ROM)/ Impact Assessment (IA) Charter

IS:

GP-03-001 (current issue) GPS Adjudication Working Group (AWG) and Rough Order of Magnitude (ROM)/ Impact Assessment (IA) Charter

Rationale:
CRM #87 11/23/2022 The Standards review showed the "A" version of GP-03-001 is not the current version and our policy is to not use version letters. (T. Anthony)

IS800-635:

Section Number:
3.2.1.1.0-2

WAS:
The nominal frequency of this source as it appears to an observer on the ground is 10.23 MHz. The SV carrier frequency and clock rates, as they would appear to an observer located in the SV, are offset to compensate for relativistic effects. The clock rates are offset by Δf/f = -4.4647E-10, which is equivalent to a change in the L1C-code chipping rate of 1.023 MHz by a Δf = -4.5674E-4 Hz. This results in an offset L1C-code chipping rate of 1.02299999954326 MHz. The nominal carrier frequency (f_0) - as it appears to an observer on the ground - shall be 1575.42 MHz.

Redlines:
The nominal frequency of this source as it appears to an observer on the ground is 10.23 MHz. The SV carrier frequency and clock rates, as they would appear to an observer located in the SV, are offset to compensate for relativistic effects. The clock rates are offset by Δf/f = -4.~~4647E~~4647 × 10^{-10}, which is equivalent to a change in the L1C-code chipping rate of 1.023 MHz by a Δf = -4.~~5674E~~5674 × 10^{-4} Hz. This results in an offset L1C-code chipping rate of 1.02299999954326 MHz. The nominal carrier frequency (f0) - as it appears to an observer on the ground - shall be 1575.42 MHz.

IS:
The nominal frequency of this source as it appears to an observer on the ground is 10.23 MHz. The SV carrier frequency and clock rates, as they would appear to an observer located in the SV, are offset to compensate for relativistic effects. The clock rates are offset by Δf/f = -4.4647 × 10^{-10}, which is equivalent to a change in the L1C-code chipping rate of 1.023 MHz by a Δf = -4.5674 × 10^{-4} Hz. This results in an offset L1C-code chipping rate of 1.02299999954326 MHz. The nominal carrier frequency (f_0) - as it appears to an observer on the ground - shall be 1575.42 MHz.

Rationale:
8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

IS800-105:

Section Number:
3.2.3.3.0-1

WAS:
Twenty-four bits of CRC will provide protection against burst as well as random errors with a probability of undetected error ≤ 2-24 = 5.96×10-8 for all channel bit error probabilities ≤ 0.5. The CRC word is calculated in the forward direction on a given message using a seed of 0. The sequence of 24 bits ($p_1, p_2, \ldots, p_{24}$) is generated from the sequence of information bits ($m_1, m_2, \ldots, m_k$) (MSB to LSB sequence) in a given message. This is done by means of a code that is generated by the polynomial

$$g(X) = \sum_{i=0}^{24} g_i X^i$$

where

$$\begin{aligned} g_i &= 1 \text{ for } i = 0,1,3,4,5,6,7,10,11,14,17,18,23,24 \\ &= 0 \text{ otherwise} \end{aligned}$$

Redlines:
Twenty-four bits of CRC parity will provide protection against burst as well as random errors with a probability of undetected error ~~£~~≤ 2^{-24} = 5.96~~´~~ × 10^{-8} for all channel bit error probabilities ~~£~~≤ 0.5. The CRC word is calculated in the forward direction on a given message using a seed of 0. The sequence of 24 bits ($p_1, p_2, \ldots, p_{24}$) is generated from the sequence of information bits ($m_1, m_2, \ldots, m_k$) (MSB to LSB sequence) in a given message. This is done by means of a code that is generated by the polynomial

where
gi = 1 for i = 0, 1, 3, 4, 5, 6, 7, 10, 11, 14, 17, 18, 23, 24
= 0 otherwise

IS:
Twenty-four bits of CRC parity will provide protection against burst as well as random errors with a probability of undetected error ≤ 2^{-24} = 5.96 × 10^{-8} for all channel bit error probabilities ≤ 0.5. The CRC word is calculated in the forward direction on a given message using a seed of 0. The sequence of 24 bits ($p_1, p_2, \ldots, p_{24}$) is generated from the sequence of information bits ($m_1, m_2, \ldots, m_k$) (MSB to LSB sequence) in a given message. This is done by means of a code that is generated by the polynomial

$$g(X) = \sum_{i=0}^{24} g_i X^i$$

where

g_i = 1 for i = 0, 1, 3, 4, 5, 6, 7, 10, 11, 14, 17, 18, 23, 24
= 0 otherwise

Rationale:
8/25/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/25/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)
Administrative fix 8/25/2025 Replaced less than or equal signs with graphics from Equation Editor (T. Anthony

IS800-1139:

Section Number:
3.2.3.3.0-9

WAS:
This code has the following characteristics:

It detects all single bit errors per code word.
It detects all double bit error combinations in a codeword because the generator polynomial g(X) has a factor of at least three terms.
It detects any odd number of errors because g(X) contains a factor 1+X.
It detects any burst error for which the length of the burst is ≤ 24 bits.
It detects most large error bursts with length greater than the CRC length r = 24 bits. The fraction of error bursts of length b > 24 that are undetected is:

$2^{-24} = 5.96 \times 10^{-8}$, if b > 25 bits
$2^{-23} = 1.19 \times 10^{-7}$, if b = 25 bits

Redlines:
This code has the following characteristics:

1) It detects all single bit errors per code word.

2) It detects all double bit error combinations in a codeword because the generator polynomial g(X) has a factor of at least three terms.

3) It detects any odd number of errors because g(X) contains a factor 1+X.

4) It detects any burst error for which the length of the burst is ~~£~~≤ 24 bits.

5) It detects most large error bursts with length greater than the ~~CRC~~parity length r = 24 bits. The fraction of error bursts of length b > 24 that are undetected is:

a) 2-24 = 5.96~~′~~ × 10^{-8}, if b > 25 bits

b) 2-23 = 1.19~~′~~ × 10^{-7}, if b = 25 bits

IS:
This code has the following characteristics:

1) It detects all single bit errors per code word.

2) It detects all double bit error combinations in a codeword because the generator polynomial g(X) has a factor of at least three terms.

3) It detects any odd number of errors because g(X) contains a factor 1+X.

4) It detects any burst error for which the length of the burst is ≤ 24 bits.

5) It detects most large error bursts with length greater than the parity length r = 24 bits. The fraction of error bursts of length b > 24 that are undetected is:

a) $2^{-24} = 5.96 \times 10^{-8}$, if b > 25 bits

b) $2^{-23} = 1.19 \times 10^{-7}$, if b = 25 bits

Rationale:
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-120:

Section Number:
3.3.0-4

WAS:
The bitstream of the $L1C_P$ signal is modulated on L1 carrier frequency using TMBOC modulation technique. The $L1C_P$ TMBOC technique uses a mixture of BOC (1, 1) spreading symbols and BOC (6,1) spreading symbols, where each BOC (6,1) spreading symbol consists of 6 cycles of a 6 x 1.023 MHz squarewave, defined as binary 101010101010 (1= binary bit value), with total duration 1/1.023 microseconds (see Figure 3.3-2b).

Redlines:
The bitstream of the L1CP signal is modulated on L1 carrier frequency using TMBOC modulation technique. The L1CP TMBOC technique uses a mixture of BOC (1, 1) spreading symbols and BOC (6,1) spreading symbols, where each BOC (6,1) spreading symbol consists of 6 cycles of a 6 ~~x~~× 1.023 MHz squarewave, defined as binary 101010101010 (1= binary bit value), with total duration 1/1.023 microseconds (see Figure 3.3-2b).

IS:
The bitstream of the $L1C_P$ signal is modulated on L1 carrier frequency using TMBOC modulation technique. The $L1C_P$ TMBOC technique uses a mixture of BOC (1, 1) spreading symbols and BOC (6,1) spreading symbols, where each BOC (6,1) spreading symbol consists of 6 cycles of a 6 × 1.023 MHz squarewave, defined as binary 101010101010 (1= binary bit value), with total duration 1/1.023 microseconds (see Figure 3.3-2b).

Rationale:
8/17/2025: as part of the normalization of multiplier notation, it was determined to also normalize that discussion of integer multiples of the transmission squarewave should use the Unicode character for multiplication and not lower case "x" (T. Anthony)

IS800-1094:

Section Number:
3.4.3.0-2

WAS:

$c = 2.99792458 \times 10^8$ meters per second

Redlines:

c = ~~2.99792458 x~~299,792,458 ~~108~~ meters per second

IS:

c = 299,792,458 meters per second

Rationale:
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-160:

Section Number:
3.5.3.0-10

WAS:

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
Ω_{0-n}	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	33*	2^{-32}		semi-circles
$\Delta\dot{\Omega}$****	Rate of right ascension difference	17*	2^{-44}		semi-circles/sec
i_{0-n}	Inclination angle at reference time	33*	2^{-32}		semi-circles
IDOT	Rate of inclination angle	15*	2^{-44}		semi-circles/sec
C_{is-n}	Amplitude of the sine harmonic correction term to the angle of inclination	16*	2^{-30}		radians
C_{ic-n}	Amplitude of the cosine harmonic correction term to the angle of inclination	16*	2^{-30}		radians
C_{rs-n}	Amplitude of the sine correction term to the orbit radius	24*	2^{-8}		meters
C_{rc-n}	Amplitude of the cosine correction term to the orbit radius	24*	2^{-8}		meters
C_{us-n}	Amplitude of the sine harmonic correction term to the argument of latitude	21*	2^{-30}		radians
C_{uc-n}	Amplitude of the cosine harmonic correction term to the argument of latitude	21*	2^{-30}		radians

* Parameters so indicated are in two's complement notation;
** See Figure 3.5-1 for complete bit allocation in Subframe 2;
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.
**** Relative to $\dot{\Omega}_{REF}$ = -2.6 x 10^{-9} semi-circles/second.

Redlines:

Parameter		No. of Bits**NOTE2	Scale Factor (LSB)	Valid Range***NOTE3	Units
Ω_{0-n}	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	33*NOTE1	2^{-32}		semi-circles
$\Delta\dot{\Omega}$****	Rate of right ascension difference NOTE4	17*NOTE1	2^{-44}		semi-circles/sec
i_{0-n}	Inclination angle at reference time	33*NOTE1	2^{-32}		semi-circles
IDOT	Rate of inclination angle	15*NOTE1	2^{-44}		semi-circles/sec
C_{is-n}	Amplitude of the sine harmonic correction term to the angle of inclination	16*NOTE1	2^{-30}		radians
C_{ic-n}	Amplitude of the cosine harmonic correction term to the angle of inclination	16*NOTE1	2^{-30}		radians
C_{rs-n}	Amplitude of the sine correction term to the orbit radius	24*NOTE1	2^{-8}		meters
C_{rc-n}	Amplitude of the cosine correction term to the orbit radius	24*NOTE1	2^{-8}		meters
C_{us-n}	Amplitude of the sine harmonic correction term to the argument of latitude	21*NOTE1	2^{-30}		radians
C_{uc-n}	Amplitude of the cosine harmonic correction term to the argument of latitude	21*NOTE1	2^{-30}		radians

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

NOTE2:** See Figure 3.5-1 for complete bit allocation in Subframe 2

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

NOTE4:**** Relative to $\dot{\Omega}_{REF}$ = -2.6 × ~~x~~ 10^{-9} semi-circles/second

IS:

Parameter		No. of Bits[NOTE2]	Scale Factor (LSB)	Valid Range[NOTE3]	Units
$\Omega_{0\text{-}n}$	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	33[NOTE1]	2^{-32}		semi-circles
$\Delta\dot{\Omega}$	Rate of right ascension difference[NOTE4]	17[NOTE1]	2^{-44}		semi-circles/sec
$i_{0\text{-}n}$	Inclination angle at reference time	33[NOTE1]	2^{-32}		semi-circles
IDOT	Rate of inclination angle	15[NOTE1]	2^{-44}		semi-circles/sec
$C_{is\text{-}n}$	Amplitude of the sine harmonic correction term to the angle of inclination	16[NOTE1]	2^{-30}		radians
$C_{ic\text{-}n}$	Amplitude of the cosine harmonic correction term to the angle of inclination	16[NOTE1]	2^{-30}		radians
$C_{rs\text{-}n}$	Amplitude of the sine correction term to the orbit radius	24[NOTE1]	2^{-8}		meters
$C_{rc\text{-}n}$	Amplitude of the cosine correction term to the orbit radius	24[NOTE1]	2^{-8}		meters
$C_{us\text{-}n}$	Amplitude of the sine harmonic correction term to the argument of latitude	21[NOTE1]	2^{-30}		radians
$C_{uc\text{-}n}$	Amplitude of the cosine harmonic correction term to the argument of latitude	21[NOTE1]	2^{-30}		radians

NOTE1: Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB
NOTE2: See Figure 3.5-1 for complete bit allocation in Subframe 2
NOTE3: Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor

NOTE4: Relative to $\dot{\Omega}_{REF} = -2.6 \times 10^{-9}$ semi-circles/second

Rationale:
P8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-180:

Section Number:
3.5.3.6.1.0-3

WAS:
The sensitivity of the SV's position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters A, C_{rc-n}, and C_{rs-n} is about one meter/meter. The sensitivity of position to the angular parameters is on the order of 10^8 meters/semi-circle, and to the angular rate parameters is on the order of 10^{12} meters/semi-circle/second. Because of this extreme sensitivity to angular perturbations, the value of π used in the curve fit is given here. π is a mathematical constant, the ratio of a circle's circumference to its diameter. Here π is taken as 3.1415926535898.

Redlines:
The sensitivity of the SV's position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters A, C_{rc-n}, and C_{rs-n} is about one meter/meter. The sensitivity of position to the angular parameters is on the order of ~~108~~$1 \times 10^{+8}$ meters/semi-circle, and to the angular rate parameters is on the order of ~~1012~~$1 \times 10^{+12}$ meters/semi-circle/second. Because of this extreme sensitivity to angular perturbations, the value of ~~p~~π used in the curve fit is given here. ~~p~~π is a mathematical constant, the ratio of a circle's circumference to its diameter. Here ~~p~~π is taken as 3.1415926535898.

IS:
The sensitivity of the SV's position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters A, C_{rc-n}, and C_{rs-n} is about one meter/meter. The sensitivity of position to the angular parameters is on the order of $1 \times 10^{+8}$ meters/semi-circle, and to the angular rate parameters is on the order of $1 \times 10^{+12}$ meters/semi-circle/second. Because of this extreme sensitivity to angular perturbations, the value of π used in the curve fit is given here. π is a mathematical constant, the ratio of a circle's circumference to its diameter. Here π is taken as 3.1415926535898.

Rationale:
9/30/2025: Administrative. Replaced PI with Unicode for sustainability. (T. Anthony)
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-181:

Section Number:
3.5.3.6.1.0-5

WAS:

Element/Equation	Description
$\mu = 3.986005 \times 10^{14}$ meters^3/sec^2	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$ *	Semi-Major Axis at reference time
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion (rad/sec)
$t_k = t - t_{oe}$ **	Time from ephemeris reference time
$\Delta n_A = \Delta n_0 + ½\, \Delta \dot{n}_0\, t_k$	Mean motion difference from computed value
$n_A = n_0 + \Delta n_A$	Corrected Mean Motion
$M_k = M_0 + n_A\, t_k$	Mean Anomaly
	Kepler's equation ($M_k = E_k - e\sin E_k$) may be solved for Eccentric anomaly (E_k) by iteration:
$E_0 = M_k$	– Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e\sin\ _{j-1}}{1 - e\cos E_{j-1}}$	– Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	– Final Value (radians)
$\nu_k = 2\tan^{-1}\left(\sqrt{\frac{1+e}{1-e}}\tan\frac{E_k}{2}\right)$	True Anomaly (unambiguous quadrant)
* A_{REF} = 26,559,710 meters ** **t** is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, t_k shall be the actual total difference between the time **t** and the epoch time t_{oe}, and must account for beginning or end of week crossovers. That is if t_k is greater than 302,400 seconds, subtract 604,800 seconds from t_k. If t_k is less than -302,400 seconds, add 604,800 seconds to t_k.	

Redlines:

Element/Equation	Description
$\mu = 3.986005$ × ~~x~~ 10^{+14} meters³/sec²	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467$ × ~~x~~ 10^{-5} rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$ NOTE1 ~~*~~	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^{\,3}}}$	Computed Mean Motion at reference time (rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A})\, t_k$	Semi-Major Axis
~~$t_k = t - t_{oe}$ **~~	~~Time from ephemeris reference time~~
~~$\Delta n_A = \Delta n_0 + ½\, \Delta \dot{n}_0\, t_k$~~	~~Mean motion difference from computed value~~
~~$n_A = n_0 + \Delta n_A$~~	~~Corrected Mean Motion~~
$n_0' = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n_0' + \Delta\dot{n}_0\, t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^{t} n_k\, dt = M_0 + n_0'\, t_k + \Delta\dot{n}_0\, t_k^2/2$ ~~$M_k = M_0 + n_A t_k$~~	Mean Anomaly
Kepler's equation ($M_k = E_k - e \sin E_k$) may be solved for Eccentric Anomaly (E_k) by iteration	
$E_0 = M_k$	– Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	– Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	– Final Value (radians
$\nu_k = 2 \tan^{-1}\left(\sqrt{\frac{1+e}{1-e}} \tan\left(\frac{E_k}{2}\right)\right)$	True Anomaly (unambiguous quadrant)

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

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

IS:

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

Rationale:
8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
8/19/2025: Mean Motion equation correction from delta-n-dot sub k to delta-n-dot sub 0 (T. Anthony)
PRAT 2025-02, Pre-RFC-1445 8/5/2025 Responds to Eccentric Anomaly Rate Fix. (T. Anthony)
Replaced Mean Motion difference from computed value and Corrected Mean Motion with Corrected Mean Motion at reference time and Mean Motion.
Also replace the Mean Anomaly equation.

IS800-182:

Section Number:
3.5.3.6.1.0-7

WAS:

Element/Equation	**Description**
$\Phi_k = \nu_k + \omega_n$	Argument of Latitude
$\delta u_k = C_{us-n}\sin 2\Phi_k + C_{uc-n}\cos 2\Phi_k$	Argument of Latitude Correction } Second Harmonic Perturbations
$\delta r_k = C_{rs-n}\sin 2\Phi_k + C_{rc-n}\cos 2\Phi_k$	Radial Correction } Second Harmonic Perturbations
$\delta i_k = C_{is-n}\sin 2\Phi_k + C_{ic-n}\cos 2\Phi_k$	Inclination Correction } Second Harmonic Perturbations
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A_k(1 - e_n \cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_{o-n} + (IDOT)t_k + \delta i_k$	Corrected Inclination
$x_k' = r_k \cos u_k$ $y_k' = r_k \sin u_k$	Positions in orbital plane
$\dot{\Omega} = \dot{\Omega}_{REF} + \Delta\dot{\Omega}$ ***	Rate of Right Ascension
$\Omega_k = \Omega_{0-n} + (\dot{\Omega} - \dot{\Omega}_e)\, t_k - \dot{\Omega}_e\, t_{oe}$	Corrected Longitude of Ascending Node
$x_k = x_k' \cos \Omega_k - y_k' \cos i_k \sin \Omega_k$ $y_k = x_k' \sin \Omega_k + y_k' \cos i_k \cos \Omega_k$ $z_k = y_k' \sin i_k$	Earth-fixed coordinates of SV antenna phase center
*** $\dot{\Omega}_{REF} = -2.6 \times 10^{-9}$ semi-circles/second.	

Redlines:

Element/Equation	Description
$\Phi_k = \nu_k + \omega_n$	Argument of Latitude
$\delta u_k = C_{us-n} \sin 2\Phi_k + C_{uc-n} \cos 2\Phi_k$	Argument of Latitude Correction (Second Harmonic Perturbations)
$\delta r_k = C_{rs-n} \sin 2\Phi_k + C_{rc-n} \cos 2\Phi_k$	Radial Correction (Second Harmonic Perturbations)
$\delta i_k = C_{is-n} \sin 2\Phi_k + C_{ic-n} \cos 2\Phi_k$	Inclination Correction (Second Harmonic Perturbations)
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A_k(1 - e_n \cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_{o-n} + (IDOT)\, t_k + \delta i_k$	Corrected Inclination
$x_k' = r_k \cos u_k$ $y_k' = r_k \sin u_k$	Positions in orbital plane
$\dot{\Omega} = \dot{\Omega}_{REF} + \Delta\dot{\Omega}$ ***	Rate of Right Ascension NOTE3
$\Omega_k = \Omega_{0-n} + (\Omega - \Omega_e)\, t_k - \Omega_e t_{oe}$	Corrected Longitude of Ascending Node
$x_k = x_k' \cos \Omega_k - y_k' \cos i_k \sin \Omega_k$ $y_k = x_k' \sin \Omega_k + y_k' \cos i_k \cos \Omega_k$ $z_k = y_k' \sin i_k$	Earth-fixed coordinates of SV antenna phase center
NOTE3:*** $\dot{\Omega}_{REF} = -2.6 \times$ ~~x~~ 10^{-9} semi-circles/second	

IS:

Element/Equation	Description
$\Phi_k = \nu_k + \omega_n$	Argument of Latitude
$\delta u_k = C_{us-n} \sin 2\Phi_k + C_{uc-n} \cos 2\Phi_k$	Argument of Latitude Correction (Second Harmonic Perturbations)
$\delta r_k = C_{rs-n} \sin 2\Phi_k + C_{rc-n} \cos 2\Phi_k$	Radial Correction (Second Harmonic Perturbations)
$\delta i_k = C_{is-n} \sin 2\Phi_k + C_{ic-n} \cos 2\Phi_k$	Inclination Correction (Second Harmonic Perturbations)
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A_k(1 - e_n \cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_{o-n} + (IDOT)\, t_k + \delta i_k$	Corrected Inclination
$x_k' = r_k \cos u_k$ $y_k' = r_k \sin u_k$	Positions in orbital plane
$\dot{\Omega} = \dot{\Omega}_{REF} + \Delta\dot{\Omega}$	Rate of Right Ascension[NOTE3]
$\Omega_k = \Omega_{0-n} + (\Omega - \Omega_e)\, t_k - \Omega_e t_{oe}$	Corrected Longitude of Ascending Node
$x_k = x_k' \cos \Omega_k - y_k' \cos i_k \sin \Omega_k$ $y_k = x_k' \sin \Omega_k + y_k' \cos i_k \cos \Omega_k$ $z_k = y_k' \sin i_k$	Earth-fixed coordinates of SV antenna phase center
NOTE3: $\dot{\Omega}_{REF} = -2.6 \times 10^{-9}$ semi-circles/second	

Rationale:
8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-1011:

Section Number:
3.5.3.6.1.0-9

WAS:

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
$(di_k / dt) = (\text{IDOT}) + 2\,\dot{v}_k (c_{is} \cos 2\phi_k - c_{ic} \sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u}_k = \dot{v}_k + 2\dot{v}_k (c_{us} \cos 2\phi_k - c_{uc} \sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r}_k = \dot{A}(1\text{-}e \cos(E_k)) + A\, e \sin(E_k)\, \dot{E}_k + 2(c_{rs}\cos(2\phi_k) - c_{rc} \sin(2\phi_k))\, \dot{v}_k$	Corrected Radius Rate for CNAV-2
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r}_k \cos u_k - r_k \dot{u}_k \sin u_k$	In- plane *x* velocity
$\dot{y}'_k = \dot{r}_k \sin u_k + r_k \dot{u}_k \cos u_k$	In- plane *y* velocity
$\dot{x}_k = -x'_k\, \dot{\Omega}_k \sin \Omega_k + \dot{x}'_k \cos \Omega_k - \dot{y}'_k \sin \Omega_k \cos i_k - y'_k(\dot{\Omega}_k \cos \Omega_k \cos i_k - (di_k / dt) \sin \Omega_k \sin i_k)$	Earth- Fixed *x* velocity (m/s)
$\dot{y}_k = x'_k\, \dot{\Omega}_k \cos \Omega_k + \dot{x}'_k \sin \Omega_k + \dot{y}'_k \cos \Omega_k \cos i_k - y'_k(\dot{\Omega}_k \sin \Omega_k \cos i_k + (di_k / dt) \cos \Omega_k \sin i_k)$	Earth- Fixed *y* velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k\, (di_k / dt) \cos i_k$	Earth- Fixed *z* velocity (m/s)

Redlines:

Element/Equation	Description
SV Velocity	
$\dot{E}_k = \dfrac{n_k}{1 - e\cos E_k}$	Eccentric Anomaly Rate
$\dot{v}_k = \dot{E}_k \sqrt{1 - e^2}/(1 - e\cos E_k)$	True Anomaly Rate
$(di_k / dt) = (\text{IDOT}) + 2\ \dot{v}_k (eC_{is} \cos 2\phi_k - eC_{ic} \sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u}_k = \dot{v}_k + 2\dot{v}_k (eC_{us} \cos 2\phi_k - eC_{uc} \sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r}_k = \dot{A}(1\text{-}e \cos(E_k)) + A_k\ e \sin(E_k)\ \dot{E}_k + 2\ (eC_{rs} \cos(2\phi_k) - eC_{rc} \sin(2\phi_k))\ \dot{v}_k$	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)

IS:

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

Rationale:
Administrative Change: 9/11/2025 Capitalize the Cxx parameters and space out the multiplied terms for easier reading. (T. Anthony)
8/19/2025: Corrected Radius Rate for CNAV equation changed "A" to A-sub-k (T. Anthony)
PRAT 2025-02, Pre-RFC-1445 8/5/2025 Responds to Eccentric Anomaly Rate Fix. (T. Anthony)
Adjusted the Eccentric Anomaly Rate equation

IS800-190:

Section Number:
3.5.3.8.0-4

WAS:
The user shall calculate the NED-related URA with the equation (in meters);
$IAURA_{NED} = URA_{NED0} + URA_{NED1} (t - t_{op} + 604{,}800*(WN - WN_{op}))$

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

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

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

where

t is the GPS system time

Redlines:
The user shall calculate the NED-related URA with the equation (in meters);

nominal $URAN_{ED}$ = nominal URA_{NED0}

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

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

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

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

where

t is the GPS system time

IS:
The user shall calculate the NED-related URA with the equation (in meters);

nominal URA_{NED} = nominal URA_{NED0}

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

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

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

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

where

t is the GPS system time

Rationale:
8/5/2025 Normalize the notation for scalar value multiply, use only implied multiply. (T. Anthony)
This update assumes RFC-519 is eventually approved

IS800-213:

Section Number:
3.5.3.10.1.0-1

WAS:
Bit 566 of subframe 2 shall be the Integrity Status Flag (ISF). A "0" in bit position 566 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than 1 x 10^{-5} per hour. A "1" in bit position 566 indicates that the conveying signal is provided with an enhanced level of integrity assurance.

Redlines:
Bit 566 of subframe 2 shall be the Integrity Status Flag (ISF). A "0" in bit position 566 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than 1 ~~x~~ × 10^{-5} per hour. A "1" in bit position 566 indicates that the conveying signal is provided with an enhanced level of integrity assurance.

IS:
Bit 566 of subframe 2 shall be the Integrity Status Flag (ISF). A "0" in bit position 566 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than 1×10^{-5} per hour. A "1" in bit position 566 indicates that the conveying signal is provided with an enhanced level of integrity assurance.

Rationale:
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-1108:

Section Number:
3.5.3.10.1.0-2

WAS:
That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than 1 x 10^{-8} per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA are not defined.

Redlines:
That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than 1 ~~x~~ × 10^{-8} per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA are not defined.

IS:
That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than 1×10^{-8} per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA are not defined.

Rationale:
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-954:

Section Number:
3.5.4.3.5.1.1.0-5

WAS:
Table 3.5-6. Reduced Almanac Parameters*****

Redlines:
Table 3.5-6. Reduced Almanac ~~Parameters*****~~Parameters[NOTE5]

IS:
Table 3.5-6. Reduced Almanac Parameters[NOTE5]

Rationale:
8/28/2025 Caught up in the transition of asterisk notes to NOTEn (T. Anthony)

IS800-260:

Section Number:
3.5.4.3.5.1.1.0-6

WAS:

Parameter	No. of Bits	Scale Factor (LSB)	Valid Range **	Units
δ_A ***	8 *	2^{+9}	**	Meters
Ω_0	7 *	2^{-6}	**	semi-circles
Φ_0 ****	7 *	2^{-6}	**	semi-circles

* Parameters so indicated shall be in two's complement notation;

** Valid range is the maximum range attainable with indicated bit allocation and scale factor;

*** Relative to A_{ref} = 26,559,710 meters;

**** Φ_0 = Argument of Latitude at Reference Time = $M_0 + \omega$;

***** Relative to following reference values:

e = 0
δ_i = +0.0056 semi-circles (i = 55 degrees)
$\dot{\Omega}$ = -2.6 x 10^{-9} semi-circles/second

Redlines:

Parameter	No. of Bits NOTE1	Scale Factor (LSB)	Valid Range NOTE2	Units
δ_A NOTE3***	8 *	2^{+9}	— **	meters
Ω_0	7 *	2^{-6}	— **	semi-circles
Φ_0 NOTE4****	7 *	2^{-6}	— **	semi-circles

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

NOTE2:** Valid range is the maximum range attainable with indicated bit allocation and scale factor;

NOTE3:*** Relative to A_{ref} = 26,559,710 meters;

NOTE4:**** Φ_0 = Argument of Latitude at Reference Time = $M_0 + \omega$;

NOTE5:***** Relative to following reference values:
e = 0
δ_i = +0.0056 semi-circles (i = 55 degrees)
$\dot{\Omega}$ = -2.6- × x 10^{-9} semi-circles/second.

IS:

Parameter	No. of Bits[NOTE1]	Scale Factor (LSB)	Valid Range[NOTE2]	Units
δ_A [NOTE3]	8	2^{+9}	—	meters
Ω_0	7	2^{-6}	—	semi-circles
Φ_0 [NOTE4]	7	2^{-6}	—	semi-circles

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

NOTE2: Valid range is the maximum range attainable with indicated bit allocation and scale factor;

NOTE3: Relative to A_{ref} = 26,559,710 meters;

NOTE4: Φ_0 = Argument of Latitude at Reference Time = $M_0 + \omega$;

NOTE5: Relative to following reference values:

$e = 0$

$\delta_i = +0.0056$ semi-circles (i = 55 degrees)

$\dot{\Omega} = -2.6 \times 10^{-9}$ semi-circles/second.

Rationale:
8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-263:

Section Number:
3.5.4.3.6.0-4

WAS:

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{oa}	8	2^{12}	0 to 602,112	seconds
e	11	2^{-16}	0.0 to 0.03	dimensionless
δ_i****	11*	2^{-14}		semi-circles
$\dot{\Omega}$	11*	2^{-33}	-1.19E-07 to 0	semi-circles/sec
$\sqrt{A}$	17	2^{-4}	2530 to 8192	$\sqrt{\text{meters}}$
Ω_0	16*	2^{-15}		semi-circles
ω	16*	2^{-15}		semi-circles
M_0	16*	2^{-15}		semi-circles
a_{f0}	11*	2^{-20}		seconds
a_{f1}	10*	2^{-37}		sec/sec

* Parameters so indicated shall be in two's complement notation;

** See Figure 3.5-5 for complete bit allocation in subframe 3, page 4;

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

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

Redlines:

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

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

NOTE2:~~**~~ See Figure 20-10 for complete bit allocation in message type 37~~;~~

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

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

IS:

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

NOTE1: Parameters so indicated shall be in two's complement notation

NOTE2: See Figure 3.5-5 for complete bit allocation in subframe 3, page 4

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

NOTE4: Relative to i_0 = 0.30 semi-circles

Rationale:
8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)
8/27/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)

IS800-297:

Section Number:
6.2.1.0-1

WAS:
User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV. URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the transmitting SV. It includes all errors for which the Space and Control Segments are responsible. Whether the integrity status flag is 'off' or 'on', 4.42 times URA bounds the instantaneous URE under all conditions with 1-(1e-5) per hour probability (‘legacy’ level of integrity assurance). When the integrity status flag is 'on', 5.73 times URA bounds the instantaneous URE under all conditions with 1-(1e-8) per hour probability (‘enhanced’ level of integrity assurance). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound value of the URA index or to the scaled composite of the upper bound values of all component URA indexes.

Redlines:
User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV. URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the transmitting SV. It includes all errors for which the Space and Control Segments are responsible. Whether the integrity status flag is 'off' or 'on', 4.42 times URA bounds the instantaneous URE under all conditions with 1-(~~1e~~1×10^{-5}) per hour probability (‘legacy’ level of integrity assurance). When the integrity status flag is 'on', 5.73 times URA bounds the instantaneous URE under all conditions with 1-(~~1e~~1×10^{-8}) per hour probability (‘enhanced’ level of integrity assurance). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound value of the URA index or to the scaled composite of the upper bound values of all component URA indexes.

IS:
User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV. URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the transmitting SV. It includes all errors for which the Space and Control Segments are responsible. Whether the integrity status flag is 'off' or 'on', 4.42 times URA bounds the instantaneous URE under all conditions with 1-(1×10^{-5}) per hour probability (‘legacy’ level of integrity assurance). When the integrity status flag is 'on', 5.73 times URA bounds the instantaneous URE under all conditions with 1-(1×10^{-8}) per hour probability (‘enhanced’ level of integrity assurance). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound value of the URA index or to the scaled composite of the upper bound values of all component URA indexes.

Rationale:
9/2/2025: Converted E notation to power of scientific Power of 10 notation. (T. Anthony)

IS800-1188:
Insertion after object IS800-855
Section Number:
6.2.1.0-6

WAS:
<INSERTED OBJECT>

Redlines:
Note #4: The URA will bound the instantaneous URE, with the stated probability, only if the user applies all of the broadcast parameters in the same CEI data set as defined in 3.5.5.2 CEI Data Sets.
Object Type: Info-Only

IS:
Note #4: The URA will bound the instantaneous URE, with the stated probability, only if the user applies all of the broadcast parameters in the same CEI data set as defined in 3.5.5.2 CEI Data Sets.
Object Type: Info-Only

Rationale:
5/5/2023 CRM #90, #82 Propagated User Range Accuracy Note 4 to IS-GPS-800. (T. Anthony)

IS800-912:

Section Number:
6.2.8.0-1

WAS:
The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6.2-18. The entire CEI data set is needed for maximum accuracy. However, the core CEI data set (parameters without NOTE1 in Table 6.2-18) is sufficient for an initial position solution. The top term provides the epoch time of week of the state data utilized for the core CEI data set.

Redlines:
The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6.2-18. The entire CEI data set is needed for maximum accuracy. However, the core CEI data set (parameters without ~~NOTE1~~NOTE3 in Table 6.2-18) is sufficient for an initial position solution. ~~The top term provides the epoch time of week of the state data utilized for the core CEI data set.~~

IS:
The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6.2-18. The entire CEI data set is needed for maximum accuracy. However, the core CEI data set (parameters without NOTE3 in Table 6.2-18) is sufficient for an initial position solution.

Rationale:
5/9/2023: CRM #128 Remove the top sentence here and keep it in 6.2.8.1 (T. Anthony)
5/1/2023: CRM #14 With the re-engineering of CEI Parameter NOTEs, the correct NOTE here is now NOTE3. (T. Anthony)
3/7/2023: Changes to the Notes section of the CEI Parameters Table has caused NOTE1 in this paragraphs to be renumbered to NOTE2 (T. Anthony)

IS800-920:

Section Number:
6.2.8.1.0-1

WAS:
A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval. The t_{op} term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a Note1 in Table 6.2-18.

Redlines:
A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval. The t_{op} term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a ~~Note1~~NOTE3 in Table 6.2-18.

IS:
A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval. The t_{op} term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a NOTE3 in Table 6.2-18.

Rationale:
5/1/2023: CRM #129 With the re-engineering of CEI Parameter NOTEs, the correct NOTE here is now NOTE3. (T. Anthony)
3/7/2023: Changes to the Notes section of the CEI Parameters Table has caused NOTE1 in this paragraphs to be renumbered to NOTE2 (T. Anthony)

IS800-917:

Section Number:
6.2.8.1-2

WAS:

Symbol	Parameter Name	Subframe
$\dot{A}$	Change Rate in Semi-major Axis	2
ΔA	Semi-major Axis Difference at Reference Time	2
Δn_0	Mean Motion Difference from Computed Value at Reference Time	2
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	2
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	2
$\Delta\dot{\Omega}$	Rate of Right Ascension Difference	2
ω	Argument of Perigee	2
a_{f0}	SV Clock Bias Correction Coefficient	2
a_{f1}	SV Clock Drift Correction Coefficient	2
a_{f2}	Drift Rate Correction Coefficient	2
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	2
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	2
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	2
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	2
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2
e	Eccentricity	2
i_0	Inclination Angle at Reference Time	2
IDOT	Rate of Inclination Angle	2
ISC_{L1CP}	Inter-signal Correction	2
ISC_{L1CD}	Inter-signal Correction	2
ISC_{L1CA}	Inter-signal Correction	3
ISC_{L2C}	Inter-signal Correction	3
ISC_{L5I5}	Inter-signal Correction	3
ISC_{L5Q5}	Inter-signal Correction	3
ISF	Integrity Status Flag ^{NOTE1}	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits)	2

Symbol	Parameter Name	Subframe
M_0	Mean Anomaly at Reference Time	2
T_{GD}	Group Delay Differential	2
WN_{OP}	CEI Data Sequence Propagation Week Number	2
t_{oe}	Time of Ephemeris	2
t_{op}	CEI Data Sequence Propagation Time of Week	2
URA_{ED} Index	Elevation Dependent User Range Accuracy, URA_{ED} Index	2
URA_{NED0} Index	NED Accuracy Index	2
URA_{NED1} Index	NED Accuracy Change Index	2
URA_{NED2} Index	NED Accuracy Change Rate Index	2
WN	Week Number	2
NOTE1: Parameters so indicated are for CEI Refinement – not limited to curve fit. Parameters not indicated are needed for/limited to curve fit. Updates to parameters in table shall prompt changes in t_{oe}. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}.		

Redlines:

Symbol	Parameter Name	Subframe
$\dot{A}$	Change Rate in Semi-major Axis	2
ΔA	Semi-major Axis Difference at Reference Time	2
Δn_0	Mean Motion Difference from Computed Value at Reference Time	2
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	2
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	2
$\Delta\dot{\Omega}$	Rate of Right Ascension Difference	2
ω	Argument of Perigee	2
a_{f0}	SV Clock Bias Correction Coefficient	2
a_{f1}	SV Clock Drift Correction Coefficient	2
a_{f2}	Drift Rate Correction Coefficient	2
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	2
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	2
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	2
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	2
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2
e	Eccentricity	2
i_0	Inclination Angle at Reference Time	2
IDOT	Rate of Inclination Angle	2
ISC_{L1CP}	Inter-signal Correction[NOTE2, NOTE3]	2
ISC_{L1CD}	Inter-signal Correction[NOTE2, NOTE3]	2
ISC_{L1CA}	Inter-signal Correction[NOTE2, NOTE3]	3
ISC_{L2C}	Inter-signal Correction[NOTE2, NOTE3]	3
ISC_{L5I5}	Inter-signal Correction[NOTE2, NOTE3]	3
ISC_{L5Q5}	Inter-signal Correction[NOTE2, NOTE3]	3
ISF	Integrity Status Flag[NOTE1, NOTE2]	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits)[NOTE2]	2
M_0	Mean Anomaly at Reference Time	2
T_{GD}	Group Delay Differential[NOTE2, NOTE3]	2
WN_{OP}	CEI Data Sequence Propagation Week Number	2

Symbol	Parameter Name	Subframe
t_{oe}	Time of Ephemeris	2
t_{op}	CEI Data Sequence Propagation Time of Week	2
URA_{ED} Index	Elevation Dependent User Range Accuracy, URA_{ED} Index	2
URA_{NED0} Index	NED Accuracy Index	2
URA_{NED1} Index	NED Accuracy Change Index	2
URA_{NED2} Index	NED Accuracy Change Rate Index	2
WN	Week Number	2

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

NOTE1: Updates to this parameter are independent of updates to t_{oe}

NOTE2: Updates to this parameter are independent of curve fit

NOTE3: This parameter is for CEI Refinement

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

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

IS:

Symbol	Parameter Name	Subframe
$\dot{A}$	Change Rate in Semi-major Axis	2
ΔA	Semi-major Axis Difference at Reference Time	2
Δn_0	Mean Motion Difference from Computed Value at Reference Time	2
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	2
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	2
$\Delta\dot{\Omega}$	Rate of Right Ascension Difference	2
ω	Argument of Perigee	2
a_{f0}	SV Clock Bias Correction Coefficient	2
a_{f1}	SV Clock Drift Correction Coefficient	2
a_{f2}	Drift Rate Correction Coefficient	2
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	2
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	2
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	2
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	2
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2
e	Eccentricity	2
i_0	Inclination Angle at Reference Time	2
IDOT	Rate of Inclination Angle	2
ISC_{L1CP}	Inter-signal Correction[NOTE2, NOTE3]	2
ISC_{L1CD}	Inter-signal Correction[NOTE2, NOTE3]	2
ISC_{L1CA}	Inter-signal Correction[NOTE2, NOTE3]	3
ISC_{L2C}	Inter-signal Correction[NOTE2, NOTE3]	3
ISC_{L5I5}	Inter-signal Correction[NOTE2, NOTE3]	3
ISC_{L5Q5}	Inter-signal Correction[NOTE2, NOTE3]	3
ISF	Integrity Status Flag[NOTE1, NOTE2]	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits)[NOTE2]	2
M_0	Mean Anomaly at Reference Time	2
T_{GD}	Group Delay Differential[NOTE2, NOTE3]	2
WN_{OP}	CEI Data Sequence Propagation Week Number	2

Symbol	Parameter Name	Subframe
t_{oe}	Time of Ephemeris	2
t_{op}	CEI Data Sequence Propagation Time of Week	2
URA_{ED} Index	Elevation Dependent User Range Accuracy, URA_{ED} Index	2
URA_{NED0} Index	NED Accuracy Index	2
URA_{NED1} Index	NED Accuracy Change Index	2
URA_{NED2} Index	NED Accuracy Change Rate Index	2
WN	Week Number	2
Updates to parameters in this table will prompt changes in t_{oe} NOTE1: Updates to this parameter are independent of updates to t_{oe} NOTE2: Updates to this parameter are independent of curve fit NOTE3: This parameter is for CEI Refinement		

Rationale:
5/13/2023: Reworked clarifying the NOTEs based on the feedback from AWG #1. (T. Anthony)
4/26/2023: CRM #5 Reworked NOTEs across all documents with SMEs to more accurately address flags and health bits. (T. Anthony)
3/7/2023: At TIM #2, the NOTES were completely reworked resulting in a new NOTE1 and other changes. (T. Anthony)
2/27/2023: This simplified note was argued as being compatible with the rest of IS-GPS-200. The comments about “curve-fit” do not speak to the main point of the note. (T. Anthony)

 # CP Status = 'In Review': 24

# of inserted requirements: 0
# of modified requirements: 5
# of deleted requirements: 0
# of TBDs: 0
# of TBRs: 0
of (added/modified) effectivities: 0
of VCRM additions: 0
# of VCRM modifications: 0
# of VCRM deletions: 0
# of descriptive texts: 10
of (added/modified) tables: 9
of (added/modified) figures: 0