CHANGE NOTICE – DELTA AT RFC-544 PRE-AWG

Affected Document: IS-GPS-200 Rev N	**IRN/SCN Number** XXX-XXXX-XXX	**Date:** DD-MMM-YYYY
Authority: RFC-000519	**Proposed Change Notice** PCN-IS-200N_RFC519	**Date:** 18-MAR-2026

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

RFC Title: Civil Integrity Support Message (ISM) Formats

Reason For Change (Driver):
Complete the Civil Integrity Support Message format portion to enable the ARAIM capability in time to meet FAA's needs in support of RTCA/DO-401A and EUROCAE/ED-259B.
(Pre-RFC-1200, Pre-RFC 1269, partial Pre-RFC-1326)

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

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

Authored By: RE: Tony Anthony **Checked By: RE:** Sean Gutierrez

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	System Delta 831	
	Mission Delta 31	

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

IS200-572:

Section Number:
30.3.3.2.4.0-3

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);

for ~~$IAURA_{NED}$~~ $t - t_{op} + 604{,}800 (WN - WN_{op}) \leq 93{,}600$ seconds
nominal $URA_{NED} =$ nominal $URA_{NED0} + URA_{NED1} (t - t_{op} + 604{,}800* (WN - WN_{op}))$
$IAURA_{NED} =$ Upper Bound $URA_{NED0} + URA_{NED1} (t - t_{op} + 604{,}800 (WN - WN_{op}))$

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

where

t is the GPS system time

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

for $t - t_{op} + 604{,}800 (WN - WN_{op}) \leq 93{,}600$ seconds
nominal $URA_{NED} =$ nominal $URA_{NED0} + URA_{NED1} (t - t_{op} + 604{,}800 (WN - WN_{op}))$
$IAURA_{NED} =$ Upper Bound $URA_{NED0} + URA_{NED1} (t - t_{op} + 604{,}800 (WN - WN_{op}))$

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

where

t is the GPS system time

Rationale:
3/19/2026 Disposing of the "*" operators to simplify managing changes in both RFC-519 and RFC-544, when the "*" operator's replacement by an implied multiply does not change engineering intent. (T. Anthony)
3/3/2026 CRM #66, #68 Upgraded the URA_NED formulae after a mistake was found while investigating RFC-00544. (T. Anthony)
5/14/2025 At PICWG CRM #158 was created to modify all formulae that don't explicitly use "*" as a multiplier symbol to use "*". (T. Anthony)
5/14/2025 CRM #143 decided at PICWG to start each formula with "Upper Bound" (T. Anthony)
3/29/2025 CRM #112 Nominal URANED added as requested, (T. Anthony)

IS200-576:

Section Number:
30.3.3.2.4.0-8

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.

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

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

Rationale:
CRM #145 5/14/2025 At PICWG the stakeholders decided the best solution was to add a note to "For N = " to add an exception for -15. (T. Anthony)

IS200-1952:

Section Number:
30.3.3.2.4.0-9

WAS:
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 CNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A and L2C users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. 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.

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

~~URA_{NED0}~~Non-elevation ~~accounts~~dependent ~~for~~URA ~~zeroth~~accounts ~~order~~for SIS contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error; the net effect of CNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A and L2C users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. Non-elevation ~~URA_{NED0}~~dependent URA 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.

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

Non-elevation dependent URA accounts for SIS-contributions to user range error which include, but are not limited to, the following: CNAV LSB representation/truncation error; the net effect of CNAV clock correction polynomial error and code phase error in the transmitted signal for single-frequency L2C users who correct the code phase as described in Section 30.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A and L2C users who correct for group delay and ionospheric effects as described in Section 30.3.3.3.1.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. Non-elevation dependent URA 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.

Rationale:
3/19/2026 CRM #75 Drop "zeroth order" from the description of Non-elevation dependent URA. (T. Anthony)
3/3/2026 RFC-544 CRM #66, #68 Upgraded the URA descriptions along with corrections made at IS200-572, IS705-261, and IS800-190. (T. Anthony)
5/14/2025 CRM #143: At PICWG all stakeholders concurred with a new option which added "and values of" into the end of the 2nd sentence. (T. Anthony)