CHANGE NOTICE – DELTA AT RFC-544 PRE-AWG

Affected Document: IS-GPS-705 Rev J	**IRN/SCN Number** XXX-XXXX-XXX	**Date:** DD-MMM-YYYY
Authority: RFC-000519	**Proposed Change Notice** PCN-IS-705J_RFC519	**Date:** 18-MAR-2026

Document Title: NAVSTAR GPS Space Segment/Navigation User Segment L5 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)

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AUTHORIZED SIGNATURES	REPRESENTING	DATE
	System Delta 831	
	Mission Delta 31	

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CODE IDENT 66RP1

IS705-261:

Section Number:
20.3.3.2.4.0-4

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);

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)
At PICWG CRM #158 was created to modify all formulae that don't explicitly use "*" as a multiplier symbol to use "*". (T. Anthony)
3/29/2025 CRM #112 Nominal URANED added as requested. (T. Anthony)

IS705-265:

Section Number:
20.3.3.2.4.0-8

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.

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 20.3.3.1.1).

URA_{NED0} accounts for zeroth order SIS-contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L5 users who correct the code phase as described in Section 20.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A/L5 users who correct for group delay and ionospheric effects as described in Section 20.3.3.3.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. URA_{NED} 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:
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.

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 20.3.3.1.1).

~~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: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L5 users who correct the code phase as described in Section 20.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A/L5 users who correct for group delay and ionospheric effects as described in Section 20.3.3.3.1.2; radial ephemeris error; anisotropic antenna errors; and signal deformation error. Non-elevation ~~URA_{NED}~~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:
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.

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 20.3.3.1.1).

Non-elevation dependent URA accounts for SIS-contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error; the net effect of clock correction polynomial error and code phase error in the transmitted signal for single-frequency L5 users who correct the code phase as described in Section 20.3.3.3.1.1.1; the net effect of clock parameter, code phase, and inter-signal correction error for dual-frequency L1 C/A/L5 users who correct for group delay and ionospheric effects as described in Section 20.3.3.3.1.2; 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_NED formulae after a mistake was found while investigating RFC-00544. (T. Anthony)
5/14/2025 CRM #144 At PICWG the stakeholders decided the best solution was to add a note to "For N = " to add an exception for -15. Originally meant for IS200-1946
