CHANGE NOTICE

Affected Document:	IRN/SCN Number	Date:
IS-GPS-800 Rev F	IRN-IS-800F-001	07-MAY-2019
Authority:	**Proposed Change Notice**	**Date:**
RFC-00400	PCN-IS-800E_RFC400	20-DEC-2018

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

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

RFC Title: Leap Second and Earth Orientation Parameters

Reason For Change (Driver):
As currently documented in the technical baseline for Earth Orientation Parameters (EOP) data and applications, CNAV/CNAV-2 and MNAV users will calculate the wrong UT1 time immediately following a leap second change, as the linkage between Coordinated Universal Time (UTC) and UT1 time is not properly captured. This issue affects user applications that require high precision pointing, which may include optical telescopes, spacecraft, or any system with this requirement. Documents affected: IS-GPS-200, IS-GPS-705, IS-GPS-800, ICD-GPS-700, ICD-GPS-801, and IS-GPS-901. The topic was originally a part of RFC-354 & RFC-374.

Description of Change:
Resolve the leap second problem such that the user knows how to calculate the correct UT1 time following a leap second change given the current definition and implementation of EOP and UTC parameters.

Authored By: Philip Kwan **Checked By: Jennifer Lemus**

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

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El Segundo, CA 90245

CODE IDENT 66RP1

IS800-875 :

Section Number :
3.5.2.0-7

WAS :

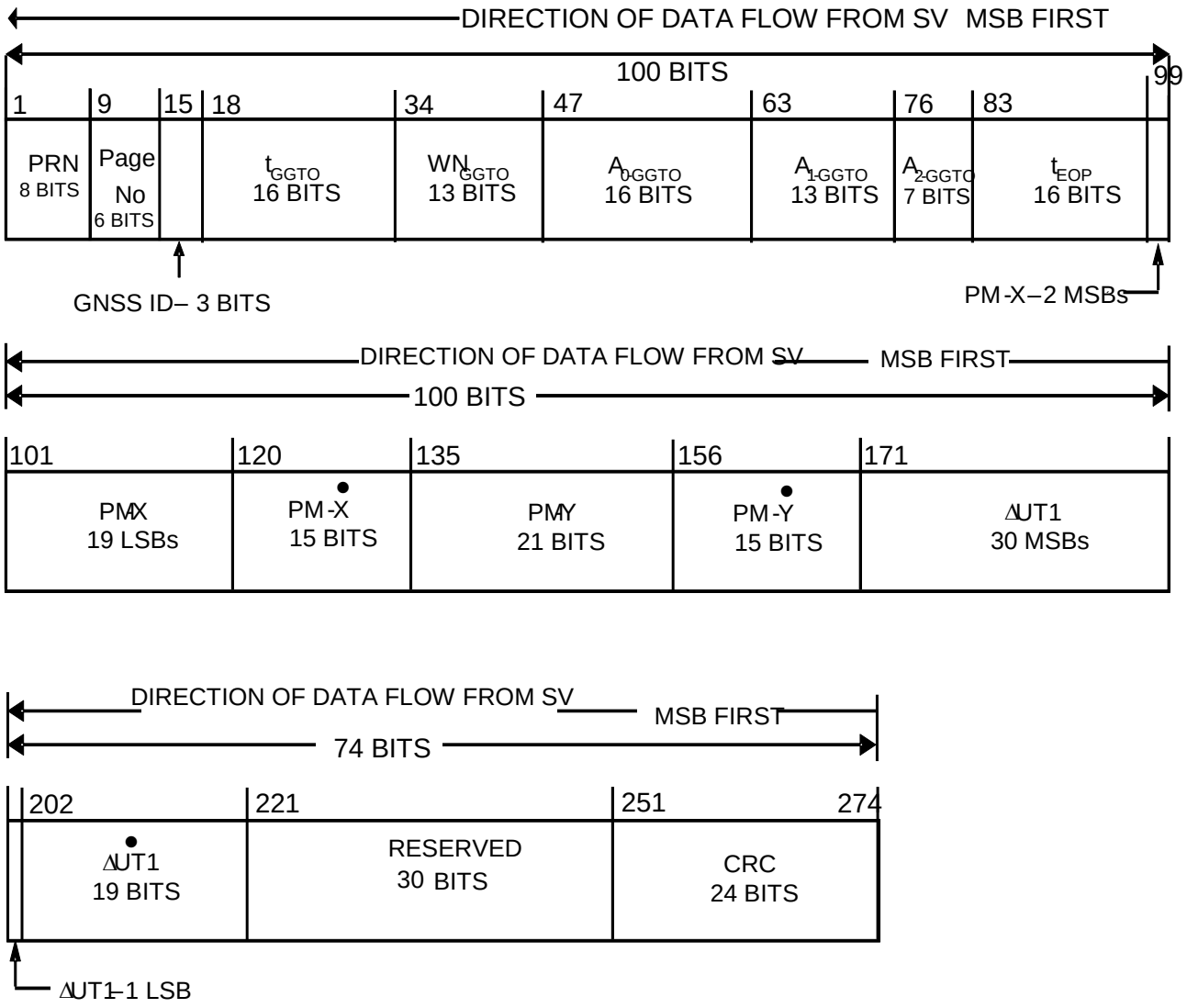

Figure 3.5-3 Subframe 3, Page 2

Redlines :

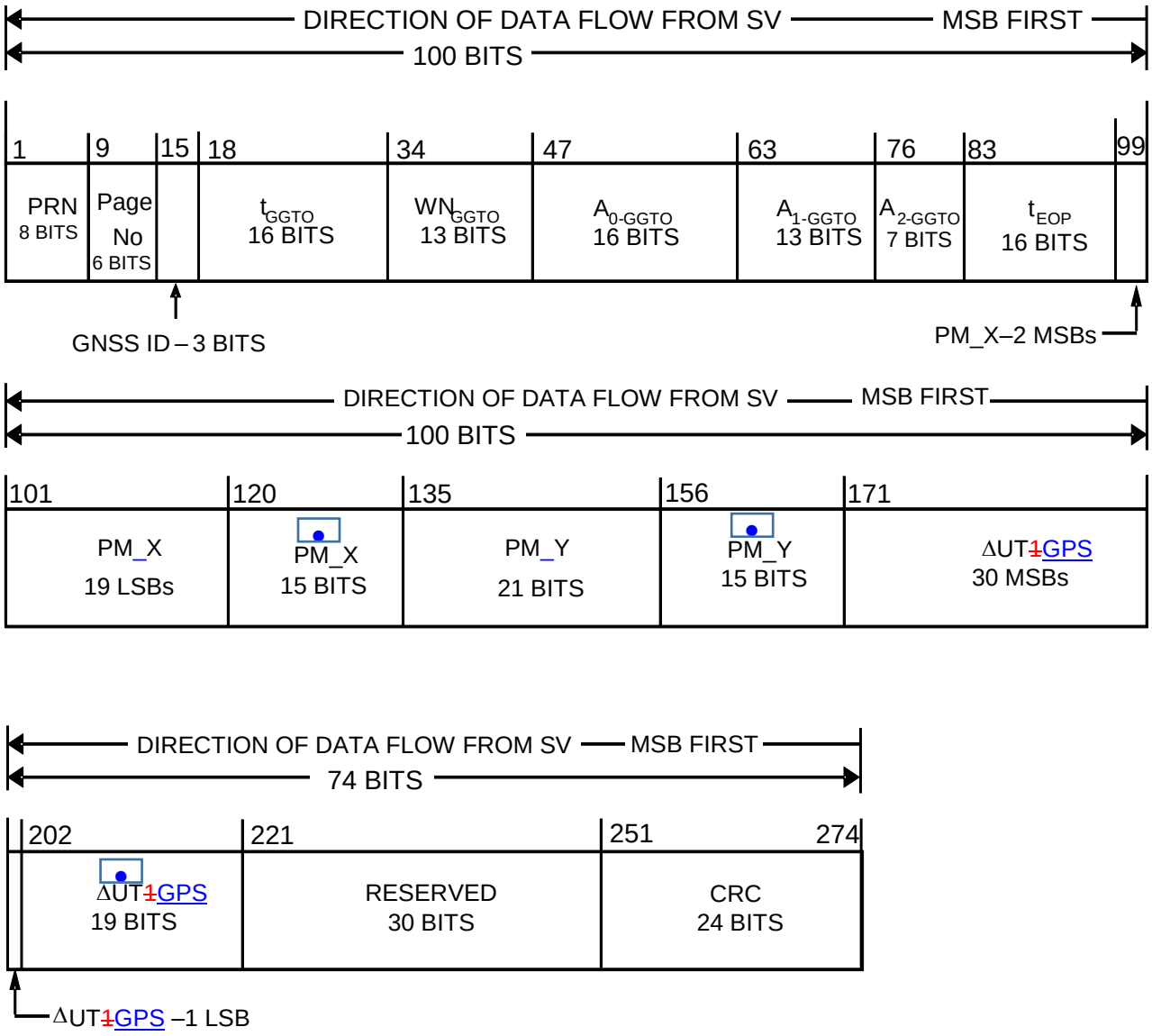

Figure 3.5-3 Subframe 3, Page 2

IS :

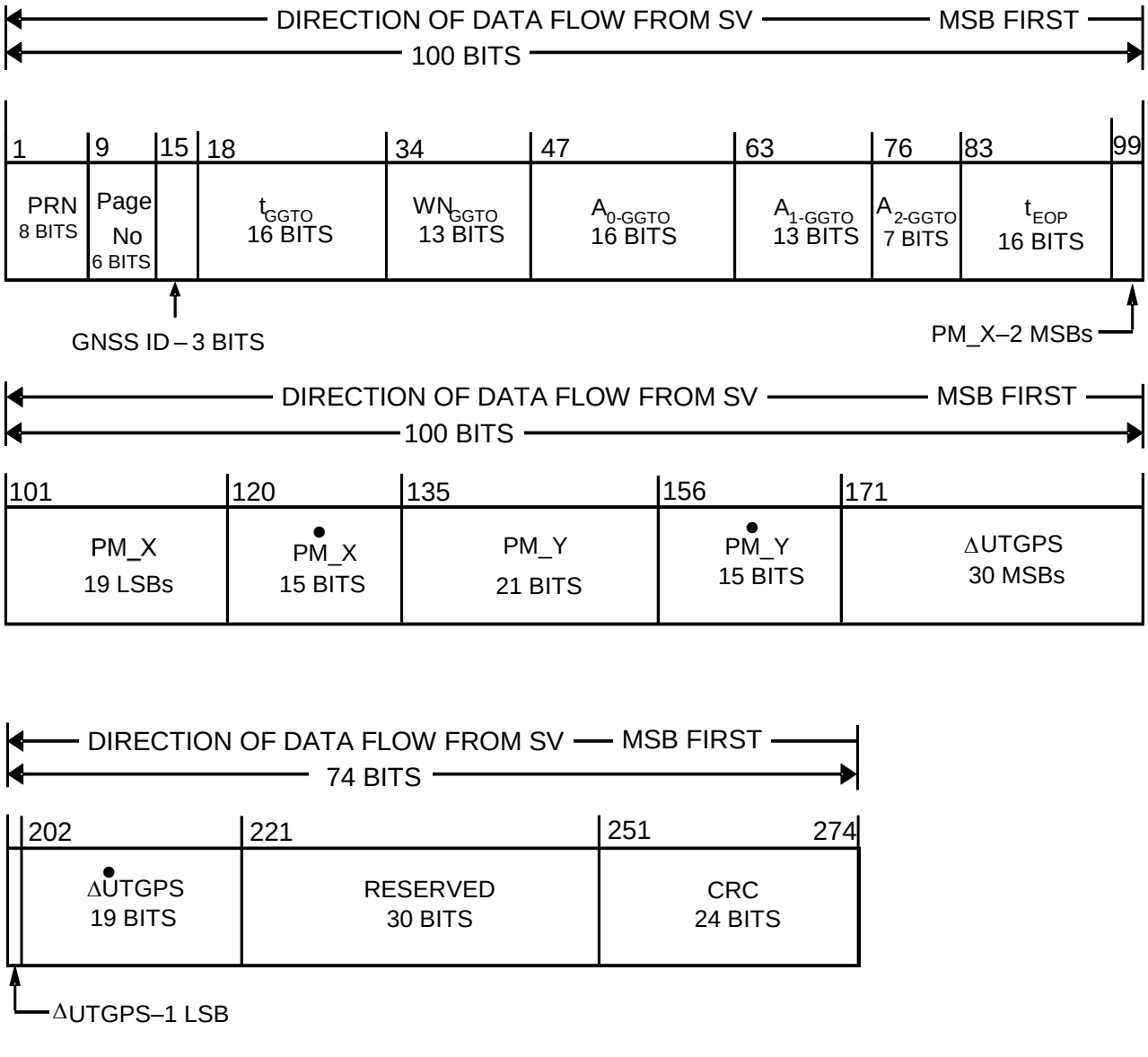

Figure 3.5-3 Subframe 3, Page 2

IS800-237 :

Section Number :
3.5.4.2.2

WAS :
EOP Parameter Content

Redlines :
EOP ~~Parameter~~ Content

IS :
EOP Content

IS800-240 :

Section Number :
3.5.4.2.3.0-1

WAS :
The EOP fields in subframe 3, page 2 contain the EOP needed to construct the ECEF-to-ECI coordinate transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 3.5-2. The coordinate transformation, for translating to the corresponding ECI SV antenna phase center position, is derived using the equations shown in IERS Technical Note 36 and Table 30-VIII of IS-GPS-200. The coordinate systems are defined in Section 20.3.3.4.3.3 of IS-GPS-200.

Redlines :
The EOP fields in subframe 3, page 2 contain the EOP needed to construct the ECEF-to-ECI coordinate transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 3.5-2. The coordinate transformation, for translating to the corresponding ECI SV antenna phase center position, is derived using the equations shown in IERS Technical Note 36 and Table 30-VIII of IS-GPS-200 in accordance with Section 30.3.3.5.1.1 of IS-GPS-200. The coordinate systems are defined in Section 20.3.3.4.3.3 of IS-GPS-200.

EOPs that are not updated by the CS will degrade in accuracy over time.

IS :
The EOP fields in subframe 3, page 2 contain the EOP needed to construct the ECEF-to-ECI coordinate transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 3.5-2. The coordinate transformation, for translating to the corresponding ECI SV antenna phase center position, is derived using the equations shown in IERS Technical Note 36 and Table 30-VIII of IS-GPS-200 in accordance with Section 30.3.3.5.1.1 of IS-GPS-200. The coordinate systems are defined in Section 20.3.3.4.3.3 of IS-GPS-200.

EOPs that are not updated by the CS will degrade in accuracy over time.

IS800-922 :

Section Number :
3.5.4.2.3.0-2 (after IS800-240)

> The EOP fields in subframe 3, page 2 contain the EOP needed to construct the ECEF-to-ECI coordinate transformation. The user computes the ECEF position of the SV antenna phase center using the equations shown in Table 3.5-2. The coordinate transformation, for translating to the corresponding ECI SV antenna phase center position, is derived using the equations shown in IERS Technical Note 36 and Table 30-VIII of IS-GPS-200. The coordinate systems are defined in Section 20.3.3.4.3.3 of IS-GPS-200.

WAS :
N/A

Redlines :
<INSERTED OBJECT>

IS :
When calculating UT1, x_p, and y_p in Table 30-VIII of IS-GPS-200, the week number for t_{EOP} is equal to the WN_{ot} value in subframe 3 page 2 when both criteria are met:

- t_{EOP} in subframe 3 page 1 is equal to t_{ot} in subframe 3 page 2
- Subframe 3 page 1 and subframe 3 page 2 were transmitted within a continuous 4-hour period

If both criteria are not met, the data between the two pages may be inconsistent with each other and should not be used for the calculations in Table 30-VIII of IS-GPS-200.

IS800-241 :

Section Number :
3.5.4.2.3.0-5

WAS :

Table 3.5-5. Earth Orientation Parameters

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

* Parameters so indicated are in two's complement notation;

** See Figure 3.5-3 for complete bit allocation in subframe 3, page 2;

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

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

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

††† With zonal tides restored.

Redlines :

Table 3.5-5. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †, ††††	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X ††††	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††, ††††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y ††††	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUT~~1~~GPS †††	~~UT1-UTC~~UT1-GPS Difference at Reference Time.	31*	2^{-24}~~23~~		seconds
$\dot{\Delta UT}$~~1~~GPS †††	Rate of ~~UT1-UTC~~UT1-GPS Difference at Reference Time.	19*	2^{-25}		seconds/day

* Parameters so indicated are in two's complement notation;

** See Figure 3.5-3 for complete bit allocation in subframe 3, page 2;

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

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

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

††† ~~With zonal tides restored.~~Already account for zonal, diurnal, and semi-diurnal tides and should not be further applied by the user.

†††† Already account for diurnal and semi-diurnal tides and should not be further applied by the user.

IS :

Table 3.5-5. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	0 to 604,784	seconds
PM_X †, ††††	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_X ††††	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
PM_Y ††, ††††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}		arc-seconds
$\dot{PM}$_Y ††††	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}		arc-seconds/day
ΔUTGPS †††	UT1-GPS Difference at Reference Time.	31*	2^{-23}		seconds
$\dot{\Delta UTGPS}$ †††	Rate of UT1-GPS Difference at Reference Time.	19*	2^{-25}		seconds/day

* Parameters so indicated are in two's complement notation;

** See Figure 3.5-3 for complete bit allocation in subframe 3, page 2;

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

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

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

††† Already account for zonal, diurnal, and semi-diurnal tides and should not be further applied by the user.

†††† Already account for diurnal and semi-diurnal tides and should not be further applied by the user.