PROPOSED INTERFACE REVISION NOTICE (PIRN)

Note: This Cover Page is not intended for signature. It is to be used during the document update (pre-ICWG) process.

Affected ICD/IS: IS-GPS-200, Rev H	**PIRN Number:** PIRN-IS-200H-003
Authority: RFC-00288	**PIRN Date:** 02-OCT-2015

CLASSIFIED BY: N/A

DECLASSIFY ON: N/A

Document Title: Navstar GPS Space Segment / Navigation User Interfaces

Reason For Change (Driver):

Some data items within IS-200 do not have either a valid range or their entire bit allocation defined.

Description of Change:

Define valid ranges and bit allocations for several data items within IS-200.

Prepared By:__Randy Grossman____ Checked By: _Laura Hainline____

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:
TASC (GPS SE&I)
300 Continental Ave., Suite 500
El Segundo, CA 90245

CODE IDENT 4A457

6.2.6 :
Insertion after object IS200-192

WAS :
N/A

IS :
Reserved Data

6.2.6 :
Insertion below object IS200-1505

WAS :
N/A

IS :
Reserved bits are intended for future or other use and their values may change throughout the life of the system.

6.2.7 :
Insertion after object IS200-1505

WAS :
N/A

IS :
Valid Range

6.2.7 :
Insertion below object IS200-1507

WAS :
N/A

IS :
Valid Range identifies the range of values used by GPS.

20.3.3.2 Handover Word:

WAS :
The HOW shall be 30 bits long and shall be the second word in each subframe/page, immediately following the TLM word. A HOW occurs every 6 seconds in the data frame. The format and content of the HOW shall be as shown in Figure 20-2. The MSB is transmitted first. The HOW begins with the 17 MSBs of the time-of-week (TOW) count. (The full TOW count consists of the 19 LSBs of the 29-bit Z-count). These 17 bits correspond to the TOW-count at the X1 epoch which occurs at the start (leading edge) of the next following subframe (reference paragraph 3.3.4).

IS :
The HOW shall be 30 bits long and shall be the second word in each subframe/page, immediately following the TLM word. A HOW occurs every 6 seconds in the data frame. The format and content of the HOW shall be as shown in Figure 20-2. The MSB is transmitted first. The HOW begins with the 17 MSBs of the time-of-week (TOW) count. (The full TOW count consists of the 19 LSBs of the 29-bit Z-count). These 17 bits correspond to the TOW-count at the X1 epoch which occurs at the start (leading edge) of the next following subframe (reference paragraph 3.3.4). The HOW-message TOW count reaches a maximum value of 100,799 prior to rolling over.

20.3.3.2 Handover Word:

WAS :

Subframe	ID Code
1	001
2	010
3	011
4	100
5	101

IS :

Subframe	ID Code
Invalid	000
1	001
2	010
3	011
4	100
5	101
Invalid	110
Invalid	111

20.3.3.3.1.2 Code(s) on L2 Channel:

WAS :
Bits 11 and 12 of word three shall indicate which code(s) is (are) commanded ON for the L2 channel, as follows:

00 = Reserved,

01 = P code ON,

10 = C/A code ON.

IS :
Bits 11 and 12 of word three shall indicate which code is commanded ON for the L2 channel, as follows:

00 = Invalid,

01 = P code ON,

10 = C/A code ON.

11= Invalid

WAS :

Table 20-I. Subframe 1 Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
Code on L2	2	1		discretes
Week No.	10	1		week
L2 P data flag	1	1		discrete
SV accuracy	4			(see text)
SV health	6	1		discretes
T_{GD}	8*	2^{-31}		seconds
IODC	10			(see text)
t_{oc}	16	2^{4}	604,784	seconds
a_{f2}	8*	2^{-55}		sec/sec^2
a_{f1}	16*	2^{-43}		sec/sec
a_{f0}	22*	2^{-31}		seconds

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

** See Figure 20-1 for complete bit allocation in subframe;

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

IS :

Table 20-I. Subframe 1 Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
Code on L2	2	1		discretes
Week No.	10	1		week
L2 P data flag	1	1		discrete
SV accuracy	4			(see text)
SV health	6	1		discretes
T_{GD}	8*	2^{-31}		seconds
IODC	10			(see text)
t_{oc}	16	2^{4}	604,784	seconds
a_{f2}	8*	2^{-55}		sec/sec^2
a_{f1}	16*	2^{-43}		sec/sec
a_{f0}	22*	2^{-31}		seconds

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

** See Figure 20-1 for complete bit allocation in subframe;

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

WAS :

Table 20-III. Ephemeris Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
IODE	8			(see text)
C_{rs}	16*	2^{-5}		meters
Δn	16*	2^{-43}		semi-circles/sec
M_0	32*	2^{-31}		semi-circles
C_{uc}	16*	2^{-29}		radians
e	32	2^{-33}	0.03	dimensionless
C_{us}	16*	2^{-29}		radians
$\sqrt{A}$	32	2^{-19}		$\sqrt{\text{meters}}$
t_{oe}	16	2^{4}	604,784	seconds
C_{ic}	16*	2^{-29}		radians
Ω_0	32*	2^{-31}		semi-circles
C_{is}	16*	2^{-29}		radians
i_0	32*	2^{-31}		semi-circles
C_{rc}	16*	2^{-5}		meters
ω	32*	2^{-31}		semi-circles
$\dot{\Omega}$	24*	2^{-43}		semi-circles/sec
IDOT	14*	2^{-43}		semi-circles/sec

* Parameters so indicated shall be two's complement, with the sign bit (+ or -) occupying the MSB;
** See Figure 20-1 for complete bit allocation in subframe;
*** Unless otherwise indicated in this column, effective range is the maximum range attainable with indicated bit allocation and scale factor.

IS :

Table 20-III. Ephemeris Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
IODE	8			(see text)
C_{rs}	16*	2^{-5}		meters
Δn	16*	2^{-43}		semi-circles/sec
M_0	32*	2^{-31}		semi-circles
C_{uc}	16*	2^{-29}		radians
e	32	2^{-33}	0.03	dimensionless
C_{us}	16*	2^{-29}		radians
$\sqrt{A}$	32	2^{-19}	4906 to 5390	$\sqrt{\text{meters}}$
t_{oe}	16	2^{4}	604,784	seconds
C_{ic}	16*	2^{-29}		radians
Ω_0	32*	2^{-31}		semi-circles
C_{is}	16*	2^{-29}		radians
i_0	32*	2^{-31}	0.237 to 0.363	semi-circles
C_{rc}	16*	2^{-5}		meters
ω	32*	2^{-31}		semi-circles
$\dot{\Omega}$	24*	2^{-43}	-5.20E-09 to 0.0	semi-circles/sec
IDOT	14*	2^{-43}		semi-circles/sec

* Parameters so indicated shall be two's complement, with the sign bit (+ or -) occupying the MSB;
** See Figure 20-1 for complete bit allocation in subframe;
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

20.3.3.5.1.1 Data ID and SV ID ::

WAS :
The two MSBs of word three in each page shall contain data ID. Data ID number two (denoted by binary code 01) denotes the NAV data structure of D(t) which is described in this Appendix. Future data IDs will be defined as necessary.

IS :
The two MSBs of word three in each page shall contain data ID. Data ID number two (denoted by binary

code 01) denotes the NAV data structure of D(t) which is described in this Appendix and is the only valid value.

WAS :

Table 20-VI. Almanac Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
e	16	2^{-21}		dimensionless
t_{oa}	8	2^{12}	602,112	seconds
δ_i****	16*	2^{-19}		semi-circles
$\dot{\Omega}$	16*	2^{-38}		semi-circles/sec
$\sqrt{A}$	24	2^{-11}		$\sqrt{\text{meters}}$
Ω_0	24*	2^{-23}		semi-circles
ω	24*	2^{-23}		semi-circles
M_0	24*	2^{-23}		semi-circles
a_{f0}	11*	2^{-20}		seconds
a_{f1}	11*	2^{-38}		sec/sec

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

** See Figure 20-1 for complete bit allocation in subframe;

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

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

IS :

Table 20-VI. Almanac Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
e	16	2^{-21}	0.03	dimensionless
t_{oa}	8	2^{12}	602,112	seconds
δ_i****	16*	2^{-19}		semi-circles
$\dot{\Omega}$	16*	2^{-38}	-5.20E-09 to 0.0	semi-circles/sec
$\sqrt{A}$	24	2^{-11}	4906 to 5390	$\sqrt{\text{meters}}$
Ω_0	24*	2^{-23}		semi-circles
ω	24*	2^{-23}		semi-circles
M_0	24*	2^{-23}		semi-circles
a_{f0}	11*	2^{-20}		seconds
a_{f1}	11*	2^{-38}		sec/sec

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

** See Figure 20-1 for complete bit allocation in subframe;

*** 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.

20.3.3.5.1.4 AS Flags and SV Config:

WAS :

Page 25 of subframe 4 shall contain a four-bit-long term for each of up to 32 SVs to indicate the A-S status and the configuration code of each SV. 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

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).

Additional codes will be assigned in the future, should the need arise.

IS :
Page 25 of subframe 4 shall contain a four-bit-long term for each of up to 32 SVs to indicate the A-S status and the configuration code of each SV. 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, 101, 110, 111 Reserved

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).

WAS :

Table 20-IX. UTC Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
A_0	32*	2^{-30}		seconds
A_1	24*	2^{-50}		sec/sec
Δt_{LS}	8*	1		seconds
t_{ot}	8	2^{12}	602,112	seconds
WN_t	8	1		weeks
WN_{LSF}	8	1		weeks
DN	8****	1	7	days
Δt_{LSF}	8*	1		seconds

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

** See Figure 20-1 for complete bit allocation in subframe;

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

**** Right justified.

IS :

Table 20-IX. UTC Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
A_0	32*	2^{-30}		seconds
A_1	24*	2^{-50}		sec/sec
Δt_{LS}	8*	1		seconds
t_{ot}	8	2^{12}	602,112	seconds
WN_t	8	1		weeks
WN_{LSF}	8	1		weeks
DN	8	1	1 to 7	days
Δt_{LSF}	8*	1		seconds

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

** See Figure 20-1 for complete bit allocation in subframe;

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

WAS :

Table 20-X. Ionospheric Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
α_0	8*	2^{-30}		seconds
α_1	8*	2^{-27}		sec/semi-circle
α_2	8*	2^{-24}		sec/(semi-circle)^2
α_3	8*	2^{-24}		sec/(semi-circle)^3
β_0	8*	2^{11}		seconds
β_1	8*	2^{14}		sec/semi-circle
β_2	8*	2^{16}		sec/(semi-circle)^2
β_3	8*	2^{16}		sec/(semi-circle)^3

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

** See Figure 20-1 for complete bit allocation in subframe;

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

IS :

Table 20-X. Ionospheric Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
α_0	8*	2^{-30}		seconds
α_1	8*	2^{-27}		sec/semi-circle
α_2	8*	2^{-24}		sec/(semi-circle)^2
α_3	8*	2^{-24}		sec/(semi-circle)^3
β_0	8*	2^{11}		seconds
β_1	8*	2^{14}		sec/semi-circle
β_2	8*	2^{16}		sec/(semi-circle)^2
β_3	8*	2^{16}		sec/(semi-circle)^3

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

** See Figure 20-1 for complete bit allocation in subframe;

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

20.3.4.4 Data Sets:

Insertion after object IS200-464

WAS :

N/A

IS :

The t_{oe} shall be equal to the t_{oc} of the same LNAV data set.

WAS :

Table 30-I. Message Types 10 and 11 Parameters (1 of 2)

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
WN	Week No.	13	1		weeks
URA_{ED} Index	ED Accuracy Index	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	Data predict time of week	11	300	604,500	seconds
?A ****	Semi-major axis difference at reference time	26*	2^{-9}		meters
$\dot{A}$	Change rate in semi-major axis	25*	2^{-21}		meters/sec
$?n_0$	Mean Motion difference from computed value at reference time	17*	2^{-44}		semi-circles/sec
$?\dot{n}_0$	Rate of mean motion difference from computed value	23*	2^{-57}		semi-circles/sec^2
M_{0-n}	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.03	dimensionless
ω_n	Argument of perigee	33*	2^{-32}		semi-circles

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

** See Figure 30-1 for complete bit allocation in Message Type 10;

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

**** Relative to A_{REF} = 26,559,710 meters.

IS :

Table 30-I. Message Types 10 and 11 Parameters (1 of 2)

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
WN	Week No.	13	1		weeks
URA_{ED} Index	ED Accuracy Index	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	Data predict time of week	11	300	604,500	seconds
ΔA ****	Semi-major axis difference at reference time	26*	2^{-9}		meters
$\dot{A}$	Change rate in semi-major axis	25*	2^{-21}		meters/sec
Δn_0	Mean Motion difference from computed value at reference time	17*	2^{-44}		semi-circles/sec
$\dot{\Delta n}_0$	Rate of mean motion difference from computed value	23*	2^{-57}		semi-circles/sec^2
M_{0-n}	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.03	dimensionless
ω_n	Argument of perigee	33*	2^{-32}		semi-circles

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

** See Figure 30-1 for complete bit allocation in Message Type 10;

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

**** Relative to A_{REF} = 26,559,710 meters.

WAS :

Table 30-I. Message Types 10 and 11 Parameters (2 of 2)

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
t_{oe}	Ephemeris data reference time of week	11	300	604,500	seconds
$\Omega_{0\text{-}n}$	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
$i_{0\text{-}n}$	Inclination angle at reference time	33*	2^{-32}		semi-circles
$i_{0\text{-}n}$ –DOT	Rate of inclination angle	15*	2^{-44}		semi-circles/sec
$C_{is\text{-}n}$	Amplitude of the sine harmonic correction term to the angle of inclination	16*	2^{-30}		radians
$C_{ic\text{-}n}$	Amplitude of the cosine harmonic correction term to the angle of inclination	16*	2^{-30}		radians
$C_{rs\text{-}n}$	Amplitude of the sine correction term to the orbit radius	24*	2^{-8}		meters
$C_{rc\text{-}n}$	Amplitude of the cosine correction term to the orbit radius	24*	2^{-8}		meters
$C_{us\text{-}n}$	Amplitude of the sine harmonic correction term to the argument of latitude	21*	2^{-30}		radians
$C_{uc\text{-}n}$	Amplitude of the cosine harmonic correction term to the argument of latitude	21*	2^{-30}		radians

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

** See Figure 30-1 and Figure 30-2 for complete bit allocation in Message Types 10 and 11;

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

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

IS :

Table 30-I. Message Types 10 and 11 Parameters (2 of 2)

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{oe}	Ephemeris data reference time of week	11	300	604,500	seconds
$\Omega_{0\text{-}n}$	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	33*	2^{-32}		semi-circles
$\dot{\Delta\Omega}$****	Rate of right ascension difference	17*	2^{-44}	-2.60E-09 to 2.6E-09	semi-circles/sec
$i_{0\text{-}n}$	Inclination angle at reference time	33*	2^{-32}	0.237 to 0.363	semi-circles
$i_{0\text{-}n}$ –DOT	Rate of inclination angle	15*	2^{-44}		semi-circles/sec
$C_{is\text{-}n}$	Amplitude of the sine harmonic correction term to the angle of inclination	16*	2^{-30}		radians
$C_{ic\text{-}n}$	Amplitude of the cosine harmonic correction term to the angle of inclination	16*	2^{-30}		radians
$C_{rs\text{-}n}$	Amplitude of the sine correction term to the orbit radius	24*	2^{-8}		meters
$C_{rc\text{-}n}$	Amplitude of the cosine correction term to the orbit radius	24*	2^{-8}		meters
$C_{us\text{-}n}$	Amplitude of the sine harmonic correction term to the argument of latitude	21*	2^{-30}		radians
$C_{uc\text{-}n}$	Amplitude of the cosine harmonic correction term to the argument of latitude	21*	2^{-30}		radians

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

** See Figure 30-1 and Figure 30-2 for complete bit allocation in Message Types 10 and 11;

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

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

WAS :

Table 30-III. Clock Correction and Accuracy Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
t_{oc}	Clock Data Reference Time of Week	11	300	604,500	seconds
URA_{NED0} Index	NED Accuracy Index	5*			(see text)
URA_{NED1} Index	NED Accuracy Change Index	3			(see text)
URA_{NED2} Index	NED Accuracy Change Rate Index	3			(see text)
a_{f2-n}	SV Clock Drift Rate Correction Coefficient	10*	2^{-60}		sec/sec^2
a_{f1-n}	SV Clock Drift Correction Coefficient	20*	2^{-48}		sec/sec
a_{f0-n}	SV Clock Bias Correction Coefficient	26*	2^{-35}		seconds

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

** See Figure 30-3 through 30-10 for complete bit allocation in Message types 30 to 37;

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

IS :

Table 30-III. Clock Correction and Accuracy Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{oc}	Clock Data Reference Time of Week	11	300	604,500	seconds
URA_{NED0} Index	NED Accuracy Index	5*			(see text)
URA_{NED1} Index	NED Accuracy Change Index	3			(see text)
URA_{NED2} Index	NED Accuracy Change Rate Index	3			(see text)
a_{f2-n}	SV Clock Drift Rate Correction Coefficient	10*	2^{-60}		sec/sec^2
a_{f1-n}	SV Clock Drift Correction Coefficient	20*	2^{-48}		sec/sec
a_{f0-n}	SV Clock Bias Correction Coefficient	26*	2^{-35}		seconds

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

** See Figure 30-3 through 30-10 for complete bit allocation in Message types 30 to 37;

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

WAS :

Table 30-IV. Group Delay Differential Parameters ****				
Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
T_{GD}	13*	2^{-35}		seconds
$ISC_{L1C/A}$	13*	2^{-35}		seconds
ISC_{L2C}	13*	2^{-35}		seconds
ISC_{L5I5}	13*	2^{-35}		seconds
ISC_{L5Q5}	13*	2^{-35}		seconds
* Parameters so indicated are two's complement with the sign bit (+ or -) occupying the MSB; ** See Figure 30-3 for complete bit allocation in Message type 30; *** Effective range is the maximum range attainable with indicated bit allocation and scale factor; **** The bit string of "1000000000000" will indicate that the group delay value is not available.				

IS :

Table 30-IV. Group Delay Differential Parameters ****				
Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
T_{GD}	13*	2^{-35}		seconds
$ISC_{L1C/A}$	13*	2^{-35}		seconds
ISC_{L2C}	13*	2^{-35}		seconds
ISC_{L5I5}	13*	2^{-35}		seconds
ISC_{L5Q5}	13*	2^{-35}		seconds
* Parameters so indicated are two's complement with the sign bit (+ or -) occupying the MSB; ** See Figure 30-3 for complete bit allocation in Message type 30; *** Valid range is the maximum range attainable with indicated bit allocation and scale factor; **** The bit string of "1000000000000" will indicate that the group delay value is not available.				

WAS :

Table 30-V. Midi Almanac Parameters

Parameter	No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
t_{oa}	8	2^{12}	602,112	seconds
e	11	2^{-16}		dimensionless
δ_i****	11*	2^{-14}		semi-circles
$\dot{\Omega}$	11*	2^{-33}		semi-circles/sec
$\sqrt{A}$	17	2^{-4}		$\sqrt{\text{meters}}$
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 two's complement with the sign bit (+ or -) occupying the MSB;

** See Figure 30-10 for complete bit allocation in message type 37;

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

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

IS :

Table 30-V. Midi Almanac Parameters				
Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{oa}	8	2^{12}	602,112	seconds
e	11	2^{-16}	0.03	dimensionless
δ_i****	11*	2^{-14}		semi-circles
$\dot{\Omega}$	11*	2^{-33}	-5.20E-09 to 0.0	semi-circles/sec
$\sqrt{A}$	17	2^{-4}	4906 to 5390	$\sqrt{\text{meters}}$
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 two's complement with the sign bit (+ or -) occupying the MSB;

** See Figure 30-10 for complete bit allocation in message type 37;

*** 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.

WAS :

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^4	604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}	1	arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}	7.8125×10^{-3}	arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}	1	arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}	7.8125×10^{-3}	arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}	64	seconds
$\dot{\Delta}$UT1 †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}	7.8125×10^{-3}	seconds/day

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

** See Figure 30-5 for complete bit allocation in Message type 32;

*** Unless otherwise indicated in this column, effective 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.

IS :

Table 30-VII. Earth Orientation Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{EOP}	EOP Data Reference Time	16	2^{4}	604,784	seconds
PM_X †	X-Axis Polar Motion Value at Reference Time.	21*	2^{-20}	1	arc-seconds
$\dot{PM}$_X	X-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}	7.8125×10^{-3}	arc-seconds/day
PM_Y ††	Y-Axis Polar Motion Value at Reference Time.	21*	2^{-20}	1	arc-seconds
$\dot{PM}$_Y	Y-Axis Polar Motion Drift at Reference Time.	15*	2^{-21}	7.8125×10^{-3}	arc-seconds/day
ΔUT1 †††	UT1-UTC Difference at Reference Time.	31*	2^{-24}	64	seconds
$\dot{\Delta}$UT1 †††	Rate of UT1-UTC Difference at Reference Time	19*	2^{-25}	7.8125×10^{-3}	seconds/day

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

** See Figure 30-5 for complete bit allocation in Message type 32;

*** 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.

WAS :

Table 30-IX. UTC Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
A_{0-n}	Bias coefficient of GPS time scale relative to UTC time scale	16*	2^{-35}		Seconds
A_{1-n}	Drift coefficient of GPS time scale relative to UTC time scale	13*	2^{-51}		sec/sec
A_{2-n}	Drift rate correction coefficient of GPS time scale relative to UTC time scale	7*	2^{-68}		sec/sec^2
? t_{LS}	Current or past leap second count	8*	1		seconds
t_{ot}	Time data reference Time of Week	16	2^4	604,784	seconds
WN_{ot}	Time data reference Week Number	13	1		weeks
WN_{LSF}	Leap second reference Week Number	13	1		weeks
DN	Leap second reference Day Number	4****	1		days
? t_{LSF}	Current or future leap second count	8*	1		seconds

* Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;
** See Figure 30-6 for complete bit allocation;
*** Unless otherwise indicated in this column, effective range is the maximum range attainable with indicated bit allocation and scale factor;
**** Right justified.

IS :

Table 30-IX. UTC Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
A_{0-n}	Bias coefficient of GPS time scale relative to UTC time scale	16*	2^{-35}		Seconds
A_{1-n}	Drift coefficient of GPS time scale relative to UTC time scale	13*	2^{-51}		sec/sec
A_{2-n}	Drift rate correction coefficient of GPS time scale relative to UTC time scale	7*	2^{-68}		sec/sec^2
Δt_{LS}	Current or past leap second count	8*	1		seconds
t_{ot}	Time data reference Time of Week	16	2^4	604,784	seconds
WN_{ot}	Time data reference Week Number	13	1		weeks
WN_{LSF}	Leap second reference Week Number	13	1		weeks
DN	Leap second reference Day Number	4	1	1 to 7	days
Δt_{LSF}	Current or future leap second count	8*	1		seconds

* Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;
** See Figure 30-6 for complete bit allocation;
*** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.

WAS :

Table 30-X. Differential Correction Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
PRN ID		8			see text
δa_{f0}	SV Clock Bias Correction	13*	2^{-35}		seconds
δa_{f1}	SV Clock Drift Correction	8*	2^{-51}		seconds/second
UDRA	User Differential Range Accuracy Index	5*			see text
$\Delta\alpha$	Alpha Correction to Ephemeris Parameters	14*	2^{-34}		dimensionless
$\Delta\beta$	Beta Correction to Ephemeris Parameters	14*	2^{-34}		dimensionless
$\Delta\gamma$	Gamma Correction to Ephemeris Parameters	15*	2^{-32}		semi-circles
Δi	Angle of Inclination Correction	12*	2^{-32}		semi-circles
$\Delta\Omega$	Angle of Right Ascension Correction	12*	2^{-32}		semi-circles
ΔA	Semi-Major Correction	12*	2^{-9}		meters
$\dot{UDRA}$	Change Rate of User Differential Range Accuracy Index.	5*			see text

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

** See Figure 30-7 , 11 and 12 for complete bit allocation in Message types 34, 13 and 14;

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

IS :

Table 30-X. Differential Correction Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
PRN ID		8			see text
t_{op-D}	DC data predict time of week	11	300	604,500	seconds
t_{OD}	time of DC data	11	300	604,500	seconds
δa_{f0}	SV Clock Bias Correction	13*	2^{-35}		seconds
δa_{f1}	SV Clock Drift Correction	8*	2^{-51}		seconds/second
UDRA	User Differential Range Accuracy Index	5*			see text
$\Delta\alpha$	Alpha Correction to Ephemeris Parameters	14*	2^{-34}		dimensionless
$\Delta\beta$	Beta Correction to Ephemeris Parameters	14*	2^{-34}		dimensionless
$\Delta\gamma$	Gamma Correction to Ephemeris Parameters	15*	2^{-32}		semi-circles
Δi	Angle of Inclination Correction	12*	2^{-32}		semi-circles
$\Delta\Omega$	Angle of Right Ascension Correction	12*	2^{-32}		semi-circles
ΔA	Semi-Major Correction	12*	2^{-9}		meters
$\dot{A}$ UDRA	Change Rate of User Differential Range Accuracy Index.	5*			see text

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

** See Figure 30-7 , 11 and 12 for complete bit allocation in Message types 34, 13 and 14;

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

WAS :

Table 30-XI. GPS/GNSS Time Offset Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Effective Range***	Units
A_{0GGTO}	Bias coefficient of GPS time scale relative to GNSS time scale	16*	2^{-35}		seconds
A_{1GGTO}	Drift coefficient of GPS time scale relative to GNSS time scale	13*	2^{-51}		sec/sec
A_{2GGTO}	Drift rate correction coefficient of GPS time scale relative to GNSS time scale	7*	2^{-68}		sec/sec^2
t_{GGTO}	Time data reference Time of Week	16	2^4	604,784	seconds
WN_{GGTO}	Time data reference Week Number	13	2^0		weeks
GNSS ID	GNSS Type ID	3			see text

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

** See Figure 30-8 for complete bit allocation;

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

IS :

Table 30-XI. GPS/GNSS Time Offset Parameters					
Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
A_{0GGTO}	Bias coefficient of GPS time scale relative to GNSS time scale	16*	2^{-35}		seconds
A_{1GGTO}	Drift coefficient of GPS time scale relative to GNSS time scale	13*	2^{-51}		sec/sec
A_{2GGTO}	Drift rate correction coefficient of GPS time scale relative to GNSS time scale	7*	2^{-68}		sec/sec^2
t_{GGTO}	Time data reference Time of Week	16	2^4	604,784	seconds
WN_{GGTO}	Time data reference Week Number	13	2^0		weeks
GNSS ID	GNSS Type ID	3			see text
* Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB; ** See Figure 30-8 for complete bit allocation; *** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.					

40.3.3.5.1.1 Data ID and SV ID:

WAS :

The two MSBs of word three in each page shall contain the data ID. Data ID number two (denoted by binary code 01) denotes the LNAV data structure of D(t) which is described in this Appendix. Future data IDs will be defined as necessary.

As shown in Table 40-V, the data ID is utilized to provide one of two indications: (a) for those pages which are assigned to contain the almanac data of one specific SV, the data ID defines the data structure utilized by that SV whose almanac data are contained in that page; and (b) for all other pages, the data ID denotes the data structure of the transmitting SV.

The six LSBs of the SV ID are given by bits three through eight of word three in each page as shown in Table 40-V. Specific IDs are reserved for each page of subframes 4 and 5. The SV IDs are utilized in two different ways: (a) for those pages which contain the almanac data of a given SV, the SV ID is equal to

32 plus the number that is assigned to the PRN code phase of that SV (reference Tables 3-Ia and 3-Ib), and (b) for all other pages the SV ID assigned in accordance with Table 40-V serves as the "page ID". IDs 65 through 95 are assigned to those pages which contain the almanac data of specific SVs (pages 1-24 of subframe 5 and pages 2-5 and 7-9 of subframe 4). The "0" ID (binary all zeros) is assigned to indicate a dummy SV, while IDs 115 through 127 are utilized for pages containing other than almanac data of a specific SV. IDs 116 through 126 have the same data as LNAV-L IDs 52 through 62. ID 115 is the LNAV-U analog of ID 51 in LNAV-L, while ID 127 is the LNAV-U analog of ID 63 in LNAV-L.

Pages which carry the same SV ID (e.g., in subframe 4, pages 1, 6, 11, 16 and 21 carry an ID of 121, while pages 12 and 24 are designated by an ID of 126) may not be considered to contain identical data. The data in the pages with the same SV ID can be different. Pages 1, 6, 11, 16 and 21 reference Appendix II. Pages 12, 19, 20, 22, 23 and 24 reference Appendix II. Pages 14 and 15: (Reference Appendix II)

IS :
The two MSBs of word three in each page shall contain the data ID. Data ID number two (denoted by binary code 01) denotes the LNAV data structure of D(t) which is described in this Appendix and is the only valid value.

As shown in Table 40-V, the data ID is utilized to provide one of two indications: (a) for those pages which are assigned to contain the almanac data of one specific SV, the data ID defines the data structure utilized by that SV whose almanac data are contained in that page; and (b) for all other pages, the data ID denotes the data structure of the transmitting SV.

The six LSBs of the SV ID are given by bits three through eight of word three in each page as shown in Table 40-V. Specific IDs are reserved for each page of subframes 4 and 5. The SV IDs are utilized in two different ways: (a) for those pages which contain the almanac data of a given SV, the SV ID is equal to 32 plus the number that is assigned to the PRN code phase of that SV (reference Tables 3-Ia and 3-Ib), and (b) for all other pages the SV ID assigned in accordance with Table 40-V serves as the "page ID". IDs 65 through 95 are assigned to those pages which contain the almanac data of specific SVs (pages 1-24 of subframe 5 and pages 2-5 and 7-9 of subframe 4). The "0" ID (binary all zeros) is assigned to indicate a dummy SV, while IDs 115 through 127 are utilized for pages containing other than almanac data of a specific SV. IDs 116 through 126 have the same data as LNAV-L IDs 52 through 62. ID 115 is the LNAV-U analog of ID 51 in LNAV-L, while ID 127 is the LNAV-U analog of ID 63 in LNAV-L.

Pages which carry the same SV ID (e.g., in subframe 4, pages 1, 6, 11, 16 and 21 carry an ID of 121, while pages 12 and 24 are designated by an ID of 126) may not be considered to contain identical data. The data in the pages with the same SV ID can be different. Pages 1, 6, 11, 16 and 21 reference Appendix II. Pages 12, 19, 20, 22, 23 and 24 reference Appendix II. Pages 14 and 15: (Reference Appendix II)

40.3.3.5.1.4 AS Flags and SV Configuration:

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
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/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 SV).

Additional codes will be assigned in the future, should the need arise.

These four-bit terms shall occupy bits 9 through 24 of word three, the 24 MSBs of words four through seven, and the 12 MSBs of word eight, all in page 25 of subframe 4.

Since the anti-spoof information is updated by the CS at the time of upload, the anti-spoof data may not correspond to the actual anti-spoof status of the transmitting SV or other SVs in the constellation.

IS :
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, 101, 110, 111	Reserved

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/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 SV).

These four-bit terms shall occupy bits 9 through 24 of word three, the 24 MSBs of words four through seven, and the 12 MSBs of word eight, all in page 25 of subframe 4.

Since the anti-spoof information is updated by the CS at the time of upload, the anti-spoof data may not correspond to the actual anti-spoof status of the transmitting SV or other SVs in the constellation.
