INTERFACE REVISION NOTICE (IRN)

Note: This Summary Signature Page is to be used after all signatories have signed separate Signature Pages.

Affected ICD:	**IRN Number**	**Date:**
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RFC-00312	PIRN-IS-705D-003A	19-MAY-2017

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

Document Title: L5 SS and Nav User Segment Interfaces

Reason For Change (Driver): To remove ambiguity in contractor interpretation, the definition of the parameter Time of Predict (T_op) and other timing parameters must be clarified in the GPS technical baseline documentation.

Description of Change: Process RFC via the proposed changes with the correct stakeholders and update the appropriate documentation for accurate implementation.

Prepared By: Amit Patel **Checked By: Huey Nguyenhuu**

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	GPS Directorate Space & Missile Systems Center (SMC) – LAAFB	
See Section XX OR See Next Page	The Boeing Company	
See Section XX OR See Next Page	HQ Air Force Space Command (AFSPC/A5M)	
See Section XX OR See Next Page	Raytheon Company	
See Section XX OR See Next Page	Lockheed Martin Corporation (GPS III)	

Interface Control Contractor:
TASC (GPS SE&I)
An Engility Company
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CODE IDENT 66RP1

INTERFACE REVISION NOTICE (IRN)

Note: Repeat this Signature Page for each document signatory.

Affected ICD: IS-GPS-705 Rev D	**IRN Number** IRN-IS-705D-004	**Date:** 25-MAY-2017
Authority: RFC-00312	**PIRN Number** PIRN-IS-705D-003A	**Date:** 19-MAY-2017

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

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Description of Change: Process RFC via the proposed changes with the correct stakeholders and update the appropriate documentation for accurate implementation.

APPROVED:

With Comments: Yes ☐ No ☐

With Exceptions: Yes ☐ No ☐

Name of Approving Organization	Authorized Signature	Date

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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) An Engility Company 200 N. Sepulveda Blvd., Suite 1800 El Segundo, CA 90245
	CODE IDENT 66RP1

IS705-1496 :

Section Number :
6.1.0-1

WAS :

AFMC	-	Air Force Materiel Command
AFSPC	-	Air Force Space Command
ASCII	-	American Standard Code for Information Interchange
bps	-	bits per second
BPSK	-	Bi-Phase Shift Key
C/A	-	Course/Acquisition
CDC	-	Clock Differential Correction
CNAV	-	Civil Navigation
CRC	-	Cyclic Redundancy Check
CS	-	Control Segment
dB	-	Decibel
dBc	-	Power ratio of a signal to a (unmodulated) carrier signal, expressed in decibels
dBi	-	Decibels with respect to isotropic antenna
dBW	-	Decibels with respect to 1 Watt
DC	-	Differential Correction
DoD	-	Department of Defense
ECEF	-	Earth-Centered, Earth-Fixed
ECI	-	Earth Centered Inertial
EDC	-	Ephemeris Differential Correction
EOL	-	End of Life
FEC	-	Forward Error Correction
GGTO	-	GPS/GNSS Time Offset
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GPSW	-	Global Positioning System Wing

Hz	-	Hertz
I5	-	In-phase Code on L5 Signal
ICC	-	Interface Control Contractor
ID	-	Identification
IODC	-	Issue of Data, Clock
IS	-	Interface Specification
ISC	-	Inter-Signal Correction
LSB	-	Least Significant Bit
MSB	-	Most Significant Bit
NAV	-	Navigation
NSI5	-	Non-Standard I-Code
NSQ5	-	Non-Standard Q-Code
OCS	-	Operational Control System
PIRN	-	Proposed Interface Revision Notice
PRN	-	Pseudo-Random Noise
P(Y)	-	Precise (Anti-Spoof) Code
Q5	-	Quadraphase code on L5 Signal
RF	-	Radio Frequency
RHCP	-	Right Hand Circular Polarization
RMS	-	Root Mean Square
SBAS	-	Satellite Based Augmentation System
sps	-	Symbols per Second.
SIS	-	Signal In Space
SS	-	Space Segment
SSV	-	Space Service Volume
SV	-	Space Vehicle
TBD	-	To Be Determined
TBS	-	To Be Supplied
TOW	-	Time Of Week
URA	-	User Range Accuracy

US	-	User Segment
USNO	-	US Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984
WN	-	Week Number
WN_e	-	Extended Week Number

Redlines :

AFMC	-	Air Force Materiel Command
AFSPC	-	Air Force Space Command
ASCII	-	American Standard Code for Information Interchange
bps	-	bits per second
BPSK	-	Bi-Phase Shift Key
C/A	-	Course/Acquisition
CDC	-	Clock Differential Correction
CEI	-	Clock, Ephemeris, Integrity
CNAV	-	Civil Navigation
CRC	-	Cyclic Redundancy Check
CS	-	Control Segment
dB	-	Decibel
dBc	-	Power ratio of a signal to a (unmodulated) carrier signal, expressed in decibels
dBi	-	Decibels with respect to isotropic antenna
dBW	-	Decibels with respect to 1 Watt
DC	-	Differential Correction
DoD	-	Department of Defense
ECEF	-	Earth-Centered, Earth-Fixed
ECI	-	Earth Centered Inertial
EDC	-	Ephemeris Differential Correction

EOL	-	End of Life
FEC	-	Forward Error Correction
GGTO	-	GPS/GNSS Time Offset
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GPSW	-	Global Positioning System Wing
Hz	-	Hertz
I5	-	In-phase Code on L5 Signal
ICC	-	Interface Control Contractor
ID	-	Identification
IODC	-	Issue of Data, Clock
IS	-	Interface Specification
ISC	-	Inter-Signal Correction
LSB	-	Least Significant Bit
MSB	-	Most Significant Bit
NAV	-	Navigation
NSI5	-	Non-Standard I-Code
NSQ5	-	Non-Standard Q-Code
OCS	-	Operational Control System
PIRN	-	Proposed Interface Revision Notice
PRN	-	Pseudo-Random Noise
P(Y)	-	Precise (Anti-Spoof) Code
Q5	-	Quadraphase code on L5 Signal
RF	-	Radio Frequency
RHCP	-	Right Hand Circular Polarization
RMS	-	Root Mean Square
SBAS	-	Satellite Based Augmentation System
sps	-	Symbols per Second.
SIS	-	Signal In Space
SS	-	Space Segment

SSV	-	Space Service Volume
SV	-	Space Vehicle
TBD	-	To Be Determined
TBS	-	To Be Supplied
TOW	-	Time Of Week
URA	-	User Range Accuracy
US	-	User Segment
USNO	-	US Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984
WN	-	Data Sequence Propagation Week Number
WN_e	-	Extended Week Number

IS :

AFMC	-	Air Force Materiel Command
AFSPC	-	Air Force Space Command
ASCII	-	American Standard Code for Information Interchange
bps	-	bits per second
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CNAV	-	Civil Navigation
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dBi	-	Decibels with respect to isotropic antenna

dBW	-	Decibels with respect to 1 Watt
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DoD	-	Department of Defense
ECEF	-	Earth-Centered, Earth-Fixed
ECI	-	Earth Centered Inertial
EDC	-	Ephemeris Differential Correction
EOL	-	End of Life
FEC	-	Forward Error Correction
GGTO	-	GPS/GNSS Time Offset
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GPSW	-	Global Positioning System Wing
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I5	-	In-phase Code on L5 Signal
ICC	-	Interface Control Contractor
ID	-	Identification
IODC	-	Issue of Data, Clock
IS	-	Interface Specification
ISC	-	Inter-Signal Correction
LSB	-	Least Significant Bit
MSB	-	Most Significant Bit
NAV	-	Navigation
NSI5	-	Non-Standard I-Code
NSQ5	-	Non-Standard Q-Code
OCS	-	Operational Control System
PIRN	-	Proposed Interface Revision Notice
PRN	-	Pseudo-Random Noise
P(Y)	-	Precise (Anti-Spoof) Code
Q5	-	Quadraphase code on L5 Signal
RF	-	Radio Frequency

RHCP	-	Right Hand Circular Polarization
RMS	-	Root Mean Square
SBAS	-	Satellite Based Augmentation System
sps	-	Symbols per Second.
SIS	-	Signal In Space
SS	-	Space Segment
SSV	-	Space Service Volume
SV	-	Space Vehicle
TBD	-	To Be Determined
TBS	-	To Be Supplied
TOW	-	Time Of Week
URA	-	User Range Accuracy
US	-	User Segment
USNO	-	US Naval Observatory
UTC	-	Coordinated Universal Time
WGS 84	-	World Geodetic System 1984
WN	-	Data Sequence Propagation Week Number
WN_e	-	Extended Week Number

IS705-1514 :
Insertion after object IS705-1512

Section Number :
6.2.8

WAS :
N/A

Redlines :
Clock, Ephemeris, Integrity (CEI) Data Set.

IS :
Clock, Ephemeris, Integrity (CEI) Data Set.

IS705-1515 :
Insertion below object IS705-1514

Section Number :
6.2.8.1

WAS :
N/A

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-I-1. The entire CEI data set is needed for maximum accuracy. However, the core CEI data set (parameters without NOTE1 in Table 6-I-1) 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-I-1. The entire CEI data set is needed for maximum accuracy. However, the core CEI data set (parameters without NOTE1 in Table 6-I-1) 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.

IS705-1523 :
Insertion after object IS705-1515

Section Number :
6.2.8.2

WAS :
N/A

Redlines :
Core CEI Data Set.

IS :
Core CEI Data Set.

IS705-1524 :
Insertion below object IS705-1523

Section Number :
6.2.8.2.1

WAS :
N/A

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 -- see Table 20-XII. The top 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-I-1.

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 -- see Table 20-XII. 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-I-1.

IS705-1520 :
Insertion after object IS705-1523

Section Number :
6.2.8.3

WAS :
N/A

Redlines :
Table 6-I-1. CEI Data Set Parameters

IS :
Table 6-I-1. CEI Data Set Parameters

IS705-1521 :
Insertion after object IS705-1520

Section Number :
6.2.8.4

WAS :
N/A

Redlines :

Symbol	Parameter Name	Message
$\dot{A}$	Change Rate in Semi-major Axis	10
ΔA	Semi-major Axis Difference at Reference Time	10
Δn_0	Mean Motion Difference from Computed Value at Reference Time	10
$\Delta \dot{n_0}$	Rate of Mean Motion Difference from Computed Value	10
ω	Argument of Perigee	10
e	Eccentricity	10
ISF	Integrity Status Flag NOTE1	10
(L1/L2/L5)	Signal Health (3 bits)	10
M_0	Mean Anomaly at Reference Time	10
URA_{ED}	Elevation Dependent User Range Accuracy	10

Symbol	Parameter Name	Message
WN_n	Week Number	10
t_{oe}	Time of Ephemeris	10, 11
t_{op}	CEI Data Sequence Propagation Time of Week	10, 30-37
$\dot{\Omega}$	Rate of Right Ascension	11
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	11
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	11
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	11
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	11
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	11
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	11
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	11
i_0	Inclination Angle at Reference Time	11
$i_{0\text{-}n}$-DOT	Rate of Inclination Angle	11
$ISC_{L1C/A}$	Inter-signal Correction	30
ISC_{L2C}	Inter-signal Correction	30
ISC_{L5I5}	Inter-signal Correction	30
ISC_{L5Q5}	Inter-signal Correction	30
T_{GD}	Group Delay Differential	30
a_{f0}	SV Clock Bias Correction Coefficient	30-37
a_{f1}	SV Clock Drift Correction Coefficient	30-37
a_{f2}	Drift Rate Correction Coefficient Index	30-37
t_{oc}	Time of Clock	30-37
URA_{NED0}	NED Accuracy Index	30-37
URA_{NED1}	NED Accuracy Change Index	30-37
URA_{NED2}	NED Accuracy Change Rate Index	30-37
Alert	Alert Flag [NOTE1]	All
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}/t_{oc}. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}/t_{oc}.		

IS :

Symbol	Parameter Name	Message
$\dot{A}$	Change Rate in Semi-major Axis	10
ΔA	Semi-major Axis Difference at Reference Time	10
Δn_0	Mean Motion Difference from Computed Value at Reference Time	10
$\Delta \dot{n_0}$	Rate of Mean Motion Difference from Computed Value	10
ω	Argument of Perigee	10
e	Eccentricity	10
ISF	Integrity Status Flag [NOTE1]	10
(L1/L2/L5)	Signal Health (3 bits)	10
M_0	Mean Anomaly at Reference Time	10
URA_{ED}	Elevation Dependent User Range Accuracy	10
WN_n	Week Number	10
t_{oe}	Time of Ephemeris	10, 11
t_{op}	CEI Data Sequence Propagation Time of Week	10, 30-37
$\dot{\Omega}$	Rate of Right Ascension	11
Ω_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	11
C_{ic}	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	11
C_{is}	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	11
C_{rc}	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	11
C_{rs}	Amplitude of the Sine Correction Term to the Orbit Radius	11
C_{uc}	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	11
C_{us}	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	11
i_0	Inclination Angle at Reference Time	11
$i_{0\text{-}n}$-DOT	Rate of Inclination Angle	11
$ISC_{L1C/A}$	Inter-signal Correction	30
ISC_{L2C}	Inter-signal Correction	30
ISC_{L5I5}	Inter-signal Correction	30
ISC_{L5Q5}	Inter-signal Correction	30
T_{GD}	Group Delay Differential	30
a_{f0}	SV Clock Bias Correction Coefficient	30-37
a_{f1}	SV Clock Drift Correction Coefficient	30-37
a_{f2}	Drift Rate Correction Coefficient Index	30-37
t_{oc}	Time of Clock	30-37
URA_{NED0}	NED Accuracy Index	30-37

Symbol	Parameter Name	Message
URA_{NED1}	NED Accuracy Change Index	30-37
URA_{NED2}	NED Accuracy Change Rate Index	30-37
Alert	Alert Flag NOTE1	All
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}/t_{oc}. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}/t_{oc}.		

IS705-1516 :
Insertion after object IS705-1514

Section Number :
6.2.9

WAS :
N/A

Redlines :
CEI Data Sequence Propagation.

IS :
CEI Data Sequence Propagation.

IS705-1517 :
Insertion below object IS705-1516

Section Number :
6.2.9.1

WAS :
N/A

Redlines :
A related time-ordered sequence of CEI data sets in which each successive CEI data set is a time propagation of the preceding CEI data set. Special provisions apply to alert users to discontinuities separating one CEI data sequence propagation from another CEI data sequence propagation (e.g., after an upload occurs). An upload may include multiple segments of temporally continuous CEI data sequence propagations.

IS :
A related time-ordered sequence of CEI data sets in which each successive CEI data set is a time propagation of the preceding CEI data set. Special provisions apply to alert users to discontinuities separating one CEI data sequence propagation from another CEI data sequence propagation (e.g., after an upload occurs). An upload may include multiple segments of temporally continuous CEI data sequence propagations.

IS705-215 :

Section Number :
20.3.3.1.1.0-3

WAS :
The t_{oe} term shall provide the user with a convenient means for detecting any change in the ephemeris representation parameters. The t_{oe} is provided in both message type 10 and 11 for the purpose of comparison with the t_{oc} term in message type 30 - 37. Whenever these three terms do not match, a data set cutover has occurred and new data must be collected. The timing of the t_{oe} and constraints on the t_{oc} and t_{oe} are defined in paragraph 20.3.4.4.

Redlines :
The toe term shall provide the user with a convenient means for detecting any change in the ephemeris representation parameters. The toe is provided in both message type 10 and 11 for the purpose of comparison with the toc term in message type 30 - 37. Whenever these three terms do not match, a CEI data set cutover has occurred and new data must be collected. The timing of the toe and constraints on the toc and toe are defined in paragraph 20.3.4.4.

IS :
The t_{oe} term shall provide the user with a convenient means for detecting any change in the ephemeris representation parameters. The t_{oe} is provided in both message type 10 and 11 for the purpose of comparison with the t_{oc} term in message type 30 - 37. Whenever these three terms do not match, a CEI data set cutover has occurred and new data must be collected. The timing of the t_{oe} and constraints on the t_{oc} and t_{oe} are defined in paragraph 20.3.4.4.

IS705-216 :

Section Number :
20.3.3.1.1.0-4

WAS :
Any change in the message type 10 and 11 ephemeris data will be accomplished with a simultaneous change in the t_{oe} value. The CS will assure the t_{oe} value for Block IIR-M/IIF and SS will assure the t_{oe} value for GPS III, for at least the first data set transmitted by an SV after an upload, is different from that transmitted prior to the cutover. See Section 20.3.4.5 for additional information regarding t_{oe}.

Redlines :
Any change in the message type 10 and 11 ephemeris data will be accomplished with a simultaneous change in the toe value. The CS ~~will assure the toe value for~~ (Block ~~IIR-M/~~IIF) and SS (GPS III) will assure that the toe value ~~for GPS III~~, for at least the first CEI data set transmitted by an SV ~~after~~from ~~an~~a ~~upload~~new CEI data sequence propagation, is different from that transmitted from the prior ~~to~~CEI ~~the~~data ~~cutover.~~sequence propagation. ~~See~~(reference ~~Section~~paragraph 20.3.4.5 ~~for additional information regarding toe.~~)

IS :
Any change in the message type 10 and 11 ephemeris data will be accomplished with a simultaneous change in the t_{oe} value. The CS (Block IIF) and SS (GPS III) will assure that the t_{oe} value, for at least the first CEI data set transmitted by an SV from a new CEI data sequence propagation, is different from that transmitted from the prior CEI data sequence propagation. (reference paragraph 20.3.4.5)

IS705-222 :

Section Number :
20.3.3.1.1.1.0-1

WAS :
Bits 39 through 51 of message type 10 shall contain 13 bits which are a modulo-8192 binary representation of the current GPS week number at the start of the data set transmission interval (see paragraph 6.2.4 of IS-GPS-200).

Redlines :
Bits 39 through 51 of message type 10 shall contain 13 bits which are a modulo-8192 binary representation of the current GPS week number at the start of the CEI data set transmission interval (see paragraph 6.2.4 of IS-GPS-200).

IS :
Bits 39 through 51 of message type 10 shall contain 13 bits which are a modulo-8192 binary representation of the current GPS week number at the start of the CEI data set transmission interval (see paragraph 6.2.4 of IS-GPS-200).

IS705-225 :

Section Number :
20.3.3.1.1.2.0-2

WAS :
The predicted health data will be updated at the time of upload when a new data set has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV.

Redlines :
The predicted health data will be updated at the time of upload when a new CEI data set has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV.

IS :
The predicted health data will be updated at the time of upload when a new CEI data set has been built by the CS. The transmitted health data may not correspond to the actual health of the transmitting SV.

IS705-227 :

Section Number :
20.3.3.1.1.3

WAS :
Data Predict Time of Week.

Redlines :
CEI Data ~~Predict~~Sequence Propagation Time of Week.

IS :
CEI Data Sequence Propagation Time of Week.

IS705-228 :

Section Number :
20.3.3.1.1.3.0-1

WAS :
Bits 55 through 65 of message type 10 shall contain the data predict time of week (t_{op}). The top term provides the epoch time of week of the state estimate utilized for the prediction of satellite quasi-Keplerian ephemeris parameters.

Redlines :
Bits 55 through 65 of message type 10 shall contain the CEI data ~~predict~~sequence propagation time of week (top). The top term provides the epoch time of week of the state ~~estimate~~data utilized for ~~the~~satellite ~~prediction~~CEI data. Users are cautioned to avoid using this parameter to compute age of ~~satellite~~data ~~quasi-Keplerian~~for ~~ephemeris~~any ~~parameters~~SV.

IS :
Bits 55 through 65 of message type 10 shall contain the CEI data sequence propagation time of week (t_{op}). The t_{op} term provides the epoch time of week of the state data utilized for satellite CEI data. Users are cautioned to avoid using this parameter to compute age of data for any SV.

IS705-239 :

Section Number :
20.3.3.1.3.0-1

WAS :
The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 20-II. The ephemeris parameters are Keplerian in appearance; the values of these parameters, however, are produced by the CS (Block IIF) or the SV (GPS III) via a least squares curve fit of the predicted ephemeris of the SV APC (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4 of IS-GPS-200.

Redlines :
The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 20-II. The ephemeris parameters are Keplerian in appearance; the values of these parameters~~,~~; however, are produced by the CS (Block IIF) or the SV (GPS III) via a least squares curve fit of the ~~predicted~~propagated ephemeris of the SV APC (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4 of IS-GPS-200.

IS :
The user shall compute the ECEF coordinates of position for the SV's antenna phase center (APC) utilizing a variation of the equations shown in Table 20-II. The ephemeris parameters are Keplerian in appearance; the values of these parameters; however, are produced by the CS (Block IIF) or the SV (GPS III) via a least squares curve fit of the

propagated ephemeris of the SV APC (time-position quadruples; t, x, y, z expressed in ECEF coordinates). Particulars concerning the applicable coordinate system are given in Sections 20.3.3.4.3.3 and 20.3.3.4.3.4 of IS-GPS-200.

IS705-241 :

Section Number :
20.3.3.1.3.0-3

WAS :

Table 20-I. Message Types 10 and 11 Parameters (1 of 2)

Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
WN	Week No.	13	1		weeks
URA_{ED} INDEX	ED accuracy	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	Data predict time of week	11	300	0 to 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
$M_{0\text{-}n}$	Mean anomaly at reference time	33*	2^{-32}		semi-circles
e_n	Eccentricity	33	2^{-34}	0.0 to 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 20-1 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.

Redlines :

Table 20-II. Message Types 10 and 11 Parameters (1 of 2)

Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
WN	Data Sequence Propagation Week Number	13	1		weeks
URA_{ED} INDEX	ED accuracy	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	CEI Data sequence propagation time of week	11	300	0 to 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
$\Delta \dot{n}_0$	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}	0.0 to 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 20-1 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.

IS :

Table 20-III. Message Types 10 and 11 Parameters (1 of 2)

Parameter Symbol	Parameter Description	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units

WN	Data Sequence Propagation Week Number	13	1		weeks
URA_{ED} INDEX	ED accuracy	5*			(see text)
Signal health (L1/L2/L5)		3	1		(see text)
t_{op}	CEI Data sequence propagation time of week	11	300	0 to 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
$\Delta \dot{n}_0$	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}	0.0 to 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 20-1 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.

IS705-247 :

Section Number :
20.3.3.2.1.0-1

WAS :
The clock parameters in any one of message types 30 through 37 describe the SV time scale during the period of validity. The parameters are applicable during the time in which they are transmitted. Beyond that time they are still applicable, however, the most recent data set should be used since the accuracy degrades over time.

Redlines :
The clock parameters in any one of message types 30 through 37 describe the SV time scale during the period of validity. The parameters are applicable during the time in which they are transmitted. Beyond that time they are still applicable, however, the most recent CEI data set should be used since the accuracy degrades over time.

IS :
The clock parameters in any one of message types 30 through 37 describe the SV time scale during the period of validity. The parameters are applicable during the time in which they are transmitted. Beyond that time they are still applicable, however, the most recent CEI data set should be used since the accuracy degrades over time.

IS705-251 :

Section Number :
20.3.3.2.1.2

WAS :
Data Predict Time of Week.

Redlines :
CEI Data ~~Predict~~Sequence Propagation Time of Week.

IS :
CEI Data Sequence Propagation Time of Week.

IS705-252 :

Section Number :
20.3.3.2.1.2.0-1

WAS :
Bits 39 through 49 of message types 30 through 37 shall contain the data predict time of week (top). The top term provides the epoch time of week of the state estimate utilized for the prediction of SV clock correction coefficients.

Redlines :
Bits 39 through 49 of message types 30 through 37 shall contain the CEI data ~~predict~~sequence propagation time of week (top). The top term provides the epoch time of week of the state ~~estimate~~data utilized for ~~the prediction~~propagating ~~of~~the SV clock correction coefficients forward in time. Users are cautioned to avoid using this parameter to compute age of data for any SV.

IS :
Bits 39 through 49 of message types 30 through 37 shall contain the CEI data sequence propagation time of week (t_{op}). The t_{op} term provides the epoch time of week of the state data utilized for propagating the SV clock correction coefficients forward in time. Users are cautioned to avoid using this parameter to compute age of data for any SV.

IS705-257 :

Section Number :
20.3.3.2.3.0-2

WAS :

Table 20-III. Clock Correction and Accuracy Parameters					
Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{op}	Data Predict Time of Week	11	300	0 to 604,500	seconds
t_{oc}	Clock Data Reference Time of Week	11	300	0 to 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 20-3 through 20-10 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.					

Redlines :

Table 20-III. Clock Correction and Accuracy Parameters					
Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{op}	CEI Data Sequence Propagation Time of Week	11	300	0 to 604,500	seconds
t_{oc}	Clock Data Reference Time of Week	11	300	0 to 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}		10*	2^{-60}		sec/sec^2

a_{f1-n}	SV Clock Drift Rate Correction Coefficient 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 20-3 through 20-10 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.

IS :

Table 20-III. Clock Correction and Accuracy Parameters

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
t_{op}	CEI Data Sequence Propagation Time of Week	11	300	0 to 604,500	seconds
t_{oc}	Clock Data Reference Time of Week	11	300	0 to 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 20-3 through 20-10 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.

IS705-1500 :

Section Number :
20.3.3.3.1.5

WAS :
Data Predict Week Number.

Redlines :
CEI Data ~~Predict~~Sequence Propagation Week Number.

IS :
CEI Data Sequence Propagation Week Number.

IS705-1502 :

Section Number :
20.3.3.3.1.5.0-1

WAS :
Bits 257-264 of Message Type 30 shall indicate the Data Predict Week Number (WN_{OP}) to which the Data Predict Time of Week (t_{op}) is referenced (see 20.3.3.1.1.3 and 20.3.3.2.1.2). The WN_{OP} term consists of eight bits which shall be a modulo 256 binary representation of the GPS week number to which the t_{op} is referenced. The user must account for the truncated nature of WN_{op} in all calculations in which WN_{op} is used.

Redlines :
Bits 257-264 of Message Type 30 shall indicate the CEI Data ~~Predict~~Sequence Propagation Week Number (~~WNOP~~WNop) to which the ~~Data Predict Time of Week (~~top~~)~~ is referenced (see 20.3.3.1.1.3 and 20.3.3.2.1.2). The ~~WNOP~~WNop term consists of eight bits which shall be a modulo 256 binary representation of the GPS week number to which the top is referenced. The user must account for the truncated nature of WNop in all calculations in which WNop is used. The combination of the epoch time of state data (top, WNop) for a valid CEI data sequence propagation will be in the past relative to the time of broadcast.

IS :
Bits 257-264 of Message Type 30 shall indicate the CEI Data Sequence Propagation Week Number (WN_{op}) to which the t_{op} is referenced (see 20.3.3.1.1.3 and 20.3.3.2.1.2). The WN_{op} term consists of eight bits which shall be a modulo 256 binary representation of the GPS week number to which the t_{op} is referenced. The user must account for the truncated nature of WN_{op} in all calculations in which WN_{op} is used. The combination of the epoch time of state data (t_{op}, WN_{op}) for a valid CEI data sequence propagation will be in the past relative to the time of broadcast.

IS705-349 :

Section Number :
20.3.3.7.3.0-1

WAS :
The SV PRN code phase offset, uncorrected by clock correction coefficient updates, is given by equation 2 in 20.3.3.3.3.1 of IS-GPS-200 (see paragraph 20.3.3.2.3). If the matched pair of DC data for the subject SV is available, the user may apply clock correction coefficient update values by;

$\Delta t_{sv} = (a_{f0} + \delta a_{f0}) + (a_{f1} + \delta a_{f1})(t - t_{oc}) + a_{f2}(t - t_{oc})^2 + \Delta t_r$

where δa_{f0} and δa_{f1}, (see Table 20-X), are given in message types 34 or 13, and all other terms are as stated in 20.3.3.3.3.1 of IS-GPS-200. Clock-related DC data shall not be applied to any SV transmitting clock correction parameters message(s) containing a t_{op} value greater than the t_{op-D} value of messages types 34 or 13 containing the clock-related DC data.

Redlines :
The SV PRN code phase offset, uncorrected by clock correction coefficient updates, is given by equation 2 in 20.3.3.3.3.1 of IS-GPS-200 (see paragraph 20.3.3.2.3). If the matched pair of DC data for the subject SV is available, the user may apply clock correction coefficient update values by;

Dtsv = (af0 + daf0) + (af1 + daf1)(t - toc) + af2(t - toc)2 + Dtr

where daf0 and daf1, (see Table 20-X), are given in message types 34 or 13, and all other terms are as stated in 20.3.3.3.3.1 of IS-GPS-200. Clock-related DC data shall not be applied to any SV transmitting clock correction parameters message(s) containing a top value greater than the top-D value of ~~messages~~message types 34 or 13 containing the clock-related DC data.

IS :
The SV PRN code phase offset, uncorrected by clock correction coefficient updates, is given by equation 2 in 20.3.3.3.3.1 of IS-GPS-200 (see paragraph 20.3.3.2.3). If the matched pair of DC data for the subject SV is available, the user may apply clock correction coefficient update values by;

$\Delta t_{sv} = (a_{f0} + \delta a_{f0}) + (a_{f1} + \delta a_{f1})(t - t_{oc}) + a_{f2}(t - t_{oc})^2 + \Delta t_r$

where δa_{f0} and δa_{f1}, (see Table 20-X), are given in message types 34 or 13, and all other terms are as stated in 20.3.3.3.3.1 of IS-GPS-200. Clock-related DC data shall not be applied to any SV transmitting clock correction parameters message(s) containing a t_{op} value greater than the t_{op-D} value of message types 34 or 13 containing the clock-related DC data.

IS705-1476 :

Section Number :
20.3.4.4

WAS :
Data Sets

Redlines :
CEI Data Sets

IS :
CEI Data Sets

IS705-1477 :

Section Number :
20.3.4.4.0-1

WAS :
The t_{oe} shall be equal to the toc of the same CNAV data set. The following rules govern the transmission of toe and t_{oc} values in different data sets: (1) The transmitted t_{oc} will be different from any value transmitted by the SV during the preceding seven days; (2) The transmitted t_{oe} will be different from any value transmitted by the SV during the preceding six hours.

Cutovers to new data sets will occur only on hour boundaries except for the first data set of a new upload. The first data set may be cut-in (reference paragraph 20.3.4.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

The start of the transmission interval for each data set corresponds to the beginning of the curve fit interval for the data set. Each data set remains valid for the duration of its transmission interval, and nominally also remains valid for the duration of its curve fit interval. A data set is rendered invalid before the end of its curve fit interval when it is superseded by the SV cutting over to the first data set of a new upload.

Normal Operations. The message type 10, 11, and 30-37 data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.

Redlines :
The toe shall be equal to the toc of the same CNAV CEI data set. ~~The~~top ~~following~~does ~~rules~~not ~~govern~~have ~~the~~to ~~transmission~~match ~~of~~ toe ~~and~~/ toc. ~~values~~As ~~in~~a ~~different~~redundant ~~data~~check, ~~sets:~~top ~~(1)~~in ~~The~~message ~~transmitted~~type ~~toc~~10 will ~~be~~match ~~different~~with ~~from~~the ~~any~~top ~~value~~term ~~transmitted~~in ~~by~~message ~~the~~type ~~SV~~30-37 ~~during~~for a valid CEI data set. The following rule governs the ~~preceding~~transmission ~~seven~~of ~~days;~~toe ~~(2)~~and toc values in different CEI data sets: The transmitted toe/toc will be different from any value transmitted by the SV during the preceding six hours.

Cutovers to new CEI data sets will occur only on hour boundaries except for the first CEI data set of a new ~~upload~~CEI data sequence propagation. The first CEI data set may be cut-in (reference paragraph 20.3.4.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

The start of the transmission interval for each CEI data set corresponds to the beginning of the curve fit interval for the CEI data set. Each CEI data set remains valid for the duration of its transmission interval, and nominally also remains valid for the duration of its curve fit interval. A CEI data set is rendered invalid before the end of its curve fit interval when it is superseded by the SV cutting over to the first CEI data set of a new ~~upload~~CEI data sequence propagation.

Normal Operations. The message type 10, 11, and 30-37 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.

IS :
The t_{oe} shall be equal to the t_{oc} of the same CNAV CEI data set. t_{op} does not have to match t_{oe}/ t_{oc}. As a redundant check, t_{op} in message type 10 will match with the t_{op} term in message type 30-37 for a valid CEI data set. The following rule governs the transmission of t_{oe} and t_{oc} values in different CEI data sets: The transmitted t_{oe}/t_{oc} will be different from any value transmitted by the SV during the preceding six hours.

Cutovers to new CEI data sets will occur only on hour boundaries except for the first CEI data set of a new CEI data sequence propagation. The first CEI data set may be cut-in (reference paragraph 20.3.4.1) at any time during the hour and therefore may be transmitted by the SV for less than one hour.

The start of the transmission interval for each CEI data set corresponds to the beginning of the curve fit interval for the CEI data set. Each CEI data set remains valid for the duration of its transmission interval, and nominally also remains valid for the duration of its curve fit interval. A CEI data set is rendered invalid before the end of its curve fit interval when it is superseded by the SV cutting over to the first CEI data set of a new CEI data sequence propagation.

Normal Operations. The message type 10, 11, and 30-37 CEI data sets are transmitted by the SV for periods of two hours. The corresponding curve fit interval is three hours.

IS705-1522 :
Insertion after object IS705-1477

Section Number :
20.3.4.4.1

WAS :
N/A

Redlines :
Updates to parameters in table 6-I-1 shall prompt changes in toe/toc. Any parameter marked with NOTE1 may be changed with or without a change in toe/toc.

IS :
Updates to parameters in table 6-I-1 shall prompt changes in t_{oe}/t_{oc}. Any parameter marked with NOTE1 may be changed with or without a change in t_{oe}/t_{oc}.
