



# IS-GPS-200 and IS-GPS-705 ICWG Minutes



**Minutes Date: 24 Nov 08**  
**Minutes By: Annabelle Abayon**

**Meeting Date: 19 Nov 08**  
**Organizer: GPSW/SE&I**

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## **ICWG Co-Chairs**

Capt Neal Roach  
Thomas Davis

## **ICWG Administration:**

Presentations on constellation expansion and NPEF results were given by Karl Kovach. The Comments Resolution Matrix (CRM) was reviewed line by line allowing the ICWG members to provide feedback on the proposed changes and in some cases the proposed resolution. The CRM and IS documents were updated in real-time and was the method used for capturing/documenting the disposition of each comment. Not all recommended changes will be incorporated into the document for the 12 Feb 09 revision. Some of the issues need further review by one or more of the stakeholders (e.g., carrier phase noise language), refer to the CRM for more detail.

The CRM was sorted by importance/subject area in order to expedite the discussions during the meeting. The minutes are organized in the same manner.

## **IS-GPS-200 CRM Review**

### *Comment 111*

The ICWG stakeholders stated that the suggested change is insufficient and needs to include a description for code "100". The change was made in real time, but exact language would need some revision. Mike Dash was assigned an action item to develop the new language and provide in the minutes. The proposed new language is below:

- "000      No A-S capability, no flags for A-S; memory capacity is other than described in paragraph 20.3.2 (e.g.,Block II/IIA/IIR SV).
- 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., Block IIIA SV). (e.g., Block IIIA SV).
- 101-111 Undefined

The undefined Additional codes will be assigned definition in the future, should the need arise. While UE developers can't anticipate what future definitions will be assigned to the undefined codes, UE shall be able to acquire and track SVs that transmit codes identified above as "Undefined" IAW applicable UE requirements."

*Comment 104*

There is concern that there is not a way to ensure changes that are made in one document but affect multiple documents will be made to those multiple documents. An action was assigned to Dr. Mike Munoz to coordinate with Mike Dash to evaluate possible solutions. The comment was deferred.

*Comment 103*

There is concern that the process and management of the documents needs improvement. It was agreed that this discussion was necessary but not in this forum. This will be worked offline.

*Comment 74*

It was suggested that the 2<sup>nd</sup> paragraph of section 3.3.1.5 be deleted and new language be added to reflect the findings of NPEF. This would include changing the title of section 3.3.1.5 from "Phase Quadrature" to "Signal Component Phase Relationship". An action was assigned to Karl Kovach to review and provide new language. Stakeholders agreed to defer comment.

*Comment 56*

The description of the additional PRN sequences is not consistent between IS-GPS-200, IS-GPS-705 and IS-GPS-800. An action was assigned to Dr. Munoz to resolve the issue. This comment will remain open.

*Comment 53*

It was proposed to add Blk III or Blk IIIA to the list of SV Blocks that have guaranteed memory retentivity for 60 days. The stakeholders agreed that all blocks of SVs subsequent to Block IIA would have this capability. The language was rewritten to state, "The memory retentivity is guaranteed for at least 60 days for SVs subsequent to Block IIA." The stakeholders concurred and the changes were made in real-time.

*Comment 51*

New language regarding the replenishment of operational SVs was introduced for Block III SVs. The stakeholders concurred with the proposed change with some modification. Changes were made in real-time.

*Comment 50*

The comment was in regards to adding "Block III" to the list of designated operational SVs. The stakeholders concurred with the proposed change.

*Comment 49*

It was suggested that the reference to the "29-bit binary number" for Z-count be removed and made more generic; now reads "binary number". The stakeholders concurred with the change, and the change was made in real-time.

#### *Comment 48*

New language was introduced to describe L2 ellipticity for Block III SVs. The stakeholders concurred with the new language with some modification. The change was made in real-time.

#### *Comment 47*

It was suggested that the angular range for the L1 ellipticity be changed from “±14.3 degrees from boresight” to “±13.8 degrees from nadir”. The stakeholders concurred with the change, and the change was made in real-time.

#### *Comment 4*

The wording, “and subsequent satellites” was removed from Table 3-Vb. Changes were made in real time and the stakeholders concur.

#### *Comment 110*

There was concern that the language describing the modulo representation Z-count significant bits was vague and provided no real value. The stakeholders concurred, and the changes were made in real-time

#### *Comments 109*

The comment was made OBE by the resolution to comment #49.

#### *Comment 102*

It was suggested that the terms “ $t_{otGGTO}$ ” and “ $WN_{otGGTO}$ ” should replace “ $t_{GGTO}$ ” and “ $WN_{GGTO}$ ” in the document. It was suggested that there should be coordination with Ed Powers to determine if there has been any preference with Galileo on the terms to use. The comment was deferred.

#### *Comment 100*

In the UTC delta time equation, term “ $WN_n$ ” is not defined in the CNAV message types. The comment was withdrawn by GPC.

#### *Comment 98*

There an equation for  $URA_{OC}$  was incorrect. The comment was withdrawn by GPC.

#### *Comment 93*

The comment suggested that the term “ $t_{oGGTO}$ ” and its associated bit number were incorrect in Fig 30-8. The stakeholders concurred that the bit number should be changed from 14 bits to 16 bits. The term “ $t_{oGGTO}$ ” will need further review (see resolution to comment #102)

#### *Comment 91*

This section describes how almanac data for the first 32 PRS (SVs) is reported. The comment has been deferred. An action item was assigned to Karl Kovach to produce language (possibly in section 6).

#### *Comments 88*

In paragraph number 20.3.3.3.1.5, it is not clear what specifically is meant by “the correction parameters.” “Correction parameter” may not be the correct term. Stakeholders concur to send the PSICA working group.

#### *Comment 87 (Figure 20-1)*

The definition for URA should be better defined for when it is used as an integrity parameter vs. when it is used as an accuracy parameter. The comment has been deferred to the PSICA working group.

#### *Comment 86*

In the note section of Figure 20-1, the term “C” does not reflect assignment of bit 23 as the Integrity Status Flag. It was suggested that bit 23 represent the Integrity Status Flag and bit 24 remain “reserved”. The stakeholders concurred with the recommended change. All eleven sheets of the figure will need to be updated accordingly.

#### *Comment 83*

Specifying a bias-like error with a 2-sigma number is incorrect, as sigma relates to Gaussian distributions of random errors. The action was assigned to Mike Deelo to have the Phase Noise/Correlation Loss working group discuss group delay also.

#### *Comments 81 & 80*

The comment originator was unclear as to some of the values related to the group delay differential and how they applied. Section 3.3.1.7.3 was edited, and the comment was found to be OBE. An action was given to GPSW/GPC to determine where in the document the equations and parameters should be located.

#### *Comments 79 and 78*

Table 3-Vc had several incorrect power levels listed and were missing minus signs in front of those values. The stakeholders concurred with the new values.

#### *Comments 77*

Comment to provide information on “received minimum RF signal strength” for orbital users such as “LEO, MEO, or GEO”. The stakeholders agreed the comment was OBE. This comment is related to Action Item #17 for IS-GPS-800.

#### *Comment 76*

It was suggested that “at worst normal orientation” be replaced with “at normal orientation” from section 3.3.1.6.1 as it doesn’t apply for a “circularly polarized antenna”. The stakeholders concurred and changes were made in real time.

#### *Comment 75*

The definition for “power gain” is not clear in section 3.3.1.6. This comment is related to Action Item #17 for IS-GPS-800.

#### *Comment 72*

The comment recommended modifying the requirement for carrier phase noise. The present spec defines phase noise only in terms of the performance of a phase lock loop, but doesn’t completely define the loop. The comment was accepted with some modifications. The language of the proposed change will be modified by B. Bakeman but was not available for inclusion into the Minutes. The updated language will be brought to a future ICWG for stakeholder review.

#### *Comment 71*

The comment recommended modifying the requirement for correlation loss. New proposed change presented at ICWG by D. Bakeman. Action assigned to Mike Deelo to set up a meeting with the appropriate stakeholders to revise the proposed change. Comment will remain open.

### *Comments 69 & 68*

Section 3.2.1 wording was deemed confusing and needing clarity. "NAV" was replaced with "navigation". The stakeholders concurred and the change was made in real-time. An action was given to Thomas Davis to make similar, appropriate changes throughout the document.

### *Comment 64*

More detailed language to allow receivers to be designed developed, and produced utilizing all available PRN codes documented through 63 was requested by the comment originator. An action was assigned to Karl Kovach to clarify wording to avoid misleading interpretation.

### *Comment 63*

The comment originator proposed that the title pages and the document should be better marked and more easily identifiable. It was suggested that older PIRNs, document drafts, etc be reviewed and changes will be incorporated in future versions of the documents.

### *Comments 45 & 44*

It was suggested that the Code Phase Assignments be moved from section 3 to section 6. An action item was assigned to Karl Kovach to investigate whether the Code Phase Assignments should be moved.

### *Comment 40*

The comment was to clarify the wording in PIRN-002 in relation to the 13 bits in the transmission week number. The following sentence was removed: "On IIF, these 13 bits are comprised of 10 LSBs (WN) that represent the ten..." in its entirety. The stakeholders concurred and the change was made in real-time.

### *Comment 39*

The comment was to clarify the wording in PIRN-002 in relation to Z-count. The stakeholders concurred that the comment was OBE due to the resolution of comment #110.

### *Comment 38*

The wording in section 3.3.1.1 was unclear to the comment originator. The stakeholders concurred with the PO resolution with some modifications. The changes were made in real-time.

## **IS-GPS-705 CRM Review**

### *Comment 59*

The description of the additional PRN sequences is not consistent between IS-GPS-200, IS-GPS-705 and IS-GPS-800. An action was assigned to Dr. Munoz to resolve the issue. This comment will remain open.

### *Comment 35*

The comment was to clarify wording in section 20.3.3.1.1.1 in relation to the 13 bits in the transmission week number. The following sentence was removed: "On IIF, these 13 bits are comprised of 10 LSBs (WN) that represent the ten..." in its entirety. The stakeholders concurred.

### *Comment 34*

The comment was to clarify the wording in section 3.3.4 in relation to Z-count. The stakeholders concurred that the comment was OBE due to similar changes made accordingly in resolution of comment #110 of IS-GPS-200.

#### *Comment 33*

It was suggested that the reference to the “29-bit binary number” for Z-count be removed and made more generic; now reads “binary number”. The stakeholders concurred with the change.

#### *Comment 31*

It was suggested that the angular range for the L1 ellipticity be changed from “±14.3 degrees from boresight” to “±13.8 degrees from nadir”. The stakeholders concurred with the change.

#### *Comment 30*

Table 3-IV added for received minimum RF signal strength in Space Service Volume (SSV) for GPS III satellites with modifications. The stakeholders concurred and changes were made in real-time.

#### *Comment 29*

New language was added to describe L5 signal power gain for Block IIIA satellites. There was also some discussion on changing this to a power spec. The stakeholders concurred.

#### *Comment 57 & 56*

It was suggested that the terms “ $t_{otGGTO}$ ” and “ $WN_{otGGTO}$ ” should replace “ $t_{GGTO}$ ” and “ $WN_{GGTO}$ ” in the document. It was suggested that there should be coordination with Ed Powers to determine if there has been any preference with Galileo on the terms to use. The comment was deferred.

#### *Comment 55*

The equations for the quasi-Keplerian elements were incorrect. The stakeholders concurred with the changes.

#### *Comment 54*

In the UTC delta time equation, term “ $WN_n$ ” is not defined in the CNAV message types. The comment was withdrawn by GPC.

#### *Comment 53 & 52*

There SSV equations in sections 20.3.3.3.1.2.3 and 20.3.3.3.1.2.2 are to be removed and placed elsewhere in the document. These sections will include references/pointers to the new location. An action was given to GPSW/GPC to determine where in the document the equations and parameters should be located.

#### *Comment 50*

There was concern an  $URA_{OC}$  equation was incorrect. Comment was withdrawn by GPC.

#### *Comment 49*

The comment suggested that the term “ $t_{otGGTO}$ ” and its associated bit number were incorrect in Fig 20-8. The stakeholders concurred that the bit number should be changed from 14 bits to 16 bits. The term “ $t_{otGGTO}$ ” will need further review (see resolution to comment #57)

#### *Comment 49*

The removal of the Boeing Letter of Exception (LOE) was rejected. An action was assigned an action to provide more rationale for removal of the LOE.

#### *Comment 46*

There SSV equations in section 3.3.1.7.3 are to be removed and placed elsewhere in the document. These sections will include references/pointers to the new location. An action was given to GPSW/GPC to determine where in the document the equations and parameters should be located.

*Comment 45*

Table 3-IV was not in the document. The table was added and the stakeholders concurred the comment was closed.

*Comment 44*

Request to define the Space Service Volume users where the received signal levels in Table 3-IV apply. The stakeholders concur to add a sentence to indicate the SSV users are referred to users at GEO.

*Comment 41*

The comment recommended modifying the requirement for carrier phase noise. The present spec defines phase noise only in terms of the performance of a phase lock loop, but doesn't completely define the loop. The comment was accepted with some modifications. The updated language will be brought to a future ICWG for stakeholder review.

*Comment 40*

The comment recommended modifying the requirement for correlation loss. New proposed change presented at ICWG by D. Bakeman. Action assigned to Mike Deelo to set up a meeting with the appropriate stakeholders to revise the proposed change. Comment will remain open.

*Comment 37*

More detailed language to allow receivers to be designed, developed, and produced utilizing all available PRN codes documented through 63 was requested by the comment originator. An action was assigned to Karl Kovach to clarify wording to avoid misleading interpretation.

*Comment 36*

The comment originator proposed that the title pages and the document should be better marked and more easily identifiable. It was suggested that older PIRNs, document drafts, etc be reviewed and changes will be incorporated in future versions of the documents.

*Comment 27*

It was suggested that the Code Phase Assignments be moved from section 3 to section 6. An action item was assigned to Karl Kovach to investigate whether the Code Phase Assignments should be moved.

*Comment 25*

Section 3.2.1.2 wording was deemed confusing and needing clarity. "NAV" was replaced with "navigation". The stakeholders concurred and the change was made in real-time. An action was given to Thomas Davis to make similar, appropriate changes throughout the document.

## Action Items

### IS-GPS-200 Public ICWG (19 Nov 08) Action Items

No	Date Assigned	Due Date	Actionee	Item	Resolution
1	23-May-08	01-Jul-08	Thomas Davis	1) Replace "unauthorized user" with SPS/PPS or similar wording (from comment #4)	Completed; updated in the document
2	23-May-08	02-Jul-08	Thomas Davis	2) Section 6.3.5.3, verify number of code pairs in table 6-11	Completed; updated in the document
3	23-May-08	Next ICWG	Karl Kovach	3) Align 200 to the results of the NPEF	
4	23-May-08	Next ICWG	Karl Kovach	4) Karl Kovach to present results of constellation expansion working group at next ICWG	
5	23-May-08	15-Jun-08	Mike Deelo	5) Correlate number of bits for $t_{\text{OGGTO}}$ within figure 30-8 and table 30-XI	In work
6	19-Nov-08	31-Jan-09	Mike Munoz	Coordinate with stakeholders possible solutions for redundant requirements throughout the 3 Public SIS docs.	
7	19-Nov-08	31-Jan-09	Karl Kovach / Bruce Peetz	Review and provide new language for phase relationship before and after year 2020 for L2C. (comment 74)	
8	19-Nov-08	31-Jan-09	Karl Kovach	Provide new language for on how almanac data will be reported for the rest of the GPS PRNs defined in Section 6.3.5. (comment 91)	
9	19-Nov-08	31-Jan-09	Mike Deelo	Have the Correlation Loss/Phase noise WG discuss group delay issues/concerns (comment 83)	
10	19-Nov-08	05-Dec-08	Thomas Davis	Identify all inappropriate instances of "NAV" and replace with "navigation." (comment 69)	
11	19-Nov-08	31-Jan-09	Thomas Davis	Review older PIRNs for how they indicated a unique draft version number or date of a particular redline version	
12	19-Nov-08	31-Jan-09	Tom Stansell, Karl Kovach, and Capt Hariharan	Research need for adding L2C PRN assignment for PRN 64-158	
13	20-Nov-08	31-Jan-09	Mike Munoz	Verify P code sequence is correctly defined	

**IS-GPS-705 Public ICWG (19 Nov 08) Action Items**

<b>No</b>	<b>Date Assigned</b>	<b>Due Date</b>	<b>Actionee</b>	<b>Item</b>	<b>Resolution</b>
1	23-May-08	Next ICWG	Rich/AJ	1) Set up a working group to evaluate 10 ns to 1ns change in signal coherence, evaluate the symmetry requirements	Decided that it would not be changed per the 14 Nov 08 TIM
2	23-May-08	01-Jul-08	Munoz	2) Confirm the formulas that need to be changed, reference CRM from GPSW/GPC comment #14	Reassigned to Chris Hegarty for discussion at ICWG
3	23-May-08	01-Jul-08	Munoz	3) Comment # 17, need to verify formulas that need to be changed, parenthesis,	Reassigned to Chris Hegarty for discussion at ICWG
4	23-May-08	Next ICWG	Kovach/AJ	4) Resolve issues with IODE and IODC	Completed for CNAV-2. Need to make the same changes for CNAV
5	19-Nov-08	31-Jan-09	GPC	Provide more rationale for the removal of the Boeing letter of exception	

## **Participants**

<b>Name</b>	<b>Organization</b>	<b>Citizenship</b>
Abayon, Annabelle	SE&I	US
Bakeman, Bud	Aerospace	US
Brown, Steven A	Infinity Systems Engineering	US
Busche, Heath	Infinity Systems of Northrop Grumman	US
Cade, Nelson	Northrop Grumman	US
Caceres, Dennis	ITT Space Systems	US
Dash, Michael	ARINC/GPA	US
Davis, Thomas	SE&I	US
Dobyne III, John C	GPSW/GPC	US
Frey, Charles	Lockheed Martin (GPSIII Space Segment)	US
Hegarty, Chris	MITRE	US
Holmes, Jack K.	Aerospace	US
Knight, Jerry	NavCom Technology (John Deere)	US
Kovach, Karl	Aerospace	US
Lorge, Frank	FAA	US
Maniego, Edgar	ITT Space Systems	US
Metzger, Dave	ARINC/GPA	US
Mullikin, Tom	Raytheon	US
Munoz, Mike	SE&I	US
Naick, Purvis	GPSW/GPC	US
Notley, William	NASA	US
Peetz, Bruce	Trimble Navigation Limited	US
Peplowski, Thomas	ITT Space Systems	US
Ranney, Scott	Lockheed Martin (GPSIII Space Segment)	US
Reigh, Daniel	Lockheed Martin (GPSIII Space Segment)	US
Roach, Neal, Capt	GPSW	US
Stansell, Tom	Aerospace	US
Vaughan, Paul	Northrop Grumman	US
Wingate, Carina	SE&I	US