

MEETING MINUTES
INTERFACE CONTROL WORKING GROUP FOR ICD-GPS-200/IS-GPS-705
24 March 2004

PURPOSE:

The purpose of the Interface Control Working Group (ICWG) meeting was to discuss the following changes to ICD-GP-200 and IS-GPS-705:

- 1.) PIRN-200C-008, which deletes all Letters of Exception except for one, updates calendar year data requirement, clarifies applicable UTC/GPS-time relationships, t_{oa} and t_{oe} .
- 2.) Draft IS-GPS-200D and PPIRN-705-001, which describe the Improved Clock and Ephemeris (ICE) message on L2C and L5. The ICE message is the new GPS nav data that will replace the current clock and ephemeris data as indicated in Section 30.3.2 of current ICD-GPS-200C.
- 3.) The meeting also addressed those deferred comments from the previous ICWG review of IS-GPS-705.

LOCATION:

The meeting was held on March 24, 2004 at the ARINC Facility, El Segundo, California.

ATTENDEES:

A list of attendees and contact information is provided in Attachment 1.

AGENDA:

The agenda for the meeting is contained in Attachment 2.

DISCUSSION:

Copies of presentation materials are included in Attachment 3.

Meeting Introduction – Soon Yi, ARINC

Mr. Yi welcomed the participants and reviewed the ICWG agenda. The second day was reserved for overflow and side meetings. Lt Kevin Reyes (GPS Joint Program Office (JPO)) gave a brief introduction about the Public ICWG process, roles, and responsibilities. He also gave a schedule update for PIRN-200C-008, IS-GPS-200D, and PIRN-705-001. Anyone interested in being added to the ICWG for either ICD-GPS-200 or IS-GPS-705 should visit the JPO Public ICWG website at <http://gps.losangeles.af.mil/engineering/icwg/>.

Review ICWG Comments on PIRN-200C-008 – Mr. Yi, ARINC

All review comments submitted by the ICWG members on PIRN-200C-008 were presented for ICWG discussion. The discussion skipped all administrative and editorial comments and mainly concentrated on substantive and critical comments. Most of the discussion will be reflected in the resulting resolutions of these comments. The final resolution of the comments will be sent to the ICWG members and posted on the GPS Public ICWG website (<http://gps.losangeles.af.mil/engineerign/icwg/>).

The following provides the ICWG disposition results and some of the discussions from the meeting:

Comments #9, #15, #29 – Accept.

Comments #8, #19, #20, #21, #23, #26, #27, #29, #32 – Other.

Comments #11, #14, #17, #18, #22, #30, #31 – Reject.

Comment #8 – Comment suggests incorporating realistic timing capabilities in the document. Currently, ICD-GPS-200 states that GPS time to be within 90 ns of Coordinated Universal Time (UTC). Group agreed that the system performs much better, but Mr. Yi stated that this is a contractual requirement and such update would require a close coordinated effort with contractors. A. J. Van Dierendonck (AJ systems) suggested referencing the realistic number in Section 6 since this section is for information only. The group agreed to defer this item to the next revision effort after Draft IS-GPS-200D.

Comment #14 – Comment recommends changing Autonav period from the current description of 180 days to 60 days. Mr. Yi stated that other contractual requirements documents need to be revised before this change can be made to ICD-GPS-200. Tom Nagle (SMC/GPC) questioned why the contractual requirement of 14 days or 180 days to support extended operations was needed in the document since the civil community doesn't need this information. Mr. Yi stated that ICD-GPS-200 is for all users including the civil community and there are users that need this information.

Comment #29 – Comment asks for clarification of the paragraph. The paragraph was clarified and it was agreed to divide the paragraph into two separate paragraphs for clarification. Mr. Van Dierendonck question why the second sentence of 20.3.3.5.2.2 was needed since there is nothing in the Nav message to indicate different blocks of SVs. Mr. Yi stated that while this is true, this is the way the system performs and this description of the difference between different blocks of SVs is needed to inform the users.

Calendar Year (CY) in Nav Message – Mr. Yi, ARINC

Mr. Yi gave a brief overview of the issue. The CY Counter is currently on contract to be implemented on only the IIF SVs. It was proposed in PIRN-200C-008 to be put on all the SVs. There are two issues with the current proposal. One issue is that there is an ambiguity in the paragraph as to when users can expect to see this information in the message. The other issue is that it is currently not a IIR/IIR-M requirement.

For the issue of ambiguity, Mr. Yi presented a revised wording for which no objection was raised.

Mr. Van Dierendonck stated that by the time the next GPS week rollover occurs, there will be IIF SVs in the constellation and a user may only need the CY information from only one IIF SV in view. Mr. Yi stated that any user using the new signal (ICE message) will not need this information because ICE provides 13-bit week number. It was the consensus of the group that this is not a critical information for users. For the contractual issue, Mr. Yi presented three possible options for which the group had no issue with any of the three options. The three options are: 1.) place CY on all SVs for commonality, 2.) place CY on only IIF SVs, 3.) no CY on any SV. Mr. Yi stated that the JPO will pursue this contractual issue and will select one of the three options to implement.

Review ICWG Comments on Draft IS-GPS-200D (Non-ICE) – Mr. Yi, ARINC

All review comments submitted by the ICWG members on Draft IS-GPS-200D were presented for ICWG discussion. Mr. Yi stated that comment submittal deadline is 8 April and there may be more comments coming in. The discussion skipped all administrative and editorial comments and mainly concentrated on substantive and critical comments. The comments related to Section 30 (ICE) of the document were postponed to be addressed in the afternoon session of ICE discussion. Most of the discussion will be reflected in the resulting resolutions of these comments. The final resolution of the comments will be sent to the ICWG members and posted on the GPS Public ICWG website (<http://gps.losangeles.af.mil/engineerign/icwg/>).

The following provides the ICWG disposition results and some of the discussions from the meeting:

Comments #1, #5, #28, #32 – Accept.

Comments #6, #15, #27, # – Other.

Comments #4, #14, #18, #19, #20, #21, #29, #30, #31, #33, #34 – Reject.

Comment #4 – Changing the statement from “will” to “shall” would be a contractual issue and Boeing objected to the recommended change. Mr. Van Dierendonck stated that it doesn’t make any sense to use the “shall” requirement for something that can not be fully identified and defined. The group agreed to reject the comment.

Comment #6 – Mr. Yi clarified that the intent of non-standard codes is to protect the users from using anomalous signal as described in ICD-GPS-200. Mr. Van Dierendonck stated generating non-standard L2 CM (NSCM) and non-standard L2 CL (NSCL) independently could confuse UE receivers. The group didn’t know if there indeed would be a problem with receivers. **ACTION ICWG-032404-01:** JPO to further explore with Integrity Failure Modes and Effects Analysis (IFMEA) team the need to generate NSCM and NSCL independently and what the impact would be to UE receivers.

Comment #15 – Mr. Yi clarified that, as the Letter of Exception (LOE) indicates, IIR-M requirement is -161.4 dBW. **ACTION ICWG-032404-02:** JPO to ask Lockheed-Martin (LM) to pull the LOE regarding the minimum received L2C signal power requirement for Block IIR-M. **Action response:** JPO is currently working with LM to remove this LOE. **Action closed.**

Comment #29 – Mr. Yi stated that the preference is not to include any reference documents, if possible, to leave ICD-GPS-200 as a stand-alone document as possible. The group's consensus was that all the needed constants are identified and specified in the ICD, and the ICD shouldn't reference the NIMA document because the constants in ICD-GPS-200 may not change even when that document is updated. It was agreed not to reference the NIMA document.

IODC Range Update (Table 20-XII of IS-GPS-200) – Mr. Yi, ARINC

Mr. Yi gave a short brief on the IODC Change Proposal. This change is proposed by Boeing and would impact the Control Segment and possibly IIR/IIR-M SVs. Mr. Yi has forwarded the proposal to LM for an initial assessment. Mr. Yi solicited input from the group on any possible issue this may pose on users. No user issue was identified by the group. Mr. Yi stated that this proposal will be included in the next version of Draft IS-GPS-200D.

Maximum Power Requirement – Lt Bryan Titus, JPO

Lt Titus gave a brief introducing a maximum power requirement in ICD-GPS-200 and IS-GPS-705. Lt. Titus stated that this is the JPO's plan but it has not been discussed with the contractors. Mr. Yi stated that there had been discussion in the past and there is currently text in Section 6 that provides expected maximum received signal power for L1 P(Y) and L1 C/A. Lt. Titus stated that the proposal would be to include this in Section 3 as a requirement. Mr. Yi stated that there would be a considerable gap between SV design limit and expected maximum received signal levels. Mr. Nagle agreed that this would be a good idea, especially with the new Flex Power capability. Lt Titus didn't want to set a maximum power requirement in ICD-GPS-200 for Flex Power. Mr. Hegarty proposed to add other ancillary power related information (i.e. SV antenna gain, etc.) in Section 6. **ACTION ICWG-032404-03:** Lt Titus to work with POCs/ICCs of ICD-GPS-200, -700, and -705 on defining maximum power requirement. Mr. Hegarty to work with Lt Titus in identifying needed information and text to be provided in Section 6.

Carrier Phase Noise Plot – Rhonda Slattery, ARINC

Ms. Slattery presented a IIF carrier phase noise plot that was provided by Boeing. She stated that this plot will be included in Section 6 of the next version of IS-GPS-705.

Additional PRN Codes (more than 32 SVs) – Mr. Yi, ARINC

This change is currently not in PIRN-200C-008 nor IS-GPS-200D. In the timeframe of GPS III, there is a good possibility that more than 32 SVs would be in the GPS constellation. There is some concern how this will impact the system including ICDs and users. Mr. Van Dierendonck stated that, by design, the legacy message can not accommodate anything more than 32 SVs. As such, the legacy message can only broadcast nav data for 32 SVs. The group didn't think this would be a problem to any receivers. Mr. Van Dierendonck stated that the additional SVs wouldn't be an issue for future civil receivers since it will probably only require a firmware change. Mr. Van Dierendonck along with the group did not see any issue with the ICDs being updated for additional SVs shortly before the actual constellation change.

Review ICWG ICE Comments on Draft IS-GPS-200D – Mr. Yi, ARINC

The remaining review comments related to Section 30 of Draft IS-GPS-200D were presented for ICWG discussion. Most of the discussion will be reflected in the resulting resolutions of these comments. The final resolution of the comments will be sent to the ICWG members and posted on the GPS Public ICWG website (<http://gps.losangeles.af.mil/engineerign/icwg/>).

The following provides the ICWG disposition results and some of the discussions from the meeting:

Comments #43, #47, #48, #60, #71, #72, #76 – Accept.

Comments #45, #46, #50, #56, #57, #58, #59, #61, #62, #73, #74, #75, – Other.

Comments #37 – Reject.

Comment #46 – Michael Tran and Chris Hegarty stated that some of the change in the range and the number of bits for some ICE ephemeris parameters do not appear to be correct. **ACTION ICWG-032404-04:** Arthur Dorsey (LM) to revisit the rationale and decision for ephemeris parameter number of bits and the range.

Comment #50 – **ACTION ICWG-032404-05:** Karl Kovach (ARINC) to provide Mr. Yi the needed text and algorithm for utilizing URA_{OC-DOT} value with URA_{OC} in Section 30.3.3.2.4.

Comment #56 – **ACTION ICWG-032404-06:** Mr. Dorsey to provide Earth Orientation Parameters (EOP) algorithms by Friday (26 Mar 04). **Action response:** The text and algorithm has been provided. **Action closed.**

Comment #62 – **ACTION ICWG-032404-07:** Ed Powers (USNO) to provide UTC A_{2-n} scale factor by (26 Mar 04). **Action response:** The scale factor has been provided. **Action closed.**

Comment #73 – Mr. Powers stated that Galileo time will probably not have any integer second difference from GPS time. However, even if it does end up having the difference, it will most likely be a fixed difference and such difference can be specified (defined) in ICDs without using any parameter.

Comment #74 – **ACTION ICWG-032404-08:** Mr. Powers to provide A_{2GGTO} and t_{0tGGTO} scale factors. **Action response:** The scale factors have been provided. **Action closed.**

Comment #75 – Group questioned why the broadcast of clock correction parameters requirement was in a note of Table 30-X. Group agreed that this requirement should be placed in the table instead of just a note. Michael Moreau stated that there are paragraphs in Section 3 of Draft IS-GPS-200 that do not require ICE message as an option on the IIR-M SVs. Mr. Moreau agreed to provide this comment to the document. **ACTION ICWG-032404-09:** Mr. Moreau to work with Tom Creel in determining how often EOP and GGTO should be broadcast.

Comment #76 – Mr. Yi stated that the baseline and the current requirement is antenna phase center.

Wide Area GPS Enhancement (WAGE) II – Bill Feess, Aerospace

Mr. Feess talked briefly about adding WAGE II (differential correction) to the ICE message. It is a way of providing the user a more rapid update of the clock and ephemeris data. A faster update provided by WAGE II would increase the accuracy by a factor of 2 to 4. He stated that there is an updated WAGE II section which should replace the current WAGE II section of Draft IS-GPS-200D. The updated section will be obtained from IS-GPS-700 POC.

A question was raised whether the differential correction should be applied to the legacy clock and ephemeris on L1 C/A. The current plan is for users to apply the WAGE correction to the ICE data. However, if for some reason, a user is only using L1 C/A signal from a satellite, it is unclear if it would be OK for that user to apply the WAGE correction obtained from another SV. It was agreed that the JPO needs to hold additional discussions on WAGE and determine the implication on the legacy ephemeris.

Reduced Almanacs – Mr. Van Dierendonck, AJ Systems & Mr. Kovach, ARINC

Mr. Van Dierendonck presented a proposal to revise the parameters of reduced almanac of ICE. The proposal adds eccentricity (e) and argument of perigee (w) to the set of almanac parameters (Section 30.3.3.4 of IS-GPS-200D), thereby improving the accuracy of the Doppler estimates. Mr. Kovach presented a set of charts to show that the current set of reduced almanac parameters would be adequate. Mr. Yi stated that there may be a military message requirement that may inhibit any change to the reduced almanac message at this time. **ACTION ICWG-032404-10:** Stakeholders (Mr. Van Dierendonck, Mr. Kovach, Mr. Hegarty, Lt Titus, and John Straton (ARINC)) form a working group to resolve this issue.

Clock Diurnal Effects – Mr. Dorsey, LM

Mr. Dorsey stated, via teleconference, that the on-board performance of the IIA/IIR SV clocks show diurnal effects with periods varying from 12-24 hours. With the improved clock technology, the future clocks may not show the diurnals but an improved clock model is needed to account for the diurnals of the current clocks. There are a few different methods to account for the effect but Mr. Dorsey proposes to add two more clock parameters. Mr. Yi stated that there has been a previous discussion on this subject and it has been decided that GPS III should address this issue.

Text Message

Mr. Yi distributed a proposal from Tom Stansell (Stansell Consulting) to use the GPS Nav message to transmit communication message to various users. Mr. Stansell was not present to brief and Mr. Yi stated that the proposal is distributed for reference and any comment or input on the subject. Ms. Slattery stated that regardless of the proposal, ICE message includes a text message type. However, currently there is no CONOP or a specific plan on how to use this text message type.

SV Group Delay Differential

Mr. Yi stated that an issue has been raised regarding the sign of T_{GD} equation in Section 20.3.3.3.2 of ICD-GPS-200. There is on-going discussion on this subject and Mr. Yi invited anyone who is interested to join the discussion.

ICD-GPS-200/705 ICWG ACTION ITEM SUMMARY

NUMBER	DESCRIPTION	ASSIGNEE	STATUS
ICWG-032404-01	Further explore with Integrity Failure Modes and Effects Analysis (IFMEA) team the need to generate NSCM and NSCL independently and what the impact would be to UE receivers.	JPO	OPEN
ICWG-032404-02	Ask Lockheed-Martin (LM) to pull the LOE regarding the minimum received L2C signal power requirement for Block IIR-M.	JPO	CLOSED - JPO is currently working with LM to remove this LOE.
ICWG-032404-03	Work with POCs/ICCs of ICD-GPS-200, -700, and -705 and Mr. Hegarty on defining maximum power requirement.	Lt Titus	OPEN
ICWG-032404-04	Revisit the rationale and decision for ephemeris parameter number of bits and the range.	Mr. Dorsey	OPEN
ICWG-032404-05	Define text and algorithm for utilizing URA_{OC-DOT} value with URA_{OC} in Section 30.3.3.2.4.	Mr. Kovach	OPEN
ICWG-032404-06	Provide Earth Orientation Parameters (EOP) algorithms.	Mr. Dorsey	CLOSED - The text and algorithm has been provided.
ICWG-032404-07	Provide UTC A_{2-n} scale factor	Mr. Powers	CLOSED - The scale factor has been provided.
ICWG-032404-08	Provide A_{2GGTO} and t_{otGGTO} scale factors.	Mr. Powers	CLOSED - The scale factor has been provided.
ICWG-032404-09	Determine how often EOP and GGTO should be broadcast.	Mr. Moreau	OPEN
ICWG-032404-10	Form working group to resolve Reduced Almanacs issue	Mr. Van Dierendonck, Mr. Kovach, Mr. Hegarty, Lt Titus, Mr. Straton	OPEN

ATTACHMENT 1

AGENDA ICD-GPS-200/IS-GPS-705/ICE Interface Control Working Group Meeting 24 March 2004

1st Day:

0900	Welcome/Introductory Remarks	SMC/GPER & ARINC
0915	Public ICWG Process Overview	Lt Kevin Reyes
0930	Review ICWG Comments on PIRN-200C-008	All
1000	Calendar Year Information in the Nav Message	ARINC
1020	Review ICWG Comments on Draft IS-GPS-200D (Limited to Non-ICE Comments)	All
1030	IODC Range Update (Table 20-XII of IS-GPS-200)	ARINC
1045	Break	
1100	Remaining IS-GPS-705 Issues (Carrier phase noise plot, maximum power)	ARINC
1130	Additional PRN Codes (more than 32 SVs)	All
1200	Lunch	
1300	ICE Discussion: Review ICWG ICE Comments on Draft IS-GPS-200D (Includes EOP and GGTO Discussion) WAGE II Reduced Almanac Clock Diurnal Effects Text Message SV Group Delay Differential	All All A. J. Van Dierendonck/Karl Kovach Art Dorsey Tom Stansell Soon Yi
1645	Review Action Item Assignments	All
1700	Adjourn	