

**AERONAUTICAL CHARTING FORUM**  
**Instrument Procedures Group**  
**April 26, 2011**

**History Record**

**FAA Control # 11-01-296**

**Subject: Magnetic Variation Differences and FMS Systems**

**Background/Discussion:** Recently American Airlines and United Pilots have noticed significant differences in the charted magnetic courses between conventional and RNAV arrivals at Chicago O'Hare International (KORD). They are also seeing differences in charted holding patterns in database holds in B737 aircraft. There have been numerous database and programming errors on SIDs out of various departure airports that have led to training and specific procedures to prevent pilot deviations on departure. These habit patterns are leading to the discovery of other discrepancies and are causing unnecessary confusion as to the proper routing to fly.

For TERPS, all courses are computed on a true course and then converted to magnetic for charting. Conventional arrivals use the magnetic declination (variation) for the facility (VOR) that the procedure is based upon. RNAV procedures (STARS, SIDs, and IAPs) use the magnetic variation of the airport. This is covered in FAA Order 8260.19E paragraph 2-18f.

The Janesville VOR (JVL) magnetic variation is 3 degrees East (epoch year 1965). Departing JVL to BULLZ the true course is 112 -3 East (East is least, West is best) yielding a magnetic course of 109. The KORD magnetic variation is 3 degrees West (epoch year 2010). So on the RNAV arrival JVL to BULLZ is a true course of 112 +3 West to yield a magnetic course of 115.

In FMS aircraft that have database holding patterns, it appears that they are reverting to a magnetic variation that is different from the charted pattern. In particular, the B737 was noted to bring up the TEDDY holding pattern for the BULZZ.BULLZ1 arrival that matched the JVL.JVL5 conventional arrival rather than the charted BULZZ arrival.

**Recommendations:**

1. Search for a better solution to prevent such as large discrepancies from appearing in charting.
2. Change applicable guidance for FMS and database manufacturers so that database holding procedures match the applicable charted procedure that is pulled up in the FMS. This is possibly related to the applicable section of Order 8260.19E, paragraph 2-18f (2)
  - a. ".....GNSS holding patterns not associated with an instrument procedure, determine the magnetic variation by using the magnetic declination (variation) for the holding fix latitude/longitude."
3. Add a note to the Legend of U.S. TPPs. in government publications with a suggestion that Jeppesen follows suit.

(continued)

4. Provide the applicable information on magnetic variation differences between conventional and RNAV procedures in the Aeronautical Information Manual in Chapter 1. Air Navigation, Section 2. Area Navigation (RNAV) and Required Navigation Performance (RNP). Add notes to the section on SIDS and STARs referring to this information.

**Comments:** This recommendation affects FAA Order 8260.16 and associated RNAV criteria directives.

**Submitted by:** FO Lev Prichard

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**Date:** 17APR11

KORD/ORD  
-O'HARE INTL

JEPPESSEN

5 FEB 10

20-2B

Eff 11 Feb

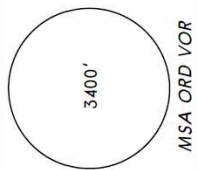
CHICAGO, ILL

RNAV STAR

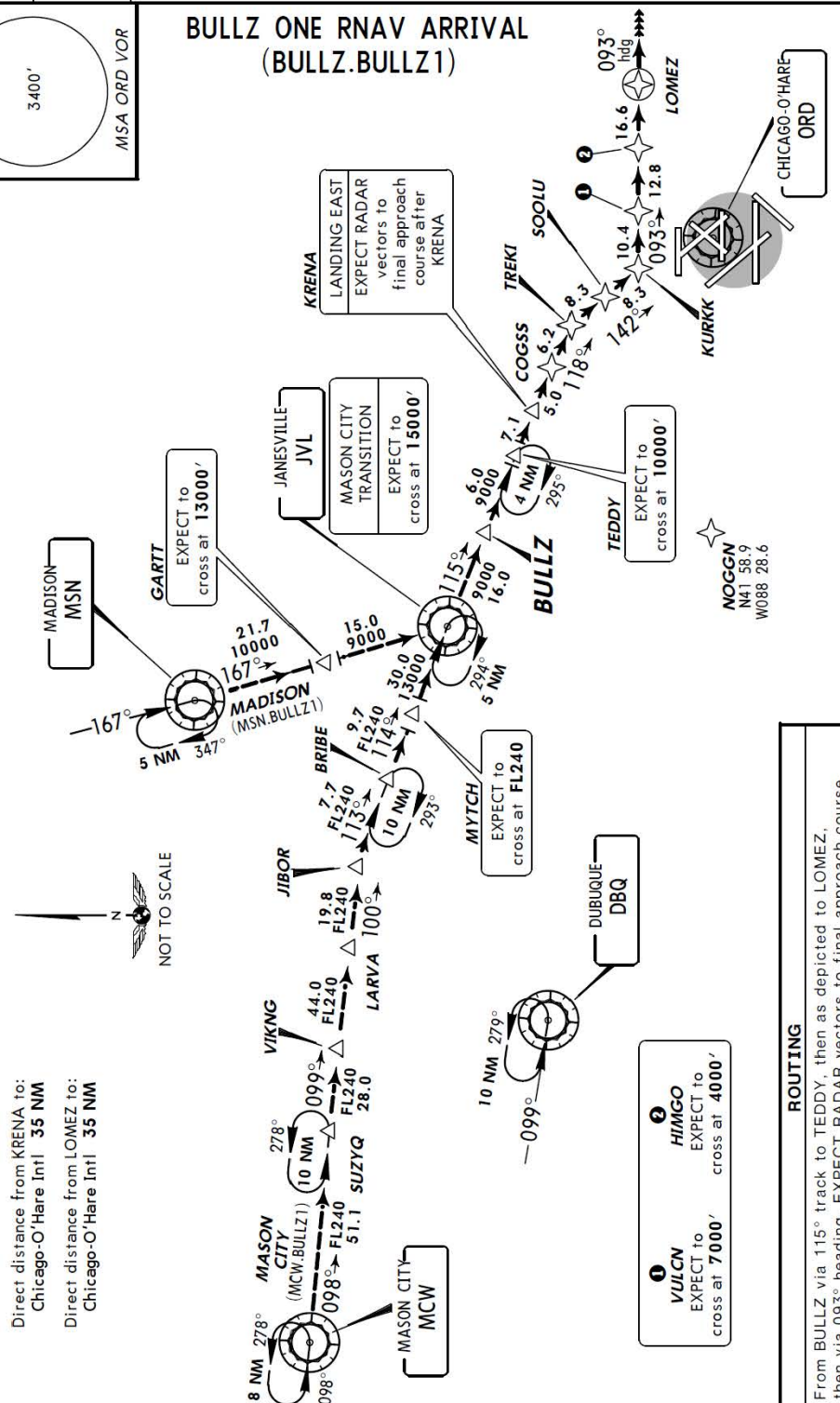
D-ATIS  
135.4

Apt Elev  
672'

Alt Set: INCHES Trans level: FL180 Trans alt: 18000'  
1. RADAR required. 2. DME/DME/IRU or GPS required. 3. RNAV 1.  
4. MADISON Transition: For non-GPS equipped aircraft, BAE DME must be operational.



# BULLZ ONE RNAV ARRIVAL (BULLZ.BULLZ1)



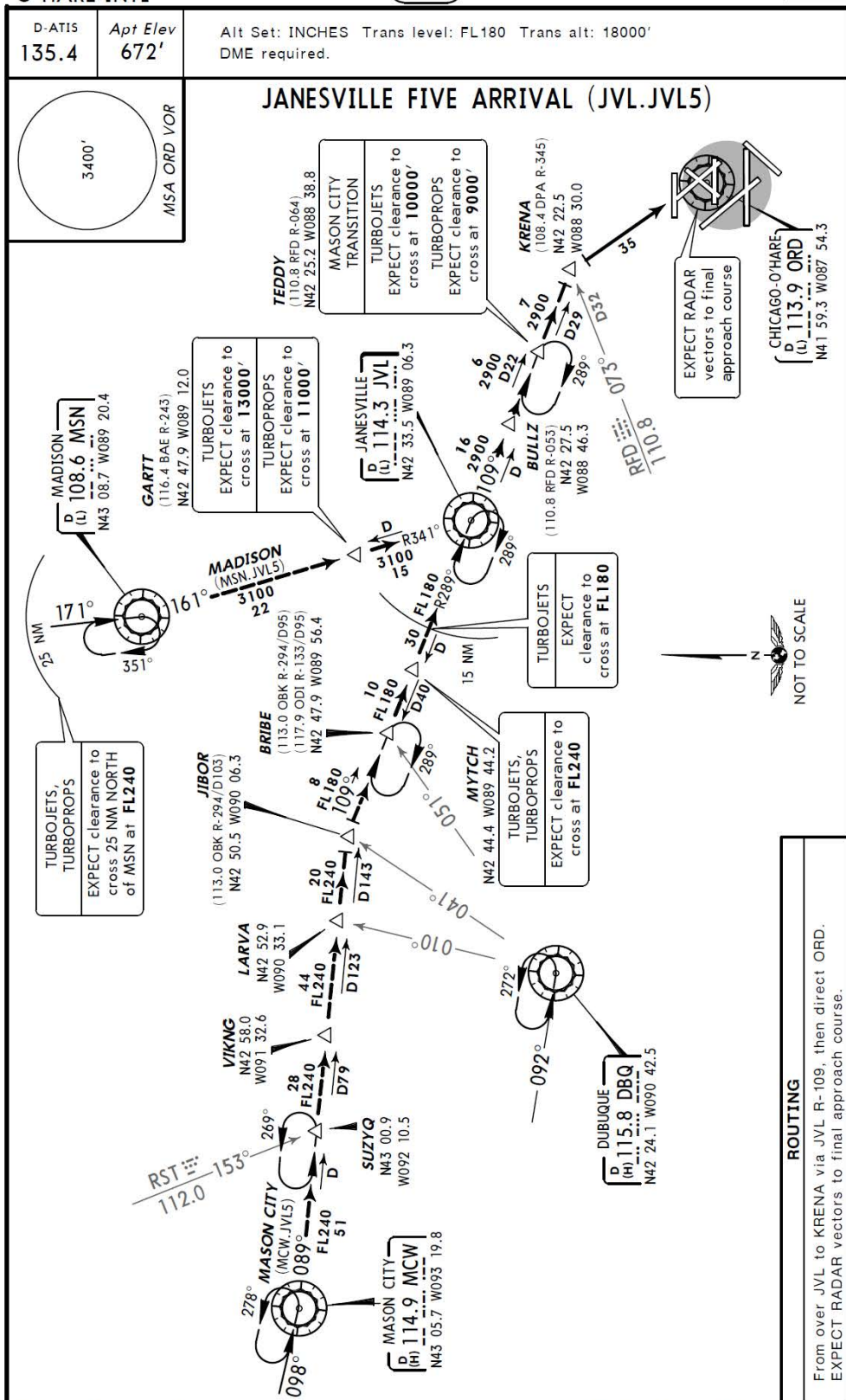
CHANGES: New procedure at this airport.

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KORD/ORD  
-O'HARE INTL

JEPPESEN  
5 FEB 10 20-2C Eff 11 Feb

CHICAGO, ILL  
STAR



CHANGES: Reindexed, JIBOR formations.

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**Initial Discussion Meeting 11-01:** New issue presented by Lev Prichard on behalf of APA. Lev states that the application of a different magnetic variation (MV) for RNAV vs. conventional routes over the same ground track creates confusion. He offered examples of RNAV and conventional STARs into Chicago O'Hare (KORD) that show a 6 degree difference between an RNAV route and the conventional route over the same ground track. The problem is caused by the different MV application. RNAV procedures use the airport MV of record, while VORs use an assigned MV. Lev believed that guidance in Order 8260.19 should be amended to make RNAV and conventional charts agree. John Moore, AJV-3B asked how making charts agree would resolve FMS differences. Valerie Watson, AJV-3B, stated that there is no charting solution and that airport or NAVAID MV of record applied when each procedure is designed must be retained. NASR provides the sanctioned source for MV for both airports and NAVAIDs and that source must be used by chart makers until revised. Brad Rush, AJV-3B, stated that the only resolution to the differences is to use True North for everything. He stated that there are varying tolerances for assigned MV. For example, CAT II and III ILS must be within 1 degree of the actual runway MV. Every attempt is made to keep VORs within 3 degrees of the actual MV; however, changing a VOR MV has a major ripple effect (airways, procedures, ATC video maps, etc.). This is especially true when the VOR has many airway radials emanating from it. Ted Thompson, Jeppesen, stated that the agenda item, as briefed, is incorrectly characterized as a "charting problem". He stated the issue is relative to source, chart, and database compatibility issues; i.e., magnetic courses - conventional vs. RNAV; holding patterns - chart vs. FMS; runway MV - runway heading vs. ILS course; etc. Brad reminded everyone that although the numerically published courses may differ, the ground tracks are the same. Ted also mentioned that Jeppesen produces a set of NavData text pages in its Airway Manual that are intended to help explain differences between charts and navigation databases. These pages were produced as a result of past recommendations from the industry. Ted offered to discuss the matter within Jeppesen and consider the possibility of creating a Jeppesen Briefing Bulletin to promote increased education and awareness of these issues among pilots. Lastly, Ted read an explanation provided by John Kasten, Jeppesen, which provided an overview and background information. A summary of John's comments as shared by Ted is included ( ). A side bar discussion began regarding some FMSs initiating holding patterns in the wrong turn direction. Bill Hammett, AFS-420 (ISI) interrupted stating that this was off the subject matter. If APA desired to discuss the holding pattern direction of turn issue, it should be via a separate issue paper. John Swigart, AFS-470, offered to review and enhance AIM language regarding MV. Ted offered to discuss the matter within Jeppesen and consider the possibility of creating a Jeppesen Briefing Bulletin to promote improved awareness of MV issues. **ACTION: AFS-470 and Jeppesen.**

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**MEETING 11-02:** Kurt Swanick (FAA AFS-240) reported that the issue is expected to be reviewed within the ATA CNS/ATM Task Force. According to Kurt, the original proponent, Lev Prichard, APA, who was not present, expressed the desire to leave this agenda item open until next spring's ACF 12-01 meeting. Bill Hammett, AFS-420 (ISI), who is also recording secretary for the ACF-IPG, expressed concern that an issue should not be worked by two different groups. History has proven that this causes miscommunication and duplication of effort. Bill recommended that since the issue was presented before the ACF, that it be addressed by an ad hoc working group of the ACF-IPG. Participants from the CNS Task Force are welcome to participate. Alternatively, the issue should be closed from the ACF-IPG and worked entirely by the CNS Task Force. Al Herndon, MITRE, stated that




he serves as recording secretary of the CNS Task Force and has no knowledge of a current working group to address this issue. Ted Thompson, Jeppesen, stated that as someone with experience in both the ACF and CNS Task Force, the ACF has a better record for working and tracking issues to resolution. He added that Lev had requested pilot education on this issue and Jeppesen is considering a briefing bulletin. The group consensus was to keep this issue on the ACF-IPG agenda in an 'inactive' status. open for tracking purposes only. The issue will be addressed by the ATA CNS/ATM Task Force who will direct their recommendations to the ACF IPG for consideration. **ACTION: ATA CNS/ATM Task Force.**

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**MEETING 12-01:** Bill Hammett briefed that he had spoken to Kurt Swanick, AFS-240, and an AFS InFO addressing the subject has been developed; however, not signed yet. A copy of the draft InFO was presented to the attendees; however, a hard copy was not provided the attendees as the document is still in draft form. Kurt also indicated that he had received no updates from the CNS Task Force Tech Pilots Group, who is supposed to be working the issue. Bill also briefed that he had received an email from Lev Pritchard, APA, stating that he also would not be in attendance at ACF 12-01 due to personal reasons. Lev wrote that he was pleased with the InFO as drafted and strongly recommended its signature and publication. He added that pilot education is the best path to create understanding at this point in time and made the following suggestions: 1) publish the InFO; and, 2) Use the information in the InFO to enhance AIM, Chapter 1, paragraph 1-1-19l, *Conventional Versus GPS Navigation Data*; and, Cross reference paragraph 1-1-19l in paragraphs 5-2-8f, *RNAV Departure Procedures* and 5-4-1e, *RNAV STAR*. Tom Schneider, AFS-420, also recommended that AFS-200 consider contacting AFS-630 and request mag var information be included in the Practical Test Standards. Tom also recommended forwarding the InFO, when signed, to the OPR for the IPH for consideration. The issue is still on record to be addressed by the ATA CNS/ATM Task Force. AFS-240 to track status of the InFO.

**ACTION: AFS-240 and ATA CNS/ATM Task Force.**

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**MEETING 12-02:** Bill Hammett briefed that the AFS InFO discussed at the last meeting was signed on June 26, 2012. The number is InFO 12009 and it is a bit different than what was shown at the last meeting. A copy is provided here (  ). Bill questioned whether anyone knew of any further involvement or input by the CNS Task Force. Ted Thompson, Jeppesen, responded that he knew that the CNS Task Force had received a copy of the InFO and that Brian Will, Industry Co-Chair of the Task Force, seemed pleased with it. Ted recommended the issue could be closed based on the InFO and lack of CNS Task Force response. Tom Schneider, AFS-420, stated there was still an open portion of the issue relating to including information from the InFO in the AIM as an update to paragraph 1-1-19l and to add a cross reference to this paragraph in paragraphs 5-2-8f, *RNAV Departure Procedures* and 5-4-1e, *RNAV STAR*. He requested that Kel Christianson, AFS-470, take on this IOU. Rich Dunham, AFS-420, also recommended the agenda item be kept active pending the outcome of technical reviews by RTCA SC-227 and the FAA PARC. Therefore, the agenda will remain open. However, based on the lack of response by the CNS Task Force at this and the previous meetings, Bill recommended they be dropped as a point of contact for this issue. The group agreed. AFS-470 will develop and coordinate the requested AIM changes, and AFS-420 to monitor actions by RTCA SC-227 and the PARC. **ACTION: AFS-420 and AFS-470.**

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**MEETING 13-01:** Kel Christianson, AFS-470, provided a briefing and presented a draft AIM change based on the AFS-200 InFO that was previously distributed to resolve this issue. A copy of the AIM change was provided to all attendees and is included here (  ). Publication is targeted for February 2014. Participants may forward comments directly to Kel at [kel.christianson@faa.gov](mailto:kel.christianson@faa.gov). Tom Schneider, AFS-420, provided the following update as received from Steve Jackson, the AFS-420 representative who is monitoring RTCA SC-227 actions: "The PARC Magnetic Variation Working Group report has not been presented to the FAA yet, and will be discussed by the PARC on April 26th. The report primarily addresses the "Anchorage issue" or how mag var affects ILS Cat II/III. The recent RTCA SC-227 meeting also had some discussion of mag var changes to DO-236. The long term solution to the issue appears to be the use of the State provided "procedure design mag var", listed on all 8260 procedure forms, and it is now the first source listed in the hierarchy, eliminating the mismatches once it is implemented. Use of airport mag var of record (there may be several "airport mag vars" available, but they may not match the one used in procedure design), is moved ahead of NAVAID mag var, except on procedures based on the NAVAID. RNAV and RNP procedures are designed based on "airport mag var of record", which comes from the same source as the procedure design mag var, not a NAVAID. The cost benefit of updating the mag var of VORs, which may come out on the list for removal under the Minimum Operational Network proposal, has also come up. This raises an increased possibility that the on-airport NAVAID will not match the airport mag var of record. Other discussions dealt with use of True for procedures, and requirements for users to update the on-board mag var tables, especially in order to fly coupled or autoland procedures. The NavLean efforts should also result in a list of the single official source for data items, including mag var. How we resolve the short term issues is not yet clear, but at least there is more understanding of what issues, such as data source, need resolution." AFS-420 will continue to monitor actions by RTCA SC-227 and the PARC, and AFS-470 will track the requested AIM changes. **ACTION: AFS-420 and AFS-470.**

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**MEETING 13-02:** Kel Christianson, AFS-470, briefed that the AIM changes presented at the last meeting were finalized and have been forwarded for the next AIM publication cycle (February 6, 2014).

Tom Schneider, AFS-420, provided the following update as received from Steve Jackson, AFS-420: "RTCA SC-227 changed the order of use for MV data to place procedure MV first, followed by airport MV. Use of procedure MV will resolve many of the issues relating to MV since the equipment would always be using the same value as that used in the procedure design. Airport MV is the basis for RNAV and ILS procedures as well as runway bearing. However, this is a long term solution since existing avionics equipment will still use the source specified when the equipment was designed, which is usually either the NAVAID or airport on-board tables, which usually don't. The NavLean initiative will help resolve the issues by identifying the correct source for this data; e.g., several airport MVs exist, but only one of which matches the instrument procedures. Due to the Minimum Operational Network (MON) plan to remove VORs, and the existing workload for developing and maintaining procedures, many VORs are already out of tolerance, and policy on splitting the VOR MV from the rest of the procedures at an airport is being discussed. This would allow updates to the ILS and RNAV based procedures without updating airways and other conventional

procedures. Once the list of VORs to be removed is finalized, a policy for bringing the remaining VORs back into tolerance will be devised.

The PARC MV Working Group completed its work and is no longer meeting. The report was delivered to the FAA in July, and most short term issues have been resolved. Long term issues such as use of True either at specific airports or as a region of True only operation in Alaska, similar to the Canadian Northern Domestic Airspace is under discussion. Another long term proposal to tie airport MV updates to aircraft MV database updates does not appear to be practical at this time, since there is no fixed schedule for manufacturers to make the data available, or for users to install the new tables, which in most cases requires sending the equipment back to the manufacturer. New guidance from Certification will cause manufacturers to notify users with older MV tables for airports where there may be issues with coupled approaches and auto-land operations.

There will be no further AFS-420 updates from the PARC MV WG and no further action on this issue is planned at RTCA; therefore, recommend closing this IOU. AFS-420 actively participates in many working groups and advisory committees. Should an issue of ACF concern arise, it will be presented as a briefing item; however, and continual updates under recommendation 11-01-296 will no longer be provided.” Tom recommends closing this second IOU and the group agreed.

Rich Boll asked will there be any requirement to change aircraft certification and whether AIR is addressing the issue. Kevin Bridges, AIR-130, said the next SC-227 meeting will address this issue; however, keep in mind that “guidance is guidance”. AFS-470 to track requested AIM changes until published. **ACTION: AFS-470.**

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**MEETING 14-01:** Kel Christianson, AFS-470, advised the AIM guidance was published on April 3. This item can be closed.

**Status:** **Issue CLOSED**