AERONAUTICAL CHARTING FORUM
Instrument Procedures Group
April 28, 2009
HISTORY RECORD

FAA Control # 09-01-284

Subject: Question of TERPs Containment With Late Intercepts

Background/Discussion: Historically, ATC has used radar for vectoring of aircraft into the segments of an instrument approach procedure prior to the final approach segment. The authority for this is regulatory as set forth in FAR 91.175 (i), which states in part:

> "Radar vectors may be authorized to provide course guidance through the segments of an approach to the final course or fix."

Long before the advent of RNAV IAPs, the primary use of radar vectors in this context was to provide vectors into the intermediate segment of an ILS (informally known as "the final approach course"). Unless the weather is VFR, long-time ATC policy has mandated that such vectors not exceed a 20 to 30 degree intercept angle at prescribed minimum distances from the PFAF. Presumably these limitations were established many years ago to assure smooth capture of the localizer, then the glide-slope, and to assure containment within the ILS narrowing intermediate segment once the radar vector was completed. Vectors to airways, feeder routes, or approach segments prior to the intermediate segment are also permitted by the above-cited regulatory language and have no intercept limits because initial, feeder or airway segments have en route width protection and pilot/system performance is less critical at these early points. Presumably Flight Standards Service expertise in TERPs containment areas, aircraft, pilot, and system performance drove the ATC radar vector limits for guidance into the intermediate segment of any IAP, but generally the ILS IAP.

TERPS, Paragraph 230 addresses radar vector guidance as one valid method of providing an unpublished initial approach segment, which states in part:

> "An initial approach may be made along an arc, radial, course, heading, radar vector, or a combination thereof."

Beyond the foregoing statement in Paragraph 230, TERPS is silent about how radar vectors may join an IAP. But, it is clear that a radar vector is a form of an initial approach segment when used to join an IAP within the intermediate segment. Further TERPS criteria prohibit other than very minor course changes in procedure design inside the IF. Course changes except at a FAF-facility (VOR or NDB) inside the IF are possible only in RNAV procedures.

Large course changes are permitted at the IF, but no later, in all IAPs where facilities permit. The normal maximum course change is 90 degrees, but can, with compensating limitations, be as much as 120 degrees. Recently, though, AFS has determined that course changes of even 90 degrees at the IF in RNAV IAPs are undesirable. There are issues relating to both containment (fly-by waypoint "undershoot") and RNAV equipment sequencing. Further, there is the never-resolved issue of whether descent is permitted at the bisector of a fly-by waypoint (ACF-IPG Issue 69-01-166).

Nonetheless, within the past few years, the FAA and industry agreed after careful consideration that ATC would be permitted to clear aircraft direct to RNAV IFs, with certain strict restrictions as to controller radar monitoring, distance, angle, and altitude compatibility. During these discussions it was also agreed that controllers **could not** clear aircraft to RNAV fixes inside the IF because of issues of narrowing containment areas, aircraft maneuvering issues, and RNAV equipment sequencing issues.

> **NOTE**: When GPS IAPs were first designed, the FAA permitted course-reversal holding patterns ("HILPT") to be at the FAF. Experience showed this created both navigation and equipment sequencing problems, so the criteria were change to require any RNAV (GPS) HILPTs to be located at the IF.

There still remains the question about whether radar-monitored direct clearances to the IF are legal under the present FAA regulatory framework. 14 CFR, Part 91.175 (i) does not address substituting radar vectors with radar monitoring of a pilot's improvisation of an ad hoc, extra-criteria initial approach segment. Further, there are no official legal interpretations which state that ATC radar monitoring of ad hoc pilot navigation to an IF is the legal equivalent of a radar vector. This legal issue is beyond the purview of the ACF. But, the safety and pilot/system performance issues and limitations are clearly within the purview of the ACF.

Recently, the Air Traffic Organization (ATO) of the FAA has decreed that ATC radar monitoring of pilot ad hoc navigation to any fix inside of the IF, up to and including the FAF, is the legal equivalent of a radar vector. Whether ATO has the authority to make such an interpretation is beyond the purview of the ACF. But, the safety and pilot/system performance issues and limitations are clearly within the purview of the ACF, and these safety issues become increasingly critical for fixes inside the IF

Recommendations: AFS immediately launch a full system analysis and study regarding the safety issues caused by ad hoc navigation to fixes inside the IF, particularly with RNAV systems and procedures, and particularly in instrument meteorological conditions. For instance, what are the maximum safe intercept angles, if any? (ATO has not addressed this in their recent proclamations, nor does NBAA believe the ATO possesses the necessary expertise to make what are fundamentally highly technical TERPS criteria and pilot/system performance issues.) Further, there is no AIM guidance whatsoever to pilots pertaining to ad hoc pilot navigation onto IAPs inside the IF.

Comments: This recommendation affects FAAOs 8260.19D, 8260.3B, 8260.52, 8260.54A, 7110.65S, the Aeronautical Information Manual (AIM) and various other FAA directives and policy statements.

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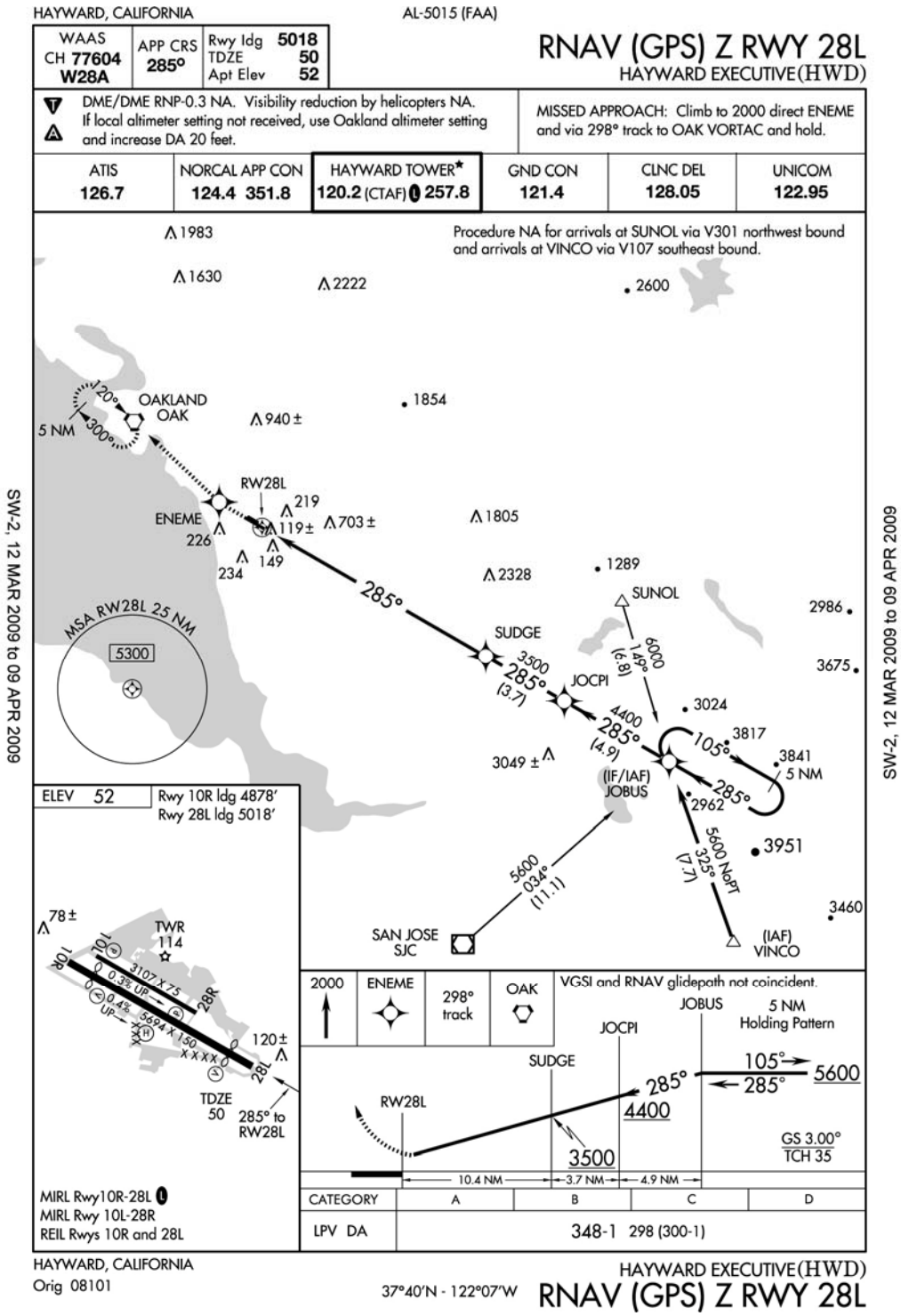
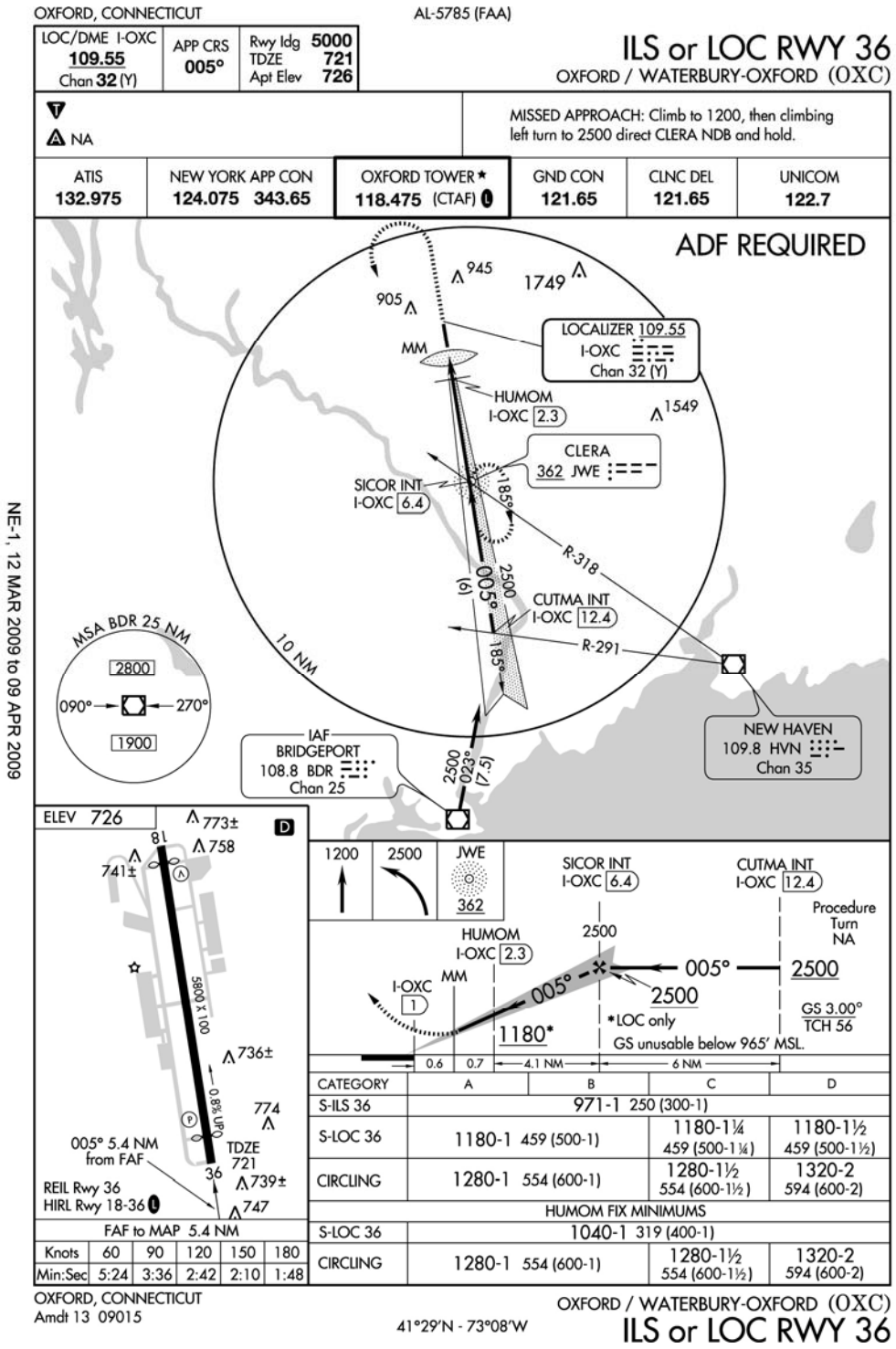
ATTACHEMENT #1

(Direct to JOCPI)



ATTACHEMENT #2

(Direct to SXCOR)



Initial Discussion - Meeting 09-01: New issue presented by Rich Boll, NBAA. NBAA has received reports that pilots are being cleared direct to fixes inside the intermediate fix (IF) for RNAV approaches. This practice has been also noted via review of pilot comments on the AOPA Forum. While all agree that TERPS and Part 91.175(i) permit radar vectors to a final approach course, NBAA is concerned over "direct to" clearances to other than the IF for RNAV approaches. Rich stated that they are requesting a full system analysis to assess the safety of ad hoc clearances to fixes inside the IF. Paul Ewing, AJR-37, suggested that perhaps controllers were not applying the provisions 7110.65 correctly. There are three ways to get aircraft on an approach; 1) a clearance to the IAF, 2) a clearance direct the IF if an RNAV approach, and 3) radar vectors to the final approach course. Paul suggested that perhaps #3 is being misapplied. Tom Schneider, AFS-420, stated that the issue was addressed at the US-IFPP and deemed to be an ATC procedural issue. He also noted the issue is on the ATPAC agenda as Area of Concern (AOC) 102. Mike Frank, AJT-22, stated that the phraseology in 7110.65 is based on TERPS and Part 91.175(i) allows vectors to final. It is a semantics issue, not a safety issue. Mike's position is that if controllers can vector to the FAF, they can issue a non-radar clearance to the FAF emulating the same track. Rich responded that during the SRMD conducted last July for clearances direct to the IF for RNAV approaches, the recommended procedure was clearances could be issued to a charted IF. Rich added that this issue addresses TERPS containment for obstruction clearance. RNAV procedures begin ramping down from the en route/initial containment areas of 2-4-4-2 NM at the IF. Clearances to intercept the final approach course inside the IF may not assure correct lateral containment whether the aircraft uses a fly-by lead or fly-over turn to re-intercept the final approach course. The practice also raises concern that the aircraft may be too close to the airport by the time they are back on course and unable to safely start a descent. If ATC is going to be allowed to clear RNAV aircraft to points inside the IF, then NBAA wants assurance that AFS has evaluated the operation for avionics performance and obstacle containment. Gary Fiske, AJT-22, asked what is the difference between "Fly heading 330" as a radar vector and "Fly heading 330 direct JOCPI". Bill Hammett, AFS-420 (ISI) stated that the question of radar vectors vs. an RNAV direct clearance while being radar flight followed has been before the ACF before. Some ATO representatives in the past have stated the two operations are the same; however, this position is not supported by the Pilot/Controller Glossary. Gary responded that "Cleared direct XXXX" is not a radar vector; "directing the pilot to "fly an assigned heading" is. Tom Schneider, AFS-420 summed up by stating the discussion indicates there is a difference of opinion of whether ATC can vector or clear RNAV aircraft to the FAF or anywhere between the IF and FAF at any angle due to 91.175 as compared to the apparent more restrictive language in Order 7110.65 that seems to limit ATC vectors to final to 20-30 degrees 2 miles outside the FAF, or a clearance direct to the IF for RNAV approaches (no more than 90-degrees off final approach course), or a vector/clearance to an IAF. Tom added there are two issues involved, 1) the ATC procedural issue before ATPAC (AOC-102) and 2) the TERPS containment issue. The ATPAC issue must be resolved before it can be determined whether any AFS action is required. Rich re-affirmed that in the unlikely event that ATPAC agrees that application of Part 91.175 without consideration of the 7110.65 associated limitations, then the issue must come back to the ACF. Tom agreed the issue would remain on the agenda pending ATPAC action. As the AFS representative at ATPAC, AFS-410 will track action on the issue. ACTION: AFS-410.

MEETING 09-02: Bruce McGray, AFS-410, briefed that the issue was discussed at ATPAC and a DCP was being developed for a change to Order 7110.65. The DCP will allow radar vectors to a point inside the IF for RNAV GNSS IAPs provided the turn on would be within 30 degrees of the final approach course and at least 3 NM prior to the FAF. They are still awaiting data collection on avionics equipment performance to determine whether a turn on at or within 3 NM will allow equipment to ramp down. Tom Schneider, AFS-420, asked if there was any update on the proposal to allow non radar clearances direct to a fix inside the IF. Gary Fiske, AJT-28, stated that this is being considered and quoted a proposed DCP change. Rich Boll, NBAA, stated that this issue was discussed in another meeting yesterday and NBAA would non-concur with such a change pending verification of FMS performance. He understood the issue is in a HIA status pending this verification. Rich added that NBAA supports direct-to-IF clearances for both RNAV and conventional IAPs, but will not support clearances inside the IF until it is determined how FMSs will perform. Paul Ewing, AJR-37 (AMTI), stated that ATPAC AOC 102-2 will close the direct-to-IF issue for conventional approaches. AFS-410, with support from AJR-37and NBAA to continue to track the issue and report result of FMS performance evaluations.
ACTION: AFS-410, AJR-37, and NBAA.

MEETING 10-01: Bruce McGray, AFS-410, reported that this issue is still unresolved at ATPAC and he will continue to track it. Gary Fiske, AJT-28, reported that an ATO Document Change proposal (DCP) to revise Order 7110.65, paragraph 4-8-1, is currently in coordination. The change is intended to address all "direct-to" clearances. Gary will keep the group apprised of the DCP status. ACTION: AFS-410 and AJT-28.

MEETING 10-02: Gary Fiske, AJT-28, briefed that the comments on the DCP changes to Order 7110.65, paragraph 4-8-1, have been received and there is one non-concur that has not been mitigated. A Safety Risk Management Panel (SRMP) is scheduled for November 9-10 and further resolution is pending the SRMD. Rich Boll, NBAA, asked whether the DCP had been re-circulated. Gary Responded that the DCP has not been re-circulated but, pending the outcome of the SRMP, may need to be. He will monitor the process and report. Bill Hammett, AFS-420 (ISI), added that the issue is still at ATPAC for resolution. AFS-410 will continue to follow and report on ATPAC actions to resolve the issue.
ACTION: AFS-410 and AJT-28.

MEETING 11-01: Janet Nichols, AFS-410, reported that the issue is still being worked through ATPAC under Area of Concern 102-2. Doug Marek, AJT-24, reported that a Document Change Proposal (DCP) was coordinated and received a non-concur. The DCP has been revised and was released for FAA internal coordination last week. Issue remains open pending further action after ATPAC resolution. AFS-410 will continue to follow and report on ATPAC action ACTION: AFS-410 and AJT-24.

MEETING 11-02: Janet Nichols, AFS-410, reported that the ATO Document Change Proposal (DCP) for Order JO 7110.65, paragraph 4-8-1, has been finalized to resolve the issue. There was a Safety Management Study (SMS) accomplished that resolved issues surrounding the proposed change and a Safety Risk Management Document (SRMD) written. Due to the significance of the changes, air traffic controller training was recommended. Paul Eure, AJE-31, stated that the training requirements have been

completed and forwarded to the FAA National Training Organization to format and distribute. George Bland, AFFSA, asked whether the training requirements had been coordinated with DoD. Paul responded that he did not know. Rich Boll, NBAA, asked who is on the hook for reviewing and updating (if required) the applicable AIM guidance. Bill Hammett, AFS-420 (ISI) responded that the OPR for AIM paragraph 5-4-7i is within AFS-400 and took an IOU to ensure the correct office is advised. ACTION: AFS-410 and AJT-24.

> ***Editor's Note:*** *Post meeting research indicates the OPR is AFS-410. Also, the secretary was advised by Rich Boll, NBAA, that a draft of DCP for an AIM change that complements the changes to JO 7110.65, paragraph 4-8-1, is being circulated among the DCP 4-8-1 SRMD participants. The AIM DCP should be released soon.*

MEETING 12-01: Gary Fiske, representing AJT-2A3, briefed that he believed all comments regarding the Document Change Proposal (DCP) for Order JO 7110.65, paragraph 4-8-4, had been vetted and the DCP forwarded for signature. He thought the document was hung up in AOV, but has since learned that it is in the En Route Service Unit. Paul Eure, AJE-31, stated that publication of the change was awaiting training guidelines. Those guidelines have been written and the training package forwarded to the ATO National Training Group. Paul added that to expedite implementation, the guidance will be published as a Notice, targeted for June, 2012, rather than awaiting formal change to Order JO 7110.65. Bruce McGray, AFS-410, stated that he has the DCP and is authoring AIM/AIP changes to support it. Rich Boll, NBAA, recommended that if a Notice is published in June, similar language should be published concurrently as a Graphic Notice in the Notices to Airmen Publication (NTAP) pending publication in the AIM/AIP. Bruce agreed to pursue this. The following IOUs are assigned: 1) AJT-2A3 and AJE-31 to track and report status of the proposed change to Order JO 7110.65; 2) AFS-410 to review the proposed changes to Order JO 7110.65 and make necessary changes to AIM paragraph 5-4-7i; and, consider interim publication of AIM guidance as a Graphic Notice in the NTAP.
ACTION: AJT-2A3, AJE-31 and AFS-410.

MEETING 12-02: Paul Eure, AJE-31, briefed on behalf of AJE-31 and AJT-2A3, that a Document Change Proposal (DCP) amending FAA Order JO 7110.65 has been finalized and is scheduled for publication in March 2013. The ATO is also making an effort to expedite publication of the change via a NOTICE in December with implementation in mid-January 2013. He added that what started out as a relatively simple fix has gotten increasingly complex over the past 5-years; however, the final verbiage has been finalized. Paul added that his office and AJT-2A3 will continue to track the change until published. Bruce McGray, AFS-410, stated that AIM language has been drafted for publication in August 2013. He added that interim publication of the AIM language as a Graphic Notice in the Notices to Airmen Publication (NTAP) is also under consideration. John Collins, GA Pilot, stated that if the JO 7110.65 change and the AIM are not published concurrently, there will be pilot/controller confusion. John added that the NTAP has low visibility among pilots. Bill Hammett, AFS-420 (ISI), suggested that AFS-410 might consider a SAFO or InFO as an interim method to broadcast the change. Bruce agreed to consider these options.
ACTION: AJT-2A3, AJE-31 and AFS-410.

MEETING 13-01: Paul Eure, AJE-31, briefed on behalf of AJE-31 and AJT-2A3, that the Document Change Proposal (DCP) amending FAA Order JO 7110.65, paragraph 4-8-1, has been finalized after 5.5 years of work. Implementation is planned via publication of a NOTICE on June 3. The DCP covers a wide range of issues and controller training is expected to begin on April 24. Bruce McGray, AFS-410, stated that when the ATO changes have gone into effect, AFS would update the AIM. Bob Lamond, NBAA, stated that it is not a good idea to have this disconnect between the new ATC procedures and the long delay until the AIM guidance to pilots is available. John Collins, GA Pilot, supported Bob's position stating that some form of notice to pilots must be published prior to the June 3 implementation date. Paul asked whether the change to Order JO 7110.65 could be "cut and pasted" into an NTAP Graphic Notice. Bruce stated that he would work with Bob and the Terminal Service Unit representative, Michael Poisson, AJT-2A3, to develop the AIM change and an interim Graphic Notice. AJT-2A3 and AJE-31 will continue to track the change to Order JO 7110.65 and AFS-410 will work with NBAA and AJT-2A3 to develop necessary pilot educational material; e.g., Graphic Notice, SAFO, InFO, AIM guidance, etc. ACTION: AJT-2A3, AJE-31, AFS-410, and NBAA.

MEETING 13-02: There were two distinct IOUs relating to this issue. The first relates to Order JO 7110.65, paragraph 4-8-1. Mike Poisson, AJV-8, briefed that the revised procedures specified in this paragraph were implemented via Notice (N JO 7110.620), which became effective July 31, 2013 and will also be included in the next update of the Order. Rich Boll, NBAA, inquired whether the Notice has been implemented and whether all AT training has been completed. Gary Fiske, AJV-8, responded that all training has been complete and the procedures are in place. John Collins, GA Pilot, stated that the diagram associated with Change 3 regarding straight-in clearances doesn't make sense. Gary agreed to work this comment off line with John and Rich.

Bill Hammett, AFS-420 (ISI/Pragmatics contract support) asked about second part of the IOU that relates to AIM guidance. Bruce McGray, AFS-410, advised that the AIM has been updated. Bill said if this has been accomplished, then we should not need InFO or SAFO guidance. Tom Schneider, AFS-420, asked Rich Boll NBAA, the originator of the issue, if he supported closure. Rich said he will work off line with Bruce on training, and he is good with closing issue. Issue CLOSED