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From: General Aviation Human Factors Program Manager, ATO-P R&D Human Factors
To: General Aviation TCRG

Subj: GENERAL AVIATION HUMAN FACTORS SECOND QUARTER '05 REPORT

Ref: General aviation human factors execution plans (http://www.hf.faa.gov/gafunded.htm)

1) Each project is listed below.

a) Human Error and General Aviation Accidents: A Comprehensive, Fine-Grained Analysis using HFACS

Although the collaborative agreement between the University of Illinois (Dr. Douglas Wiegmann) and the Civil Aerospace Medical Institute (Dr. Scott Shappell) associated with this requirement has been completed, both parties have agreed to extend the agreement *at no cost to the Federal Government* to include several important initiatives on the FAA's agenda. Specifically, CAMI and the University of Illinois will complete a number of HFACS analyses and provide reports to sponsors on the following issues (many of which are part of the AVR business plan and dashboard):

- *Complete data processing and prepare report describing the analysis of commercial aviation accidents (1990-2000) using the Human Factors Analysis and Classification System (HFACS).* This project can be found on page 10 of the AVR Business Plan as part of Flight Plan Performance Target: Airline Fatal Accident Rate; Strategic Initiative: Human Factors; Strategic Activity: Commercial Accidents Analysis.

  Progress to date: The commercial aviation database has been classified by our pilot subject matter experts (SMEs) and delivered by OMNI Corporation to the principal investigators in December. Since then, the database has been undergoing the human factors quality assurance process. The scope of the study has been expanded to include all commercial aviation accidents occurring from 1990-present. Preliminary analyses of a subset of this data (Air

tour accidents) have been conducted in February and tentative results have been briefed to the sponsor and will be presented at the Annual Meeting of the Aerospace Medical Association.

- *Conduct a detailed human factors comparison of general aviation accidents occurring in Alaska with those occurring in the rest of the U.S.* This project can be found on page 11 of the AVR Business Plan as part of Flight Plan Performance Target: GA Fatal Accidents; Strategic Initiative: Human Factors; Strategic Activity: Human Factors Comparisons and Analysis.

  Progress to date: All general aviation accidents from 1990-2000 have been classified by our pilot subject matter experts (SMEs) and delivered by OMNI Corporation in October, 2004. The human factors quality assurance (HFQA) process was completed in December, 2004. A draft report has been completed and is undergoing internal review and modification. Depending on when the remaining GA accidents 2001-present are classified by our pilot SMEs, delivered by OMNI Corporation, and HFQA'd by CAMI scientists, the current draft report may be revised to include all GA accidents occurring between 1990-present.

- *Conduct a human factors analysis of accidents involving emergency medical services (EMS) aircraft.* This project can be found on page 11 of the AVR Business Plan as part of Flight Plan Performance Target: GA Fatal Accidents; Strategic Initiative: Human Factors; Strategic Activity: Human Factors Comparisons and Analysis.

  Progress to date: EMS aircraft operate under both 14 CFR Part 91 (General Aviation) and 14 CFR Part 135 (Commercial Operations). As such, analysis of these accidents requires completion of both databases. However, in the interest of time, and given the small number of EMS accidents relative to the entire 14 CFR Part 91 and 135 accident databases, a decision was made to identify EMS accidents and classify them before the remaining accidents were analyzed. That data has been identified, classified by our pilot subject matter experts, and is currently undergoing the final human factors quality assurance process. Preliminary analyses have been presented to the sponsor (AFS-840 Bill Wallace), Helicopter Association International (Dick Wright), and at the Air Medical Transport Conference in Cincinnati, OH. A large part of the draft report has been completed and is awaiting final results.

  *Analysis of Air Tour Operations.* Dr. Bert Boquet and Ms. Cristy Detwiler met with Mr. Paul Joly, Las Vegas FSDO-LAS, to present preliminary HFACS analyses (1990 to 2000) of accident data associated with the air tour industry. Another purpose of the trip was to obtain sponsor input regarding potential analyses to be performed prior to the generation of the final report.

The findings of the initial analyses revealed some consistency with other aviation platforms: more skill-based errors than any other kind, (65%), followed by decision errors (34%), then violations (22%), and finally perceptual errors (8.9%). It is important to note that while no differences were noted between 14 CFR Part 91 and 135 operators for skill-based, decision, and perceptual errors, violations were 4 times more likely in 135 operations compared with 14 CFR Part 91 operations. The fine-grained analyses revealed that Air Tour operators were more likely to: 1) make more *In-flight Planning/Decision* errors; 2) make more *Refueling* decision errors; 3) *continue VFR flight into IMC*; and 4) *violate established Procedures/Directives*. The demographic analyses for Air Tour operators revealed that the majority of accidents occurred in the Cruise and Takeoff phases of flight. Finally, compared to other 14 CFR Part 91 and 135 operations, there were a higher percentage of fatal accidents and more accidents occurring in IMC.

*The original requirement has been completed and a final report has been submitted for approval. The requirement has been extended to include the analyses above. Note that the two principal investigators (Dr. Scott Shappell and Dr. Bert Boquet) for this project have taken positions within academia. However, their departure from the FAA is not anticipated until the July-August time-frame. Nevertheless, all indications are that the additional items are on track.*

b) Credit for Instrument Rating in a Flight Training Device or Personal Computer: Phase III: Transfer of Training Effectiveness of a Flight Training Device (FTD).

All data has been collected and final analyses are being conducted. There have been no changes in the preliminary analyses since the 1st quarter of FY05.

*All available information indicates that this project is on track.*

c) Visibility in the Aviation Environment

We have continued to refine our model of detection based on sparse coding by physiological plausible mechanisms. The present model incorporates several stages including ganglion cell filtering, cortical neuron rectification, and variable threshold of response based on a form of contrast adaptation. We have continued to develop interactive training software to teach pilots how to recognize distance, relative direction, and altitude of targets. We continue to evaluate vision detection models of visibility. We are trying to include the parameters of attention and prior knowledge of target features which play a large role in actual target detection. We have continued running detection experiments designed to evaluate the utility of synchronous and asynchronous strobe lights as aids to detection. Preliminary results indicate that there is very little advantage of asynchromous strobes over synchronous strobes for detection. However the presence of strobe lights (either synchronous or asynchromous) greatly increases detection of targets

on masking backgrounds. We are continuing to develop experiments that will objectively measure performance under simulated flat light conditions.

*All available information indicates the project is on track.*

d) Electronic Primary and Multi-function Flight Displays for GA; Certification Criteria and Usability Assessments.

*The GA/VF TCRG rescinded this requirement due to the researcher's failure to follow the execution the plan.*

e) Migration of HFACS database to a web-based interface

Work is continuing on the pilot data entry confirmation screen which will insure that the data the pilots selected for is visible to them before they commit it. Work is ongoing for the data entry sections to delineate who can edit maintenance related HFACS issues versus pilot error issues. Work has begun on the administrative section of the web site.

*All available information indicates the project is on track.*

f) Unmanned Aircraft Vehicle Mishap Analysis

The report entitled, "*A Summary of Unmanned Aircraft Accident/Incident Data: Human Factors Implications*" has been published as an Office of Aviation Medicine Technical Report: (http://www.cami.jccbi.gov/aam-00A/Abstracts/2004/FULL%20TEXT/0424.pdf)

A submission for a chapter in a book on the human factors of unmanned aircraft entitled, "Human Factors Implications of UA Accidents: Flight Control Issues", for the future *Human Factors of Remotely Piloted Vehicles* volume of the *Advances in Human Performance and Cognitive Engineering Research* series has been completed and is undergoing FAA Headquarters review. In addition, a summary of UAV accident data was received from Anthony Tvaryanas for review and comments.

In January of 2005 a meeting of the NASA Access 5 group was convened in Las Vegas, NV. The subgroup on human factors presented their latest efforts and planning for future efforts was completed. CAMI provided a KSA analysis for manned aircraft that will assist in the development of KSA requirements for unmanned aircraft. A second meeting of the NASA Access 5 Group was convened in February of 2005 in support of the development of the KSA analysis for unmanned aircraft. Regular telecons have also been held. In March of 2005, a draft KSA analysis developed by the Access 5 group was reviewed and edited.

In addition, contact was made with Dr. Rich Adams in regard to work being performed in the SAE-G10 unmanned aircraft working group. Assistance will be provided toward the development of training and pilot qualifications for UA.

Finally, initial planning for the development of a UAV simulation at CAMI has begun. Implementations for both AGARS and BGARS are being considered.

*All indications indicate that this project is on track to complete the milestones as planned.*

g) National Airspace Human Factors Integration Plan for Unmanned Aerial Vehicles

*This requirement was completed. The final report can be found at http://www.hf.faa.gov/docs/508/docs/uavPlanFinal.pdf.*

h) Flight Deck Technologies and Procedures, Discriminability Assessment of Proposed Traffic Symbol Set

On February 24th, the program office sponsor POC spoke to the researcher about the project and expected deliverables. The sponsor POC was satisfied with the projects' progress.

The following work plan has been formulated

1. Construct a model for image categorization in Matlab. The current image discrimination model has the following steps.
    a. Two images are converted to contrast.
    b. The two contrast images are filtered by a contrast sensitivity filter.
    c. The visible contrast images are reduced in contrast by a contrast gain masking function.
    d. The generalized distance between the images is converted to a number of threshold discrimination units (JNDs).
2. For our preliminary image categorization model we will perform the following steps to each image that is to be categorized.
    a. The image is converted to contrast.
    b. The contrast image is filtered by a contrast sensitivity filter.
    c. The visible contrast image is reduced in contrast by a contrast gain masking function.
    d. The minimum distance between all the translated versions of the visible masked contrast images and each of the category templates is computed. These minimum distances are then converted to a response probability distribution over the categories.

e. There are many candidate rules for computing the templates, including filtered and unfiltered examples of the category. Initially we plan to use unfiltered contrast examples, but since this issue has not been researched much, we plan to test multiple rules for generating the templates.

3. Test the model on the last year's data collected by Volpe and reported in the FY04 quarter 3 report (http://www.hf.faa.gov/docs/508/docs/gaFY04Q3.pdf)

4. Set up a symbol discrimination experiment with possible goals:

   a. Evaluate other proposed symbols.

   b. Include some background variation, or other desired variables.

   c. Specifically test among alternative classification models.

   d. Test the model(s) on the new data.

   e. Complete these steps by the end of the summer and then begin trying to extend the model so that it has some size and rotation invariance as well as the translation invariance.

5. We have begun looking at the previously collected Volpe data (http://www.hf.faa.gov/docs/508/docs/gaFY04Q3.pdf). Some preliminary results are:

   a. There are significant order effects that are confounded with observer effects because the design was not balanced. Observer 5 made more than twice as many errors as anyone else, but he was the only one to begin with the farthest distance.

   b. There are significant rotation effects. They only seemed to occur for the selected directional symbols. We will not be able to tell if these are perceptual or cognitive (categorical) without knowing what the actual images were (the rotation may have changed the outline). When Image 13 was in rotation 1 (we do not know what the positions mean), it was almost always called 13, but in other orientations it was often called 3.

      13  3. 

   c. The errors are not symmetric. A line version is called a filled version, but not visa versa. At distance 88, if wrong, Image 1 was most likely to be called 2, but not visa versa. Image 2 errors were most likely to be 12, an indication of size invariance. At that distance, Image 11 was more likely to be called 12 than 11.

      1  2  11  12 

   d. At least one confusion (13 being called 3) seems to be consistent with this principle and size invariance.

13  3 

Such principles would mean that simple perceptual difference scaling can not predict the actual pattern of responses. Another possible cause of such effects is that the observer scanned through the responses sequentially, stopping when a match occurred without considering other possibilities. It would be nice to know the arrangement of the responses on the laptop so that this idea could be evaluated.

6. We have looked at the two images 15 (pink plane) and 20 (pink cross). These two images were mainly confused with each other, with a strong bias for responding that the plane was present. At the 88 distance, they were actually more likely to say that the plane was present when the cross was. At that distance, the 2x2 confusion matrix has a d' of 0.6, while the image discrimination model predicts a d' of 0.9 (under various assumptions about the presentation conditions that we know are wrong). This result suggests the model can do a fair job of predicting the observed discriminability, since the observers vary in sensitivity by at least a factor of three.

15  20 

7. Next quarter, the researcher plans to:
    a. to get more information from sponsor POC about the stimuli;
    b. to see how well the confusion matrix can be predicted by the simple image discrimination model.

*New start. This grant is cost shared with NASA Ames. All available information indicates the project is on track.*

i) <u>FITS - Proficiency Standards for Technically Advanced Aircraft</u>

A series of workshops were held at NASA Ames to create a draft of a technical elements document for technical advanced aircraft. This document describes the knowledge and skill elements deemed relevant to flying in technically advanced aircraft. Pilots, flight instructors, and researchers attended the workshops. The researcher will distribute the proficiency standard list to AFS-800 and ATO-P HF R&D early April 2005. AFS-800 will send the list to AFS-600 for review. AFS-800 will distribute to NAFI, AOPA, industry in May/June timeframe. AFS-800 will deliver the revised list following their input to the researcher in July 2005.

A draft of a sample chapter of a proposed supplement to the FAA series of technical publications was written and illustrated by a graphic artist. This draft will be delivered to FAA HQ by early April and include ten illustrative examples with a described context.

*New start. This grant is cost shared with NASA Ames. All available information*

*indicates the project is on track.*

j) FITS - Enhanced Decision Making (EDM)

We are using four techniques to identify the most crucial issues present for today's general aviation pilot with special emphasis on transitioning to glass cockpit.

First, we are close to completion of a meta-analysis of transition to glass cockpits reported in the Part 121 literature. This should be completed in the next few weeks. Second, we have completed a review of ASRS reports revealing five top issues for general aviation. These include (a) inadequate instrument scan (b) underestimating the weather (c) pilot not heeding cautionary signs (d) automation (e) relationship gap between pilot and ATC. The FITS group requested that we focus our decision making training on weather issues. Third, CFI/novice interviews: we have been working with experts in the field of interviewing techniques to develop non biased interview questions and analysis strategies. Fourth, simulation observations: we have been perfecting the verbal protocol technique to uncover underlying cognitive processes behind the differences between novice and expert decision making in piloting TAA aircraft. This fourth issue identification technique will provide required information as to what skills we need to train.

We have also been assessing the current state of pilot training for in-flight weather decision-making through reviewing publications and computer-based training courses.

*New start. This grant is cost shared with NASA Ames. All available information indicates the project is on track.*

k) Unmanned Aircraft Operator Qualification and Training Requirements

The Civil Aerospace Medical Institute (CAMI) has agreed to coordinate the organization of a group of subject matter experts (pilots, UAV experts, scientists, and physicians) to evaluate current medical certification requirements for the operation of unmanned aircraft. Dr. Kevin Williams is the POC for CAMI on this effort.

*The final report will be due to AVR on December 31st, 2005*

l) General Aviation Private Pilot Survey / Initial Certified Flight Instructor – Airplane Survey/ Designated Pilot Examiner Program Assessment

**GA ASEL Pilot Survey.** The GA ASEL Pilot survey is under review at OMB. Unfortunately, the survey has been under review for over 60 days. Consequently,

Dr. Carla Hackworth (CAMI) contacted Ms. Judy Street, the FAA liaison, to request an update on the status and to stimulate the review.

The extent of the survey continues to be an issue. Specifically, ASW-200 (Mr. Ron McGarry and Mr. Roger Moore), would like to have results provided at the FSDO level while, the HQ sponsor of the survey (Mr. Lance Nuckolls AFS-800) would like the survey results to be released only at the regional level. After some discussion during a recent telecom between Drs. Shappell, Hackworth, Ms. Janine King (OMNI Corporation), Mr. Ron McGarry (ASW-200) and Mr. Lance Nuckolls (AFS-800), it was decided that a final decision on the level of reporting should come from AFS-2. CAMI is awaiting direction from HQ before commencing the survey distribution.

Dr. Hackworth and Mr. Moore visited the OKC FSDO to review Airman Certification forms. Based upon this visit, Dr. Hackworth and Ms. King sent changes to Ms. Tracey Edwards for the KSN website that will be used to solicit pilot names and addresses from FSDOs. Dr. Hackworth and Ms. King are working to develop a list of FSDOs by region that Ms. Edwards will use to generate a unique username and password for each FSDO allowing access to enter in pilot names and addresses.

**GA ASEL Designated Pilot Examiner (DPE) Survey.** The latest DPE survey was submitted to the team for their approval. CAMI is waiting for feedback. The goal is to have the DPE survey completed early in the 3rd quarter of FY05. Dr. Hackworth has been working with AFS-900 to obtain the ASEL DPE names and addresses. We have received a list of names and addresses that will be used to mail DPE surveys. The cover letter for the GA ASEL survey is ready for endorsement from AFS-1 or AFS-2. The letter that will describe and announce the commencement of the survey to the FSDOs is under review by Mr. Nuckolls. In addition, Dr. Hackworth sent the completed DPE survey cover letter for his review.

*All indications indicate that this project is on track to complete the milestones as planned.*

m) A New Approach to Aviation Accident/Incident Prevention/Mitigation

The execution plan can be found at
http://www.hf.faa.gov/docs/508/docs/GAHFIXexeplan.pdf

As planned, both NTSB and FAA JSAT/JSIT data continued to be classified by subject-matter experts at both the University of Illinois and the FAA's Civil Aerospace Medical Institute (CAMI) during the 2nd quarter. The data collection phase is nearing completion and data analysis phase is expected to begin early in the 3rd quarter of FY05. Toward these ends, a meeting was recently held at CAMI (March, 2005) with Dr. Douglas Wiegmann (University of Illinois) to further refine the Human Factors Intervention Matrix (HFIX) as part of the validation

effort and to discuss progress on regarding data collection and the impending analysis phase.

Data from this effort will be used to determine the extent to which current general aviation aircrew causal factors are being addressed by existing and planned FAA safety programs. Where gaps exist, this project will identify them and make recommendations for additional prevention/mitigation strategies.

*All available information indicates that this project is on track.*

n) Aviation Safety Inspector Training for Technically Advanced Aircraft

ATO-P R&D HF and sponsor office are drafting the requirement and execution plan.

*This is a new start project. On Febraury 2nd, 2005 the GA/VF TCRG identified this requirement as a FY05/FY06 "pop-up" requirement.*

o) ASRS Weather Callback

The research requirement can be found at http://www.hf.faa.gov/docs/508/docs/GAASRSreq.pdf. The execution plan can be found at http://www.hf.faa.gov/docs/508/docs/GAASRS_exeplan.pdf.

*This is a new start project. On Febraury 2nd, 2005 the GA/VF TCRG identified this requirement as a FY05/FY06 "pop-up" requirement.*

p) How to Pilots Use Weather Ground (internet, FSS dial-up, or other internet services) and/or Aircraft (e.g., data link) Products?

The research requirement can be found at http://www.hf.faa.gov/docs/508/docs/GAWxreq.pdf. The execution plan can be found at http://www.hf.faa.gov/docs/508/docs/GAWxexeplan.pdf.

*This is a new start project. On Febraury 2nd, 2005 the GA/VF TCRG identified this requirement as a FY05/FY06 "pop-up" requirement.*

q) Ultra-Fine Grained Analysis of General Aviation Accidents 1990-present

The research requirement can be found at http://www.hf.faa.gov/docs/508/docs/GAUltrareq.pdf . The execution plan can be found at http://www.hf.faa.gov/docs/508/docs/GAUltra_exeplan.pdf.

As part of the FAA's endeavor to better understand the human causes of GA accidents, the FAA/Civil Aerospace Medical Institute (CAMI) and the University of Illinois have analyzed fifteen years (1990-2004) of general aviation (GA) accidents using the Human Factors Analysis and Classification System (HFACS).

The findings have identified that among the unsafe acts of aircrew, skill-based errors account for roughly 3 out of every 4 accidents, followed by decision errors (28%), violations (13%), and perceptual errors (5%). In the last collaborative effort, these analyses were extended to identify the general types of errors within each causal category (i.e., a fine-grained analysis of GA accidents). For example, it was determined that the top skill-based errors included technique errors such as the loss of directional control on the ground, management of airspeed, loss of control in-flight, and compensation for winds. While these analyses provide the most comprehensive examination of the human causes associated with GA accidents to date, more information about the specific operational and individual pilot factors associated with each unsafe act is needed to generate targeted interventions.

As a result, AFS-800 has requested that a comprehensive and systematic "ultra" fine-grained analysis of the operational and individual pilot factors associated with each of the major HFACS unsafe acts previously identified as causal to GA accidents be performed. As a joint effort between researchers at the University of Illinois and CAMI, operational factors and pilot characteristics associated with GA accidents will be systematically and comprehensively analyzed to explore the relationships between these factors and the occurrence of specific unsafe acts of aircrew. These demographic analyses will be integrated with the results of the previous HFACS analysis of the underlying aircrew errors, so that a complete picture of the causes GA accidents can be realized. In turn, this information will provide the necessary information for evaluating current intervention strategies, as well as developing future interventions, using the Human Factors Intervention Matrix (HFIX).

*This is a new start project. On Febraury 2nd, 2005 the GA/VF TCRG identified this requirement as a FY05/FY06 "pop-up" requirement.*

r) Low Visibility and Visual Detection: Design and Development of a Visibility Analysis Tool

The researcher was funded in FY04 to support a low visibility requirement. In FY05, the researcher effort shifted to support the "Lowering GA Accidents in Low Visibility: UAV See-and-Avoid Requiremements" project. The execution plan can be found at http://www.hf.faa.gov/docs/508/docs/GAVisTool_exeplan.pdf.

**Research Objective:** The overall objectives for this fiscal year are to: 1) Enhance and validate the Air Traffic Control Tower (ATC) visibility analysis tool (FAA Vis) that was developed for the FAA by ARL in FY04 and, 2) Provide the FAA with a See-and-Avoid analysis tool that provides quantitative information on the available time that a UAV operator would have to respond to a potential conflict with other manned and unmanned aircraft. The technical approach that ARL SEDD will utilize to accomplish the first objective is to team with the U.S.

Army's Night Vision and Electronics Sensor Directorate (NVESD) to update the working desktop version of FAA Vis to include: charting routines, new graphical user interface (GUI) elements, the ability to reliably handle a wide range of observation luminance levels, more accurate slant-path calculations, and the ability to account for the effects of atmospheric attenuation by incorporating MODTRAN into FAA Vis. The technical approach that ARL SEDD will utilize to accomplish the second objective is to (again) team with NVESD to develop an interface between NVESD's Solid-State Camera (SSCAM) and Night Vision Thermal Imaging Systems (NVTherm) performance models, and the FAA's See-and-Avoid Detection and Recognition Visibility Analysis tool. The NVESD models will be used to generate all camera- and display-related performance parameters, while the FAA See-and Avoid tool will account for all atmospheric- and target-related performance effects. The FAA See-and-Avoid tool will combine all of the performance parameters to generate overall results. The majority of the algorithms and routines used in the See-and-Avoid tool will be identical to those used in the enhanced version of the ATC analysis tool FAA Vis. Overall validation of the subject analysis tools will require establishment of the proper detection and recognition discrimination criteria. Toward this end, ARL will team with NVESD and participate in a NASA-led *aircraft*-human perception experiment/study.

**Tasks/Status:**

1. Validate the Probability of Discrimination vs. Range predictions of the visibility analysis tool(s) through participation in a NASA-led *aircraft*-human perception experiment/study.

   **Status:** In early February, NVESD received a request from Andrew Watson (NASA – Ames) for a target set (complete w/ experimentally-determined N50's) for use in their *aircraft*-human perception experiment/study. NVESD has compiled a CD with a 12-target tank set and a single-handed object set, complete with documentation on their respective N50 derivations. This CD must now pass through NVESD security prior to release. Barring any complications, the CD should be available within the next two weeks. Additional collaborations with NASA on this effort will be forthcoming. (Expected completion date: Sept '05)

2. Update ARL's working desktop version of FAA Vis by adding charting routines and new GUI elements.

   **Status:** Work has just started on this task. ARL is working with NVESD on both elements of this task. (Expected completion date: Apr '05)

3. Enhance FAA Vis to reliably handle a wide range of observation luminance level inputs and implement more accurate slant-path calculations.

   **Status:** Work on the first element of this task has started. Recent experience gained in another performance model development effort with NVESD will

soon be utilized in the approach to more reliably handle a wide range of observation luminance input levels in FAA Vis. (Expected completion date: May ’05)

4. Modify FAA Vis to account for the effects of atmospheric attenuation by first, incorporating Moderate Resolution Transmittance (MODTRAN) code into FAA Vis, and second, by incorporating MODTRAN-generated attenuation data into FAA Vis calculations.

   **Status:** Work has started on this task in two areas: 1) NVESD has negotiated with the supplier of MODTRAN (Ontar Corp.) to provide a NVESD model-to-MODTRAN interface that will allow for the arbitrary observer-to-target slant-path calculations that will be required for the See and Avoid analysis tool (expect delivery in one week), and 2) ARL has provided the latest ARL/FAA Vis source code to NVESD; NVESD has now started the process of developing the Atmospheric Attenuation GUI and providing the MODTRAN interface and functionality. (Expected completion date: Jun ’05)

5. Develop an interface/mechanism to import relevant camera- and display-related performance parameters from NVESD’s SSCAM and NVTherm performance models into the FAA’s See-and-Avoid Detection and Recognition Visibility Analysis tool.

   **Status:** Work has started on this task. ARL has had several discussions with NVESD toward the development of an efficient and flexible approach to implement this task; a working approach has now been developed. Implementation should begin in May. (Expected completion date: Jun ’05)

6. Incorporate the camera- and display-related performance parameters into the See-and-Avoid tool performance calculations.

   **Status:** Work has no yet started on this task. (Expected completion date: Aug ’05)

7. Develop GUI elements and calculation routines into the See-and-Avoid tool for additional scenario inputs and outputs.

   **Status:** Work has no yet started on this task. (Expected completion date: Sept ’05)

8. Integrate all improvements into the Web version of FAA Vis, as available. This task will require time and resources from both ARL and from an FAA-designated information technology (IT) organization (e.g. CSSI, Inc.).

   **Status:** Work has no yet started on this task. (Expected completion date: Sept ’05)

**Schedule:** Shown below is the original schedule for the tasks funded for FY05, along with the estimated progress to date. Note that while we are somewhat

behind original estimates at this point, we anticipate the project to progress at a much faster rate in the next several weeks and months due to greater availability and application of resources (time) from ARL and NVESD.

*New start. This grant is cost shareed with Army Research Lab and US Army CECOM NVESD.*

William K. Krebs