



AAR-100

Human Factors Newsletter # 03-07

April 12, 2003 – April 30, 2003

Recent Publications/Project Reports

- **Technical Note:** *The Effect of Voice Communications Latency in High Density, Communications-Intensive Airspace.* R. Sollenberger, ACB-220D; M. McAnulty, ACB-220; K. Kerns, AND-300; MITRE/CAASD. The Next Generation Air-Ground Communications (NEXCOM) program plans to replace aging analog radio equipment with a digital system, the Very High Frequency Digital Link Mode 3 (VDL3). VDL3 will include both digital voice and data link communications, and will include special features such as controller override, anti-blocking, and a transmit status indicator. Two human factors concerns with the VDL3 system were the quality of the speech generated by voice coding technology, and the effect of additional audio throughput delays introduced by the voice coding and time division multiple access techniques implemented in the VDL3 system configuration. Previous studies by the Federal Aviation Administration William J. Hughes Technical Center (WJHTC) and other International Civil Aviation Organization States determined that the intelligibility of the digital voice was acceptable for Air Traffic Control operations. Engineering Research Psychologists from the Human Factors Group (ACB-220) of the WJHTC Research and Development and Human Factors Laboratory conducted a high fidelity, human-in-the-loop simulation to compare system efficiency and controller performance and workload using a simulated VDL3 system with anti-blocking, controller override and transmit status features under three delay conditions based on increasing ground system delays: 250 ms (current specification), 350 ms (practical alternative), and 750 ms (to demonstrate the sensitivity of the simulation measures). Each of the delay conditions also included appropriate delay factors for airborne system processing. The resulting end-to-end delays were somewhat longer for controller-to-pilot than they were for pilot-to-controller transmissions. Ten controllers from the busiest Level 11 and 12 Air Route Traffic Control Centers participated in the study. The results indicated that there were no significant differences between the 250 and 350 ms delay conditions. However, the 750 ms condition did produce a significant increase in controller overrides, and the controllers rated it as interfering with some aspects of their communication (e.g., providing optional services). The conclusion of the study is that a VDL3 system with anti-blocking, controller override, and transmit status features, and a 350 ms ground system delay, would be operationally effective for Air Traffic Service

communications, and acceptable to controllers. <http://acb220.tc.faa.gov/technotes/dot-faa-ct-tn03-04.pdf>

Symposium on Aviation Psychology: AAR-100 sponsored human factors research was showcased at the 12th International Symposium on Aviation Psychology held at the Dayton Convention Center in Dayton, Ohio, April 14 - 17. The symposium was sponsored by Wright State University in cooperation with Inventing Flight (Dayton), and celebrated the centennial anniversary of powered flight. Presentations included:

- A Volpe Center contribution titled *Flight Simulator Fidelity: An Update on Motion Requirements* reported on efforts to obtain scientific data on the platform motion simulation requirements for training and evaluation of airline pilots. Another paper, titled *Determining Minimal Display Element Requirements for Surface Map Displays*, described issues in the design of electronic map displays to enhance safety and reduce incidents on or near the airport surface. General aviation pilots were asked to rate their need for different types of information required for conducting operations on or near the airport surface. The ratings identified a set of "high need" items common to all operational phases, but also emphasized the shifting need for information across different phases. A third paper, *Hidden Markov Models as a Tool to Measure Pilot Attention Switching During Simulated Instrument Landing System Approaches*, described the development of a means of inferring a pilot's current cognitive task from a sequence of eye fixations on cockpit instruments. Modern flight deck displays, such as head-up displays, present integrated information for multiple tasks at the same fixation point, thus preventing inferring a task from one fixation. By mathematically analyzing a stream of fixations for distinct statistical patterns, the most likely current task at any point in time can be determined. (J. Bürki-Cohen, Volpe Center)
- CAMI presentations included the following:
 - *Safe Flight 21 Ohio River Valley Project: Human Factors Considerations for the In-flight use of a Cockpit Display of Traffic Information.* O. V. Prinzo, FAA Civil Aerospace Medical Institute, Oklahoma City, OK; V. Battiste, NASA Ames Research Center, Moffett Field, CA; N. Johnson, San Jose State University Foundation, San Jose, CA; R. Bone, and D. Domino, The MITRE Center for Advanced Aviation System Development, McLean VA. Safe Flight 21 Ohio River Valley Project is a joint government/industry cooperative effort to explore the use of Automatic Dependent Surveillance Broadcast (ADS-B) services and other related enabling technologies for improving the efficiency and capacity of the National Airspace System (NAS). This is being accomplished through the development, demonstration, and testing of applications, procedures, and equipment in the Ohio River Valley (in conjunction with the Cargo Airline Association) and in Alaska via the Capstone initiative. Human factors research is being conducted today to ensure that tomorrow's technologies such as the ADS-B system and Cockpit Display of Traffic Information (CDTI) are designed properly to leverage the inherent strengths and limitations of the human operator. Researchers will highlight human factors considerations for the in-flight use of CDTI for operational communications, runway and final approach

- occupancy awareness, airport surface situational awareness, approach spacing and departure spacing/clearance on operator task allocations, workload, and human performance. (R. Prinzo, CAMI)
- *Development of an Empirically-Based Index of Aircraft Mix.* E. Pfeiderer, FAA Civil Aerospace Medical Institute. This study is a comparison of the salient variables governing en route controllers' perceptions of the performance capabilities of a sample of aircraft and the actual performance of the aircraft in the en route environment. A group of 24 Certified Professional Controllers (CPCs) from Kansas City ($N = 17$) and Boston ($N = 7$) en route centers provided estimates of cruising speed, climb, and descent rates for a sample of 24 aircraft. A matrix of squared Euclidean distances derived from summary measures (i.e., means of estimated speed, climb, and descent rates) was used to construct a classical multidimensional scaling (CMDS) model representing controllers' perceptions of each aircraft's performance capabilities. A second matrix was derived from means of speed, climb, and descent rates for the same 24 aircraft computed from a sample of live air traffic data collected from the Kansas City and Boston en route centers. This matrix was used to construct a CMDS model representing actual aircraft performance. In both CMDS models, interpretation of the dimensions demonstrated that Dimension 1 was related to engine type, whereas Dimension 2 was primarily associated with aircraft weight class. Subject weights from an individual differences scaling (INDSCAL) analysis of the two matrices revealed that controllers attached more importance to Dimension 1 (Engine Type) relative to Dimension 2 (Weight Class) than was demonstrated by actual aircraft performance. Results are discussed in terms of the development of a measure of aircraft mix (i.e., the mix of aircraft with different performance characteristics) to be added to a suite of controller activity and taskload measures as part of an ongoing effort to identify objective predictors of subjective air traffic controller workload. (E. Pfeiderer, CAMI)
 - *An Airborne Study of General Aviation Pilot Response to Loss of Vacuum-Driven Instrumentation.* D. B. Beringer, FAA Civil Aerospace Medical Institute; K.M. Roy, AOPA Air Safety Foundation. Forty-one instrument-rated pilots were exposed to an unannounced failure of attitude and heading instrumentation in single-engine general aviation aircraft: 25 in a Piper Archer PA-28 and 16 in a Beechcraft Bonanza A36. Some Piper pilots received 30 minutes of partial-panel instruction in a personal-computer-based aviation training device (PCATD) prior to the flight. Bonanza pilots experienced either a failure of the AI only, or a failure of the AI and the horizontal situation indicator (HSI). All of the Piper pilots maintained control of the aircraft, and sixty-eight (68) percent of them flew successful partial-panel approaches. However, 25 percent of the Bonanza pilots could not maintain control, requiring the evaluator to assume control of the aircraft. Bonanza pilots who had the HSI fail with the AI detected the failure more quickly than those who did not (2.6 vs. 4.6 min). Although PCATD use produced a trend towards shorter detection times, the difference was not statistically significant. Recommendations are presented regarding both training and instrumentation. (D. Beringer, CAMI)

- *Effects of Visibility, Cloud Ceiling, and Financial Incentive on General Aviation Voluntary Takeoff into Adverse Weather.* W. Knecht, H. Harris, Jr., S. Shappell, FAA Civil Aerospace Medical Institute. Weather-related accidents in U.S. general aviation are a serious problem. In this study, scientists investigated the effects of ground visibility, cloud ceiling, and financial incentive on 60 pilots' decisions whether or not to take off into marginal weather. Results showed trends for Financial Incentive ($p = .07$), Visibility ($p = .11$), and Ceiling ($p = .43$). The interaction Visibility x Ceiling ($p = .037$) gives support to a cognitive model of pilot weather-related behavior based on simultaneous consideration of multiple factors. (W. Knecht, CAMI)
- *Maintenance-Related Accidents: A Comparison of Amateur-Built Aircraft to General Aviation.* N. Nelson, S. Goldman, and E. Fiedler, FAA Civil Aerospace Medical Institute. Using 1983-2001 NTSB general aviation (GA) accident investigation reports, this study compared maintenance-related accidents for amateur-built and all other GA aircraft by type of maintenance procedure, airframe hours, phase of operation, and time since last inspection.
- Other CAMI presentations:
 - *Age and Experience Interactions in Air Traffic Controller Performance.* J. Becker, D. Broach.
 - *Comparison of the Effectiveness of a Personal Computer Aviation Training Device, a Flight Training Device, and an Airplane in Conducting Instrument Proficiency Checks.* T.W. Emanuel, H. L. Taylor, D.A. Talleur, and E.M. Rantanen.
 - *Taxonomies of Measures in Air Traffic Control Research.* E.M. Rantanen and A. Nunes..
 - *Design and Evaluation of Tools to Support the Reroute Advisory System to Support Distributed Work in the Traffic Flow Management System.* P. Smith, K. Campbell, M. Murphy, R. Beatty, and T. Behbehani.
 - *Incremental Training Effectiveness of Personal Computers used for Instrument Training.* H. L. Taylor, D.A. Talleur, T.W. Emanuel, E.M. Rantanen, G.L. Bradshaw, and S.I. Phillips.
 - *Are ATC Subject Matter Experts Created Equal?* L. Bailey and A. Scarborough.
 - *Development and Validation of a Pre-employment Test for Airline Passenger Security Screeners.* D. Broach.
 - *Relationship between Age, Flight Strip Usage Preferences, and Strip Marking.* C. Manning, F. Durso, P. Batsakes, T. Truitt, and J. Crutchfield.

- *Improved Technology Places Greater Emphasis of Automated Flight Service Station Air Traffic Control Specialists' Color Discrimination Ability.* N. Milburn.
 - *GPS Use in General Aviation: An Overview of Studies in New Zealand, Australia, and the United States.* M. Nendick, R. St. George, J. Bevitt, K. Williams, and K. Joseph.
 - *Pilot and Controller Operational Communication: Lessons Learned from OpEval-2.* O. V. Prinzo.
 - *Human Factors Classification of Runway Incursions Associated with Vehicle and Pedestrian Deviations.* A. Scarborough and J. Pounds.
 - *Reshaping the Way We Look at General Aviation Accidents using the Human Factors Analysis and Classification System.* S. Shappell and D. Wiegmann.
 - *A Comparison of U.S. Military and Civilian Aviation Accidents using the Human Factors Analysis and Classification System (HFACS).* S. Shappell, D. Wiegmann, J. Fraser.
 - *General Aviation Pilot Use of ADS-B Displays: Human Factors Issues.* K. Williams.
- William J. Hughes Technical Center presentations included the following:
 - *Causes and Steps to Resolve Error in the Airway Facilities Work Environments.* R. Muldoon, Northrop Grumman Information Technology; V. Ahlstrom, ACB-220, Human Factors Group. Safely routing aircraft from one airport to another requires thousands of pieces of equipment representing billions of dollars in investment. Airway Facilities (AF) is the group of the National Airspace System (NAS) responsible for that equipment. Currently, AF specialists in Air Route Traffic Control Centers Maintenance Control Centers (AMCCs) interface with 25 different systems for maintenance and control. These systems have been designed with little consideration to the systems already present in the AF operational environment. There are different means of interacting with the systems, ranging from graphical user interface to command line interaction. Among the 25 systems, we have catalogued over 1500 different options for command and attribute interactions, with limited overlap between systems. Realizing that inconsistency between systems could lead to user error, human factors researchers analyzed the potential sources of error due to lack of system integration. Research on causes of error from the literature was applied to the AF operational environment, in particular the inconsistency in system interaction methods, options and attributes, to identify potential causes of error. Once potential causes of error were identified, mitigating strategies were suggested. (E. Stein, WJHTC)

Welcome Back: Larry Cole has recently returned to the Human Factors and Engineering Division (AAR-100) after a detail as human factors advisor to the Office of Runway Safety. Larry's duties in AAR-100 will center on identifying human factors requirements for air traffic systems currently under development.

Flight Operations Quality Assurance (FOQA): Dr. Eleana Edens attended the quarterly Demonstration Project FOQA Industry Meeting on April 15th and 16th in Alexandria, Virginia. The meeting was sponsored by the AFS-230 Voluntary Safety Programs Office and attended by airline industry representatives that participate in FOQA. The agenda focused on emerging technology that can be employed in FOQA programs. Several commercial vendors presented their latest software that either replays flight segments or analyzes FOQA data. NASA scientists presented their latest updates to the Automated Performance Measuring System (APMS) program that was started by the FAA but has been pursued by the NASA Aviation Safety Program. (E. Edens, AFS-230)

Human Performance: Dr. William "Kip" Krebs (AAR-100) participated in a Defense Advanced Research Projects Agency (DARPA) BAA03-02, Addendum 2, Special Focus Area: Metabolic Dominance proposal review on April 28, 2003 in Arlington, VA. DARPA's Metabolic Dominance program objective is to develop innovative science and technology capable of affording superior physiological qualities to the war fighter. The ultimate goal is to enable superior physical and physiological performance by controlling energy metabolism on demand. An example is continuous peak physical performance and cognitive function for 3 to 5 days, 24 hours per day, without the need for calories. Continuous exertion over numerous days is currently limited by: 1) the ability to transport and ingest adequate calories and/or effectively access stored calories (e.g., adipose, glycogen); 2) available training time; extended training periods are required to adapt muscle and mitochondria to meet intense physical loads; and 3) the ability of physiological systems to rapidly recover after extended, repeated bouts of physical exertion. The DARPA program is divided into four categories - Metabolic Optimization, Thermophysiology, Muscle and Mitochondria, and Recovery and Maintenance. Dr. Krebs' participation in the DARPA proposal review will help the FAA better understand what DARPA intends to fund in the area of human performance, fatigue, stress, and physical exertion (W. Krebs, AAR-100).

*More information on human factors research can be found at
the FAA Human Factors (AAR-100) web site: <http://www.hf.faa.gov>*

Mark D. Rodgers
FAA (AAR-100)



May 3-10, 2003 – International Conference on Software Engineering, Hilton Portland, Portland, OR <mailto:ldillon@cse.msu.edu>

May 4-9, 2003 – 74th Annual Scientific Meeting of the Aerospace Medical Association, Convention Center, San Antonio, TX <http://www.asma.org/>

May 5-8, 2003 – ATCA Civil/Military Air Traffic Management Conference, Prague, Czech Republic http://www.atca.org/static2_item.asp?item_ID=19

May 6 – 8, 2003 - AHS International 59th Annual Forum and Technology Display, Phoenix Civic Plaza, Phoenix, AZ. [General Information](#) - [Call for Papers](#) - [Exhibitors](#)

May 12-15, 2003 – DOD TAG-49, Country Suites Augusta Riverwalk, Augusta, GA <http://hfetag.dtic.mil/meetschl.html>

May 12-17, 2003 - 2003 IEEE International Conference on Robotics and Automation, The Grand Hotel, Taipei, Taiwan <http://www.icra2003.org/>

May 18-21, 2003 - Institute of Industrial Engineers Annual Conference
<http://www.iienet.org/annual/>

June 2003 – SAE Digital Human Modeling for Design and Engineering, Location TBD
<http://www.sae.org/calendar/aeromtgs.htm>

June 2-3, 2003 - The National Center of Excellence for Aviation Operations Research (NEXTOR) Conference on Air Traffic Management and Control, hosted by NEXTOR - Virginia Tech, Virginia Tech Graduate Center, Falls Church, VA

June 4-6, 2003 - Institute of Electrical and Electronics Engineers (IEEE) American Control Conference, Denver, CO <http://acc2003.me.berkeley.edu/>

June 9 – July 4, 2002 – World Radio Communication Conference, Geneva, Switzerland
<http://www.itu.int/ITU-R/conferences/wrc/wrc-03/index.asp>

June 9-13, 2003 - Institute of Electrical and Electronics Engineers (IEEE) Intelligent Vehicles Symposium (IV 2003), Columbus, OH <http://www.eleceng.ohio-state.edu/~umit/IV2003/>

June 14-17, 2003 - Association for the Advancement of Medical Instrumentation (AAMI) 2003 Annual Conference and Expo, Long Beach, CA
<http://www.aami.org/meetings/aami2003/index.html>

June 15-22, 2003 – 45th Paris Air Show le bourget <http://www.paris-air-show.com/index3.htm>

June 16-19, 2003 –SAE Digital Human Modeling for Design and Engineering, Montreal, Canada <http://www.sae.org/calendar/dhm/index.htm>

June 18-19, 2003 – 6th GAIN World Conference, Alitalia Auditorium, Rome, Italy
<http://www.gainweb.org/whatsnew.html>

June 22-27, 2003 – 10th International Conference on Human-Computer Interaction, Institute of Computer Science Foundation, Research and Technology, Science and Technology Park of Crete, Heraklion, Crete, Greece <mailto:info@hciei2003.gr>

June 23-25, 2003 – Human Systems Integration Symposium “Enhancing Human Performance in Naval and Joint Environments”, Sheraton Premier Hotel, Tyson’s Corner, VA
<http://www.navalengineers.org/Events/HSIS2003/HSIS.html>

June 23-26, 2003 – Electronic Industries Alliance SSTC & G33/G47 Quarterly Meeting, Charleston, SC mpetitt@eia.org

July 7-10, 2003 – SAE 33rd International Conference on Environmental Systems, The Westin Bayshore Resort and Marina, Vancouver, Canada <http://www.sae.org/calendar/aeromtgs.htm>

July 14-17, 2003 – AIAA/ICAS International Air & Space Symposium and Exposition, Dayton Convention Center, Dayton, OH <http://www.flight100.org/>

July 20-24, 2003 - 2003 International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS '03) <http://www.scs.org/confernc/coninfo.html#spect2003>

July 21 – 23, 2003 - 4th Australian Pacific Vertiflite Conference on Helicopter Technology, Melbourne, Victoria, Australia. Contacts: [Dr. Arvind K. Sinha](#) and [Mr. Raden Kusumo](#)

July 29-August 4, 2003 – 51st Annual AirVenture, Oshkosh, WI <http://airventure.org/>

August 7-10, 2003 – 111th Convention of the American Psychological Association, Toronto, Ontario, Canada <http://www.apa.org/convention>

September 8-12, 2003 – SAE Aerospace Congress and Exhibition, Palais des Congrès, Montreal, Quebec, Canada <http://www.sae.org/calendar/aeromtgs.htm>

September 15-17, 2003 – FAA/TCA/CAA Safety Management in Aviation Maintenance Symposium, Toronto, Canada

September 16 – 18, 2003 - 29th European Rotorcraft Forum, Friedrichshafen, Germany. Contact B. Gmelin at bernd.gmelin@dir.de

September 16-18, 2003 – MRO Europe, Cardiff International Arena, Cardiff, Wales
<http://www.awgnet.com/conferences/meumain.htm>

September 16-19, 2003 – Investigation and Reporting of Incidents and Accidents (IRIA), Williamsburg, VA <http://shemesh.larc.nasa.gov/iria03/>

September 17-21, 2003 - Institute of Electrical and Electronics Engineers (IEEE) 25th Annual Engineering in Medical and Biology Society International Conference, Cancun, Mexico
<http://itzamna.uam.mx/cancun/>

September 18-19, 2003 – National Academy of Engineering 2003 Frontiers of Engineering Symposium, Irvine, CA [Welcome to the National Academy of Engineering \(NAE\)](#)

September 22-24, 2003 - 41st Annual SAFE Symposium, Jacksonville, FL
<http://www.safeassociation.org/2003symposium1.htm>

September 22 – October 3, 2003 – ICAO 11th Air Navigation Conference, Montreal, Canada
<http://www.icao.int/icao/en/anb/meetings/anconf11/index.html>

September 24-25, 2003 –IATA/ICAO/Flight Safety Foundation ICARUS Committee/University of Texas LOSA Meeting, Montreal, Canada <mailto:helmreich@mail.utexas.edu>

September 24-26, 2003 - Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Technology and Society, Amsterdam, The Netherlands
<http://radburn.rutgers.edu/andrews/projects/ssit/istas03.pdf>

October 5-8, 2003 - Institute of Electrical and Electronics Engineers (IEEE) International Conference on Intelligent Control, Houston, TX <http://vlab.ee.nus.edu.sg/~isic2003/>

October 5-8, 2003 - 2003 IEEE International Conference on Systems, Man, and Cybernetics, Washington, DC http://becat.engr.uconn.edu/IEEE_CSMC_2003/

October 6 – 9, 2003 - NATO Research and Technology Agency, Applied Vehicle Technology Panel (AVT) will present "The Vehicle Propulsion Integration Symposium" in Poland. For more information contact cheynes@rta.nato.int

October 7 – 9, 2003 - National Business Aviation Association Annual Meeting & Convention, Orlando, Florida. Contact: www.nbaa.org

September 24-26, 2003 - International Symposium on Technology and Society, Amsterdam, The Netherlands <http://radburn.rutgers.edu/andrews/projects/ssit/istas03.pdf>

October 13-17, 2003 – Human Factors and Ergonomics Society 47th Annual Meeting, Adams Mark Denver Hotel, Denver, CO <http://www.hfes.org/>

October 26-30, 2003 – ATCA 48th Annual International Technical Program and Exhibits, Marriott Wardman Park Hotel, Wash, DC http://www.atca.org/static2_item.asp?item_ID=19

October 27-28, 2003 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, DC <http://wwwsearch.nationalacademies.org/>

October 27-30, 2003 – SAE DoD Maintenance Symposium and Exposition, Valley Forge Convention Center, King of Prussia, PA <http://www.sae.org/calendar/aeromtgs.htm>

November, 2003(tentative) – DOD TAG-50, Fall 2003, Phoenix, AZ
<http://hfetag.dtic.mil/meetschl.html>

November 17-20, 2003 – 56th Annual Air Safety Seminar, A Joint Meeting of Flight Safety Foundation, International Federation of Airworthiness, and International Air Transport Association, Bangkok, Thailand <http://www.flightsafety.org/seminars.html>

December 2-4, 2003: National Training Systems Association Inter-Service/Industry Training, Simulation and Education Conference (IITSEC), Orlando, FL <http://www.trainingsystems.org>

December 9-12, 2003 - Institute of Electrical and Electronics Engineers (IEEE) Decision and Control Conference, Maui, HI <http://www2.acae.cuhk.edu.hk/~ycliu/cdc03/>

January 11-15, 2004 – Transportation Research Board Annual Meeting, Washington, DC
<http://www4.trb.org/trb/annual.nsf>

January 21 – 23, 2004 - AHS 4th Decennial Specialists' Meeting on Aeromechanics, Fisherman's Wharf, San Francisco, CA. For more information contact the Technical Chairman, Tom Maier at tmaier@mail.acr.nasa.gov

April, 2004 – SAE General Aviation Technology Conference and Exhibition, Century II Convention Center, Wichita, KS <http://www/sae.org/calendar/aeromtgs.htm>

May 3-6, 2004 – 75th Annual Scientific Meeting of the Aerospace Medical Association, Egan Convention Center, Anchorage, AK <http://www.asma.org/>

May 6-8, 2004 - AHS International 60th Annual Forum and Technology Display, Virginia Beach, VA. Contact Staff@vtol.org

July 27-August 2, 2004 – 52nd Annual AirVenture, Oshkosh, WI <http://airventure.org/>

July 28 – August 1, 2004 – 112th Convention of the American Psychological Association. Honolulu, Hawaii <http://www.apa.org/convention>

September 20-24, 2004 – Human Factors and Ergonomics Society 48th Annual Meeting, Sheraton New Orleans Hotel, New Orleans, LA <http://www.hfes.org/>

October 18-19, 2004 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, DC <http://wwwsearch.nationalacademies.org/>

May 9-12, 2005 - 76th Annual Scientific Meeting of the Aerospace Medical Association, Kansas City, MO <http://www.asma.org/>

October 24-25, 2005 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, *DC* <http://wwwsearch.nationalacademies.org/>

Note: Calendar events in Italics are new since the last Newsletter



Comments or questions regarding this newsletter?
Please contact Bill Berger at (334) 271-2928
or via e-mail at bill.ctr.berger@faa.gov