

Center of Excellence for General Aviation Research

Accomplishments Report

The Federal Aviation Administration (FAA) established a Center of Excellence (COE) in the technology area of general aviation (GA) in 2001. General aviation, commonly known as GA, is defined as all aviation other than military and commercial airlines. GA aircraft range from small, single-engine planes to mid-size turboprops to the larger turbofans capable of intercontinental non-stop flying. General aviation supports business and recreation, and serves a diversity of needs from emergency medical evacuations to border patrols, fire fighting, state governments, universities, companies and individuals.

The Center for General Aviation Research (CGAR) continues efforts to work partnerships with private industry and state agencies to address common needs in general aviation research. The GA COE has supported two of the largest General Aviation events, Sun & Fun in Lakeland, Florida and the EAA fly-in at Oshkosh, WI promoting the efforts of the Center in general aviation research through community awareness. Through several outreach programs at the University of Alaska and Florida A&M University, the Center has been actively involved in educational efforts to attract the students /aviators of tomorrow into University educational programs.

Sponsoring Organization: Airport and Aircraft Safety R&D Division
FAA-GA Program Manager: Peter Sparacino (609-485-5430)

COE Core Team – Points of Contact

Prof. Steven Hampton, co-director, ERAU, 386-226-6725
Prof. Paul Lindseth, co-director, UND, 701-777-2917
Prof. Billy Connor, co-director, UAF, 907-474-7497
Prof. Leonard Kirk, co-director, UAA, 907-786-7224
Prof. John Tomblin, co-director, WSU, 316-978-5234

CGAR Program Office:

Mike Edwards, Director of Business Development, 386-323-8083
Deborah Burke, Finance, 386-226-4952
Karen Forte, Contracts Administrator, 386-226-7745
Danielle Lauritsch, Communications and Planning, 386-323-8083

Office of the Center of Excellence for General Aviation
600 S. Clyde Morris Blvd.
Daytona Beach, Fl. 32114
E-mail address: dbcgar@erau.edu

Awards Recognition

2003

Jesse Romo (ERAU CGAR Student of the Year)

Entrants into the COE 3rd Annual Poster Contest

Rohan Dudley STATISTICAL ANALYSIS FOR GENERAL AVIATION ACCIDENTS
Dr. Massoud Bazargan, ERAU Daytona Beach, Fl

Aber Abou-Rahma FAA On Line Educational Library
Dr. Remzi Seker, William Kirkwood ERAU Daytona Beach, Fl

Andrew Eklund ARCTIC STUDY FOR ENGINEERED MATERIAL ARRESTING Lutfi Raad,
Peter Brown SYSTEM (EMAS) UAF

Paul Snyder Joint Training Standards Development for New Technology Charles Robertson,
General Aviation Aircraft under the FAA/Industry Training UND Standards (FITS) program

Pavel Hosa Development and Calibration of Model for Analysis of Safety Dr. Notis A. Pagiavlas
of 14CFR137 Agricultural Aircraft Operations ERAU Daytona Beach, Fl

H. Nagarajan Enhancement of NIAR Component Head Injury Criteria Hamid M. Lankarani
C.S. Koshy Tester for General Aircraft Seat Certification WSU

2006

Katie Kallusch, a graduate assistant currently working with CGAR, was recently awarded the
2005-2006 International Aviations Womens Association (IAWA) Scholarship.

2007

Alison Barber (DOT Award Recipient Student of the year UND)
Steven Abreu-Hill (ERAU CGAR Student of the Year)
Christopher Griffis (UND CGAR Student of the Year)

NIAR

Brian Brown, associate director of the CAD/CAM Laboratory at WSU took first place in
the Top Gun Competition at the 2007 CATIA Operators Exchange (COE) Annual Product
Lifecycle Management Conference held April 29-May 2 in Las Vegas.

2008

Daniel J. Halperin (ERAU CGAR Student of the Year)

Center of Excellence Researcher of the Year Nominees (CGAR)



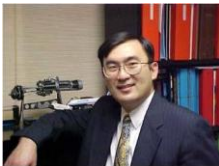
Archie Dickey ERAU Prescott



Leonard Kirk UA-A



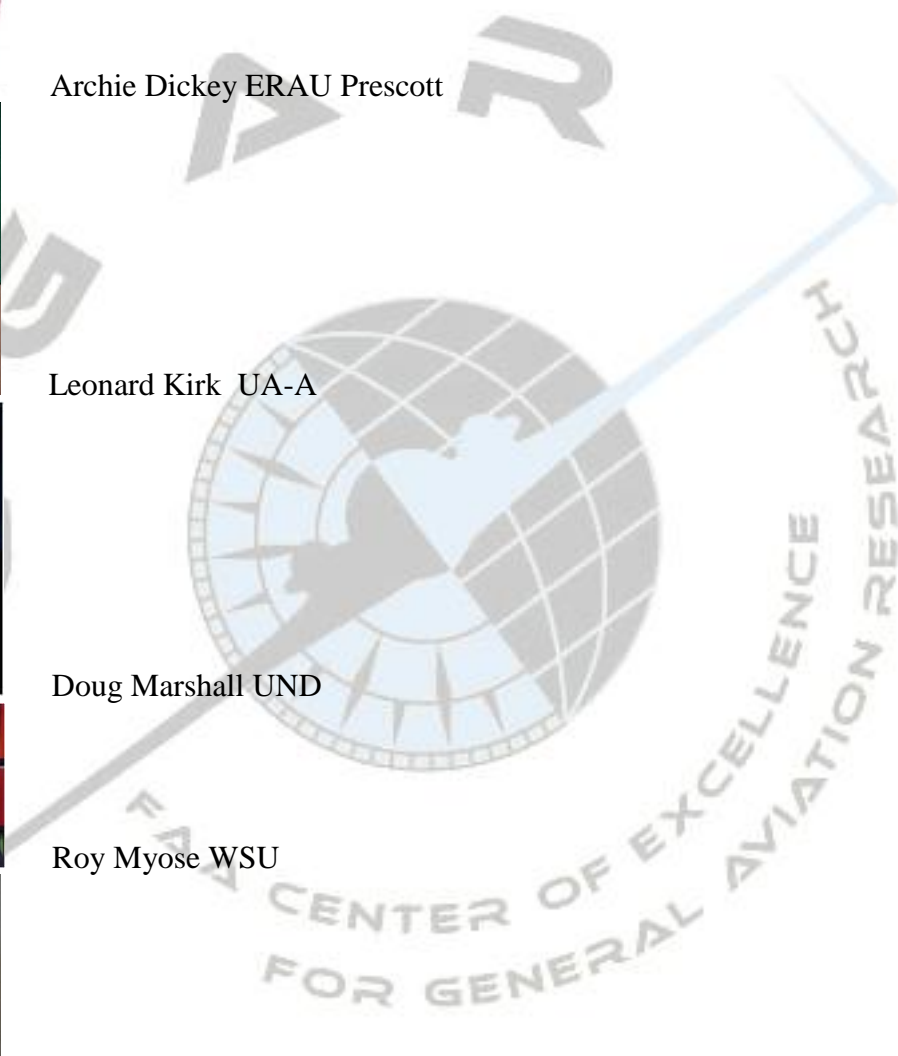
Doug Marshall UND



Roy Myose WSU



Tim Wilson ERAU



2009 Awards

FAA Alaska Regional Administrator Recognizes One of our own, Leonard Kirk, Aviation Technology Division Deputy Directory and General Aviation Researcher, was recently recognized by the FAA Alaska Regional Administrator, Bob Lewis, as a "Visionary Leader" for his many dedicated years of service as the Co-Chair and Chair of the Alaska Regional Aviation Coordination Council. Lewis presented Kirk an engraved brass telescope, symbolic of insight and vision.

Danielle Lauritsch, a graduate assistant currently working with CGAR, was recently awarded the 2009 American Business Women's Association (ABWA) Scholarship.



Active Projects

Project Title	University	PI
Training Standards Development for General Aviation Aircraft	ERAU	Michele Summers
Development of an Aviation Weather Database Highlighting Weather Encounters (Phase I)	ERAU	Massoud Bazargan
Remote Airfield Lighting Systems	ERAU	Chris Grant
UAS Emergency Flight Recovery and Termination: Technology Survey and Regulatory Gap Analysis	ERAU	Timothy Wilson
Development of aviation database highlighting weather encounters	ERAU	Massoud Bazargan
GA Systems Safety Management Research	ERAU	Alan Stolzer
Flight Data Monitoring: General Aviation Safety Information Analysis & Sharing	ERAU	David Esser
Weather Technology in the Cockpit – Pilot Training Requirements	ERAU	John Lanicci
A Database Management System for General Aviation Safety	ERAU	Massoud Bazargan
Data Communications Human Factor Air Traffic Control Implications on Preferential Treatment Service for equipage Scenarios Across the NAS	ERAU	
Pilot Awareness of Current and LED Elevated Runway Guard Lighting	ERAU	Jon French
Helicopter Advanced Navigation Research Flight Training	UND	Leslie Martin
Business Jet Loads Data Acquisition	UND	Douglas Marshall
Helicopter Terrain Awareness Warning System (TAWS) and Enhanced Vision Systems(EVS)	UND	Richard Graziano
Octane Enhancers from Crop Oils	UND	Wayne Seames
Development of UAS Operational Data Collection Concept	UND	Douglas Marshall
Friction Study	UND	Tom Zeidlik
GA Systems Safety Research	UND	Gary Ullrich

Weather Technology in the Cockpit – User Needs Segment	UND	Joseph Vacek
Subject Matter Expert Support for FAA UAS Simulator Workstation	UND	Douglas Marshall
Helicopter lighting system	UND	Tom Zeidlik
Development of a 3-Dimensional Radar Based Airspace Monitoring and Surveillance Instrument	UAF	Gregory Walker
Remote Airport Lighting Systems III	UAA	Leonard Kirk
GA Systems Safety Management research	UAA	Leonard Kirk
Load Spectrum Development for Unmanned Aerial Systems Airworthiness	WSU	Allison Crockett



Completed Accomplishments

Project Title	University	PI
Terminal Operations Safety Research Project-Landing and Holding Short (LAHSO)	ERAU	John Johnson
CGAR Strategic Plan for Self Sufficiency	ERAU	Abe Harraf
To Produce Center of Excellence-GA Video	UND	Henry Borysewicz
Taxiway Centerline Deviation Study	UAF	Leonard Kirk
Development of Analytical Methods to Predict crash impact Responses of General Aviation Aircraft Seat/Occupant/Restraint System	WSU	Dr. Hamid
Florida A & M University Summer Camp	FAMU	Robert R. Klein
Security Plan for General Aviation	ERAU, UA, FAMU, UND, WSU	Dr. Tim Brady, Dean College of Aviation, ERAU-DB
Measurements of Icing Conditions in Western Atlantic Stratocumulus	UND	Michael R. Poellot
Evaluation of Gravel Runway Surface Conditions and Their Effects on Aircraft Performance During Winter Operations	UAF	Lutfi Raad, PhD.
Development and Calibration of Model for Analysis of Safety of 14CFR137 Agricultural Aircraft Operations	ERAU, UND	Dr. Seth Young (corresponding), ERAU
Development and Implementation of a Data Based Capacity Prediction Tool to Facilitate Increased Airport Throughout	ERAU	Ken Fleming
To Establish a Special Emphasis Outreach Program at the University of Alaska	UAF	Leonard Kirk
A Framework for Revalidation of Airport Standards	FAMU	Robert R. Klein
Airport Capacity Prediction and Conditions and Their Effects on Aircraft Performance During Winter Operations	ERAU	Ken Fleming
FAA Multiengine Refresher Training	ERAU	Richard P. Theokas
Outreach Program in Aviation at the University of Alaska- Fairbanks	UAF	Lutfi Raad

Aviation Safety Education and Research at Florida A&M University	FAMU	Venkitaswamy Raju, PhD.
Advanced Flight Control Systems Development for Safety Enhancements and Certification Aspects	WSU	James E. Steck
P-Pamphlet Rewrite	ERAU	Joseph Clark
Ethanol as a Fuel for General Aviation	UND	Frank Argenziano
Review of the FITS Program: Program tasks, goals, and pilot training initiatives	WSU	Alex Chaparro
Engineered Material Arresting System (EMAS)	UAF	Lutfi Raad
Defining the Optimal Mix of Aircraft and Flight Training Devices in Aviation Safety Inspector Introduction Training	ERAU	Richard P. Theokas
Safety Impact of the Capstone Program	ERAU	M. Bazargan
Automated Laser-Based Bird Dispersion System	UND	James Dunlop
Airworthiness Inspector Training	ERAU	Steve Hampton
Airport Funding Strategies	ERAU	Massoud Bazargan
FAA Airman Notification, Seminar & Event Tracking and Online Education	ERAU	Steve Hampton
Aviation-Grade Ethanol Development	UND	Paul Lindseth
LAHSO Data Collection-Phase II	ERAU	John Johnson
Conduct of Aviation Safety Inspector Training for Multiengine Airplane, Instrument and Performance Refresher in Light Twin Aircraft and Flight Training Devices	ERAU	Richard P. Theokas
Simulation of Reduced Separation Helicopter Routes in NY TRACON	ERAU	Ken Fleming
Phase II Aviation Safety, Education and Research	FAMU	Yves Anglade
GA Aircraft: In-flight Load Data Collection and Analysis Project	ERAU	Richard (Pat) Anderson

Technical Assistance with Capstone Phase II Avionics	UAA	Leonard Kirk
Effect of ADS-B on Near Mid-Air Collision Rates of GA Aircraft	ERAU	Richard P. Theokas
Statistical Analysis for General Aviation Accidents	ERAU	M. Bazargan
Analysis and Evaluation of Green LED Threshold lights	ERAU	Stephan Kahne
Joint Training Standards Development- FAA Industry Standards Program	ERAU	Frank Ayers
Remote Airport Lighting Systems (RALS)	UA-A/ ERAU	Mike Inman
Technology Survey on UAS Propulsion Systems	ERAU	Timothy Wilson
Compression Ignition Engine Certification Issues	ERAU	Timothy Wilson
Course Development for Qualification Training for Technically Advanced Aircraft	ERAU	Steve Hampton
Evaluation Instructor Training Course	ERAU	Steve Hampton
Investigation of the Optimal Mix of Aircraft and Flight Training Devices In Aviation Safety Inspector Indoctrination Training	ERAU	Steve Hampton
Conduct of Aviation Safety Inspector (ASI) Training for Multi-engine Aircraft	ERAU	Steve Hampton
GA Airport Funding Strategies-Phase II	ERAU	Massoud Bazargan
UAS Detect, Sense, and Avoid	UAA	Leonard Kirk
Regulation Study on Commercial UAS Vehicle Design	UAA	Leonard Kirk
ASI Course Development	ERAU	Mark Friend

Operational Usage Information for a General Aviation Propeller	WSU	Kamran Rokhsaz
Operational Evaluation of Remote Airfield Lighting System	ERAU	Chris Grant
SBS Operational Test Flight Support	ERAU	Frank Ayers
Wildlife Strike Database and Website Maintenance and Expansion of Graphics Applications to Web Search for General Aviation	ERAU	Archie Dickey
Remote Airport Lighting System (RALS)	UAA	Michael R. Inman
Evaluating the Effectiveness of ADS-B in the Collegiate Flight Training	ERAU/ UND	Schumacher/Northam
Gap Analysis/Risk Analysis for UAS Propulsion Systems	ERAU	Tim Wilson
Regulatory Gap Analysis for Detect, Sense, and Avoid	ERAU	Tim Wilson
Command, Control and Communication for Unmanned Aircraft Systems	ERAU	Tim Wilson
Exploratory Examination of Glyphworks to Determine Usage Data for a GA Propeller	WSU	Kamran Rokhsaz
2-Day Workshop in Support of the FAA's ADS-B Implementation Program Office	ERAU	Steven Hampton
Development of an Aviation Weather Database Highlighting Weather Encounters (Phase I)	ERAU	M. Bazargan
General Aviation System Safety Management Research	UA-A	Leonard Kirk
Helicopter Advanced Navigation Research Flight Training	UND	Leslie Martin
Detection & Prevention of Carbon Monoxide Exposure in GA Aircraft	WSU	Hossein Cheraghi
Structural Usage Monitoring and Flight Regime Recognition Algorithm and Methodology Enhancement & Validation (HUMS Project)	ERAU	Richard (Pat) Anderson
Helicopter Terrain Awareness Warning System (TAWS) and Enhance Vision Systems (EVS)	ERAU	Rocky Graziano
Analysis of 14 CFR Parts 91 & 43 for UAS Applications	UND	Doug M. Marshall

*Key:

ERAU Embry Riddle Aeronautical University
WSU Wichita State University
UA A/F University of Alaska Anchorage & Fairbanks
UND University of North Dakota
FAMU Florida A&M University



Phase I Completed Projects

Terminal Operations Safety Research Project-Landing and Holding short

This project was an effort that involved graduate students, under supervision of graduate faculty, collecting data for the project operating tow video cameras, recording the position of aircraft – on or above runway threshold to stop – at taxiway exit, with a RADAR device used to record aircraft speeds during final approach, touchdown, and rollout. The tapes were reviewed and stored at the Aviation Safety Center and the data recorded in a database (hardware and software supplied by ERAU).

Investigator: John Johnson, ERAU

Taxiway Centerline Deviation Study

The taxiway centerline deviation research project provided an in depth study regarding deviation from centerline of aircraft, and the effect this may have on taxiway standards in the area of width and separation, and existing taxiway networks. The study included the use of equipment provided by the FAA and already installed at Anchorage International Airport. The project included the following: a). Weekly checks for laser alignment b). Bi-weekly data downloads c). Data Reduction d.) Bi-weekly data transfer e.) Maintain a journal of activity with photos f). Development of software routines to sort data by various aircraft type.

This effort represented a cooperative agreement between the University of Alaska Anchorage, Aviation Technology Division, the Anchorage International Airport Authority, the State of Alaska Department of Transportation and Public facilities, and the FAA Technical Center, is designed to be a mutually beneficial effort.

Investigator: Leonard Kirk, University of Alaska

Development of Analytical Methods to Predict crash impact Responses of General Aviation Aircraft Seat/Occupant/Restraint System

This project developed procedures and capabilities for analytical methods and models to predict the dynamic response of GA aircraft structures, seat-occupant-restraint systems and interior structural members to crash impacts.

Investigator(s): Dr Hamid Lankarani, WSU

Security Plan for General Aviation

A methodology was created for improving general aviation security in the United States. The plan included: (1) a survey of the general aviation security landscape, (2) a thorough review of all applicable literature, (3) a study of the security concerns of the professional associations that deal with general aviation, (4) discovery of security technology applicable to general aviation, (5) a discussion of possible short-term, mid-term, and long-term security strategies for general aviation, (6) a matrix of recommendations that will address policy and procedure, regulatory and certification issues, technology applications, phased implementation, and funding issues

The center developed the plan by working together; with industry groups and the FAA to cohesively develop a plan that addressed security issues related to general aviation.

Investigator: Dr. Tim Brady, ERAU Daytona

Measurements of Icing Conditions in Western Atlantic Stratocumulus

The Center for General Aviation Research has a diverse fleet of aircraft that includes a UND Citation (a twin-engine fanjet aircraft) that has been modified for atmospheric research, UND has operated this research platform since 1980, conducting studies in cloud microphysics, dynamics and electrification, air pollution, turbulence, aircraft icing and low-level wind shear. This research effort required the aircraft to be flown in a number of field projects for the study of aircraft icing, including the Winter Icing and Storms Program, NEXRAD/TDWR icing algorithm development, the Canadian Atlantic Storms Project, and icing certification for an aircraft manufacturer.

Investigator: Michael R. Poellot, UND

Evaluation of Gravel Runway Surface Conditions and Their Effects on Aircraft Performance During Winter Operations

This evaluation stemmed from the fatal aircraft accident in Dryden, Ontario, in 1989. The Dryden Commission of Inquiry investigated the disaster and recommended the need to establish technically accurate means of defining surface conditions of runways and their effect on aircraft safety. The efforts studied in this research effort included the surface traction characteristics of gravel runways during spring breakup and assessing the influence of existing runway conditions such as slush, ruts, and potholes on aircraft performance. This determined the influence of adverse wind coupled with runway surface conditions on aircraft maneuverability and performance during landing. By doing so they developed meaningful correlations between data in this study and data from JWRFMP, which created a practical methodology for reporting runway conditions and other relevant information to GA pilots necessary for safe aircraft operations.

Investigator(s): Dr Lutfi Raad, UAF

Development and Calibration of Model for Analysis of Safety of 14CFR137 Agricultural Aircraft Operations

The project described was undertaken in accordance with the Federal Aviation Administration (FAA) to assess and analyze the practices of aviation activity operating under 14CFR137 – “Agricultural Aircraft Operations”. Specifically, this project helped develop and calibrate a computer model, using Administration recommended software, to assess and analyze safety requirements and potential hazards associated with agricultural aircraft operations. The project-involved familiarization with all appropriate Civil Federal Regulations associated with agricultural aviation activity, identification of agricultural aircraft operators and their professional organizations, familiarization of FAA recommended software, development of model, data collection, and model calibration and validation. A comprehensive report on research performed and a calibrated model for use by the FAA towards fulfilling its mission of promoting a safe aviation industry was authored.

Investigator: Dr. Seth Young, ERAU Daytona

To Establish a Special Emphasis Outreach Program at the University of Alaska

This project expanded the relationship between The University of Alaska Anchorage (UAA) and the workforce in the aviation industry. The UAA Aviation Technology Division, is a land-grant institution, has about 16,000 students, and produces more than 2,000 graduates annually. The university's baccalaureate academic programs include, among others, arts and sciences, engineering, business, nursing, and aviation technology. The university has a long history of working with industry and government in developing and promoting diversity in the technical and managerial workforce of the State of Alaska. UAA would like to expand its role in workforce diversity in the aviation industry. This proposal recommends implementation of a program in Aviation Education at the University of Alaska Anchorage that significantly enhances the human resource base in aviation by enhancing diversity. FAA's current research initiatives in aviation at UAA (including the present Capstone research project) have helped generate a great deal of interest in aviation studies at UAA.

An investment on the part of FAA in promoting minority student participation in aviation education and a matching investment on the part of UAA, Alaskan Native corporations, and minority-owned businesses will enhance such participation, and will produce major dividends to the human capital of the country. A grant of the order of \$25,000 for the first year to promote aviation education to Alaskan Native high school students, recruit them for degree programs in aviation technology, and to assist Alaskan Native students with college costs is requested.

Investigator: Leonard Kirk, University of Alaska

A Framework for Revalidation of Airport Standards

This project developed a new framework for validating airport standards for general aviation. The framework of this effort provided a logical extension of the established procedures and conceptual models that already exist within the Federal Aviation Administration (FAA). The research was carried out on behalf of the Center of Excellence for General Aviation Research (CGAR) and the Florida A&M University faculty. Industry partners and the associates from the University of Alaska participated as needed to complete the project.

Investigator: Robert R. Klein, FAMU

Advanced Flight Control Systems Development for Safety Enhancements and Certification Aspects

This research project included the development of smart robust control augmentation algorithms for low-cost FBW design application in GA airplanes, and a reduced reliance on redundant control channel architectures for achieving satisfactory system reliability and safety. Raytheon Aircraft Co. had financially supported the WSU flight controls research, with the ultimate goal of flight-testing the WSU algorithms on their Bonanza airplane. This project addressed specific tasks that further expanded the development and evaluation of the adaptive flight control algorithms and the EZ-fly system onboard the Bonanza by: 1) extending the evaluation to turbulence and wind shear conditions, 2) performing piloted fixed base simulation and flight testing of the control systems, 3) investigating system robustness to un-modeled airplane characteristics, 4) examining and improving the current envelope protection, auto land and flare routine on the Raytheon Bonanza, and 5) developing a list of certification requirements that need to be examined for the economic and safety benefits of the AFCS to be brought to the consumer.

Investigator: James E. Steck WSU

Ethanol as a Fuel for General Aviation

Three major areas of research were proposed for this project: 1) Fuel Development; 2) Engine Development; and 3) Airframe Development. In addition, a fourth major effort was proposed to conduct an ethanol workshop for the aviation community. Each of the research areas also involved several tasks.

Investigator: Paul Lindseth, UND

Automated Laser-Based Bird Dispersion System

This research project tested the feasibility of utilizing automated laser systems for wildlife abatement of waterfowl near the Grand Forks, North Dakota International Airport. The results of this research will add to aviation safety by greatly decreasing bird strikes around airports. The Grand Forks International Airport proposed this project to the FAA because of a waterfowl trouble area near the airport. Since the University of North Dakota's (UND) John D. Odegard School for Aerospace Sciences is based at this airport.

Investigator: Archie Dickey

Airport Funding Strategies

A thorough research and study towards understanding the current levels of utilization and funding sources of select representative GA airports was the outcome of this project. The research focused towards studying the potential future traffic growth for these airports. The study highlighted the various strategies to meet the capital requirements for possible expansion of existing infra-structures for these airports.

Investigator: Massoud Bazargan, ERAU

FAA Airman Notification, Seminar & Event Tracking & Online Education

This project allowed the FAA Aviation Safety Program to provide a greater access for effective communication to pilots via the World Wide Web. It established an up-to-date national online database and email notification system to inform airmen of new information, including safety seminars in their region, local notices to airmen, emergency notices, changes in regulation, and any other information that may be subject to mass distribution.

Investigator: Steve Hampton, ERAU

Aviation-Grade Ethanol Development

The objective of this project was to address two key remaining research requirements crucial to establishing the commercial viability of AGE, which are 1) completing assessment of AGE compatibility with all major materials utilized in aircraft fuel systems and/or regularly exposed to fuel, and 2) developing a method for fuel water content determination.

Investigator: Paul Lindseth, UND

Phase II Aviation Safety, Education and Research

This project focused on establishing an aviation option within the Electronic/Manufacturing Technology program in the division of engineering technology. The initial establishment of the program was part of the Phase I of the proposal which was funded by the FAA. Phase II requested funds to allow FAMU to continue developing and implementing the aviation option program, to initiate a planning phase for setting up a baccalaureate level degree program in aviation technology, and the continued development of the faculty expertise in aviation and aviation related research.

The primary objective focused on the promotion of diversity in aviation through continued effort at recruiting minority students and the retention of existing students for the aviation option within the Electronic/Manufacturing engineering technology program.

Investigator: Yves Anglade, FAMU

GA Aircraft: In-Flight Load Data Collection and Analysis Project

This project focused on the requirements for evaluating the fatigue life of critical aircraft structures. Two of these are the wings and the empennage structure. Most commonly, the fatigue life is determined using the Palmgren-Miner linear cumulative damage theory. To calculate the fatigue life using this method, one must know the loading history or the loading spectra of the aircraft. There is information on flight loads. i.e., normal acceleration near aircraft center of gravity, for general aviation aircraft that can be used to determine the fatigue life of airplane wings

Investigator: Richard (Pat) Anderson, ERAU

Effect of ADS-B on Near Mid-Air Collision Rates of GA Aircraft

This project shed the light on new technology used to reduce collision rates for GA aircraft. A new aircraft collision-avoidance system was installed on more than 100 aircraft at Embry-Riddle Aeronautical University's Daytona Beach, Florida, and Prescott, Arizona, campuses. It used the MX20 multi-function displays and DL90 universal access transceivers from UPS Aviation Technologies. The new technology gave pilots of small aircraft unprecedented awareness of their surroundings and significantly decreased hazards associated with traffic, weather, and terrain. Historical data was compared to data collected during the experiment period to determine the validity of the hypothesis.

Investigator: Richard P. Theokas, ERAU

Statistical Analysis for General Aviation Accidents

The author reviewed the existing data on General Aviation accidents resulting in fatalities, by identifying associations and patterns between flight elements and risk factors, and recommending a methodology to identify root cause. The study focused at identifying causes such as Human, Weather, Machine, Maintenance and FBO oriented problems. Furthermore, the study highlighted patterns (if any) and ranking of major causes among these accidents on a year-by-year basis. The results of this study will enable the FAA to view historical data in a fresh perspective, ultimately suggesting actions to reduce such accidents in the future.

Investigator: Massoud Bazargan, ERAU

Joint Training Standards Development-FAA Industry Standards Program

The SAFER SKIES initiative created a focused action plan to reduce General Aviation fatal accidents by 20% by 2007. At the same time, a new generation of aircraft has emerged offering high performance and dramatically increased capabilities to the General Aviation pilot. In FY 2002, AFS created a new program, FAA Industry Training Standards (FITS). When fully implemented, this program provided a vehicle to incorporate system safety initiatives in training standards and practices. FAA Flight Standards Service is engaging industry partners and the GA Center of Excellence through the FAA Technical Center in the development of FAA Industry Training Standards (FITS). The purpose of this project was to develop the methodology to create and deploy joint training standards under the FAA/Industry Training Standards (FITS) program for a new generation of technologically sophisticated and extremely capable aircraft entering the General Aviation fleet.

Investigator: Frank Ayers, ERAU

Remote Airport Lighting Systems (RALS)

The goal of this project was to organize, conduct, and report the results and recommendations of this airfield lighting review. This review was anticipated to be a 3 year project beginning with first year project team development, project scope of work assignments, literature review, and prototype identification. The follow-on years involved flight and ground testing of available systems and research and development of improved systems.

Investigator: Mike Inman, UAA

Investigation of the Optimal Mix of Aircraft and Flight Training Devices in Aviation Safety Inspector (ASI), General Aviation (GA) Operations Indoctrination Training

The tasks to be performed and reports delivered in support of Aviation Safety Inspector (ASI), General Aviation (GA) Operations Indoctrination Training allowed the FAA to evaluate mixes of single engine and multiengine aircraft and their respective Level 6 Flight Training Devices (FTDs) and to define an optimal mix of aircraft and FTDs for its ASI GA Operations Indoctrination Training course.

Investigator: Steve Hampton, ERAU

Phase II Completed Projects

Conduct of ASI Training for Multiengine Airplane Instrument and Performance Refresher in Light Twin (Reciprocating Engine) Aircraft and Flight Training Devices

The training provided refreshed ASIs in job-relevant knowledge and skills including aircraft systems and performance, new technology avionics, review of instrument flight principles, and flight under normal and abnormal conditions. Previous efforts have demonstrated the training value and skill transfer effectiveness of Flight Training Devices (FTDs) that exactly match the aircraft equipment, to effectively train and refresh the ASI™ flight performance.

Investigator: Steve Hampton, ERAU

Regulation Study on Commercial UAS Vehicle Design

The CGAR research team looked at design and certification criteria with an emphasis on size, speed and impact energy limits of UAS as it relates to the safety of manned aircraft and persons and property on the ground. In reviewing regulations for vehicle design, the working group looked at work that has been accomplished with other UAS efforts.

Investigator: Leonard Kirk, UAA

Compression Ignition (Diesel) Engine Certification Issues

The purpose of this effort provided a survey of relevant, extant propulsion systems, either in use or nearly operational, and those which are certified systems whose capability is particularly well suited to unmanned autonomous aircraft (Phase 1). The goal ascertained the best choices for various classes of vehicles including latest developments. Additionally, a second phase will investigate the existing regulations for certification the ability of these systems to meet these requirements (Phase 2).

Investigator: Timothy Wilson, ERAU

ASI Course Development

A partnership was forged between Embry-Riddle Aeronautical University (ERAU) as a member of the General Aviation Center of Excellence, and the Federal Aviation Administration (FAA), including members of the management team and a select group of General Aviation Safety Inspectors (ASIs) that determined the scope and direction of a cohesive training and assessment program that is expected to improve the business and interpersonal competencies of FAA (ASIs) and, in turn, the safety practices within general aviation.

Investigator: Mark Friend, ERAU

Effect of ADS-B on Near Mid-Air Collision Rates of General Aviation Aircraft

A new aircraft collision-avoidance system, the Automatic Dependent Surveillance-Broadcast (ADS-B) system, was evaluated on aircraft at Embry-Riddle Aeronautical University's Daytona Beach, Florida and Prescott, Arizona, campuses. The introduction of this technology may have vast potential to improve the way general aviation aircraft are controlled in flight by giving pilots unprecedented awareness of their surroundings. The effect of ADS-B on flight safety was evaluated by a comparison of Near MidAir Collisions (NMAC) extracted from the incident reports before their installation and after over the study period of two years. Efforts were made to ensure that the data were collected in the same manner over the two year period of study, pre and post ADS-B installation. The 6 months, immediately' before the installation (January-June, 2004) served as the pre-installation baseline (control) ,period against which three subsequent 6 month intervals from the July-August 2004 installation interval were compared. A Kruskal Wallis analysis nonparametric analysis of the data revealed that the resulting three 6 month intervals post installation showed a drop in NMAC data in which the last two achieved statistical significance ($p < 0.05$). The study resulted in a reasonably fair test of the impact of ADS-B on safety of flight. However, a larger sample of use in other flight training environments using more objective data would further substantiate the conclusion that the ADS-B system has the potential to decrease hazards leading to NMAC.

Steven Hampton

UAS DETECT SENSE & AVOID

UAA, UND, and NMSU sent representatives to an October FAA sponsored conference, designed to coordinate UAS research efforts. Work on project is on hold pending review and comments from the sponsor on the Draft Report submitted in June 2007. Participation: University of Alaska Anchorage (UAA) is work lead, University of North Dakota (UND), and ERAU supporting. NMSU is providing technical expertise and research to the team. Future Plans: Current no cost extension runs to the end of Feb 2008. Upon receipt of review and guidance from the sponsor, the first action will be to determine if available funds and time are sufficient to complete the study as requested by the sponsor. If not, a request for additional funding and/or time will be made to the sponsor by the PI. Having solved this issue, NMSU will refine the draft report and submit to the team for review and forwarding to the sponsor.

Leonard Kirk

Enhanced Jet Exhaust Mixing to Reduce Jet Aircraft Engine Noise

The downstream development of jet flow emanating from different nozzle shapes was investigated. The project was motivated by a desire to reduce the jet exhaust flow noise by increasing the mixing between the jet and its surroundings. The jet flow for baseline straight circular cross-section nozzle, converging nozzle, and two-chevron converging nozzles were visualized in water tunnel experiments. For the Computational Fluid Dynamics (CFD) work, Detached Eddy Simulation of jet flows and shear layers were carried out using the finite volume solver Cobalt. The CFD work included baseline investigation for the effect of chevrons on mixing enhancement for a compressible turbulent shear layer as well as for supersonic jets. The chevrons located at the trailing edge of a splitter plate, regardless of their number, did not noticeably increase the mixing. Different results were obtained for the supersonic jet flow. Although the 8-chevron configuration led to results consistent with the literature, i.e., no significant change was found compared to the straight-edge configuration, the 2-chevron geometry increased the size of the core region and decreased the level of pressure fluctuations. When the chevrons were tapered (i.e., brought to converge at) 10 degrees, the 2-chevron geometry modified the jet structure substantially, resulting in elliptic-like jet. In both the flow visualization experiment and the CFD simulation, the jet appeared to be squeezed along the peak to peak plane and escaped in the trough to trough plane, which enhanced the mixing between the flow and its surroundings.

Roy Myose

Establish a North American Bird Strike Advisory System (NABSAS)/ US Civilian Airport Wildlife Advisory System

An analysis of US airports for their suitability as test sites for a General Aviation (GA) AHAS was conducted. Approximately 100 airports were analyzed according to the following criteria: the level of GA traffic, the number of birdstrikes and damaging birdstrikes in 2006 and in the five-year period 2002-2006, the species of birds struck, the proximity to major flyways of the strikes, the presence or absence of wildlife refuges and major agricultural areas at or near the airport, and the location of WSR-88D radar at or near the airport.

Sacramento International Airport and Salt Lake City International Airport both ranked very high according to the preceding criteria. The PI (Dickey) contacted personnel at both airports and SLC was chosen as the test site. The result was a study of one airport into the development of a low-cost BAM system. Both positive and negative results were found using several datasets (i.e., eBird, Breeding Bird Survey, and Christmas Bird Count).

Archie Dickey

Gap Analysis/Risk Analysis for UAS Propulsion Systems

The Code of Federal Regulations, Title 14, serves as a guide to regulate production, operation, and maintenance of manned aircraft in the National Airspace System; while this creates an effective barrier against risky or unsafe designs, it also is predisposed to slow technological advances of new airworthy designs, such as Unmanned Aircraft Systems. There must, therefore, be some way in which these new technologies can be reconciled with the present regulations.

This study focuses on the integration of Unmanned Aircraft propulsion systems into the current regulatory framework. The gaps existing between the current regulation umbrella and the needed coverage regarding unmanned propulsion systems are isolated, highlighted, and discussed. The findings are presented in the Regulatory Gap Analysis and Risk Analysis, with the Gap Analysis examining current regulations as related to various propulsion systems and finding areas needing a closer look, and the Risk Analysis identifying and categorizing areas of risk associated with each technology.

Together they are a formalized attempt at reconciling the differences of the existing regulations with the propulsion technologies, identifying ambiguities and assessing the risk of each technical issue. The information presented is then drawn upon to make conclusions and recommendations as to how to handle issues brought up within this research, describing possible further work.

Timothy A. Wilson

Regulatory Gap Analysis for Detect, Sense and Avoid

There is a growing demand for the use of unmanned aircraft systems (UAS) ranging from agricultural to homeland security uses. UAS technologies currently exist in emergent stages, posing difficulties towards safe implementation into the NAS framework. One of the biggest challenges in implementation, therefore, is to determine and achieve the equivalent level of safety currently existing for manned flight operations.

The intent of this report is in conducting an examination of current Federal Aviation Administration (FAA) regulations directly applying to Detect, Sense, and Avoid (DSA) capabilities of UAS. This included an extensive analysis of mandated and recommended material distributed by the FAA was closely scrutinized for its applicability towards DSA operations, reviewing such materials as 14 Code of Federal Regulations 91, the Airman's Information Manual, the Federal Aviation Regulations, as well as some other publications. Prior to this analysis, a brief overview of various research being conducted in the realm of UAS was discussed, including, a technology review containing a high level assessment of potential technologies currently associated with DSA applications. The report concludes with a discussion of specific concerns in DSA and summary of the findings as well as areas of future research.

Timothy A. Wilson

Command, Control and Communication for Unmanned Aircraft Systems: Technology Survey and Regulatory Gap Analysis

This report presents a technology survey and regulatory gap analysis for command, control, and communication (C3) technologies for unmanned aircraft systems. The safe integration of UAS into the United States National Airspace System (NAS) presents many challenges to the aviation industry and its regulators. Modifying the existing regulatory framework toward UAS is both time consuming and costly. To aide the airworthiness certification process, regulators need a means of evaluating UAS toward the existing regulation and/or provide guidance toward the demonstration of an equivalent level of safety. UAS manufacturers and their potential customers also desire quick access to the NAS in order to take advantage of the opportunities that UAS provide. This paper presents research to aide regulators by analyzing current regulations to identify issues that must be addressed by identifying gaps between the regulations and current technology.

Timothy A. Wilson

