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Aircraft Design & Manufacturing Resource Center (ADMRPC)
NIAR/Industry/State (NIS)

Cover art: “Searching,” a sculpture by Fred Sudermann

NIAR Located on the Wichita State University campus, in a city recognized as the Air Capital of the World, the National Institute for Aviation Research (NIAR) integrates university, government and industry in cooperative efforts to advance technologies for aviation safety and manufacturing. Our 120,000 square-foot facility is recognized internationally as a high-tech research, development, testing, certification and learning center.

Aviation has been a part of the Wichita community for many years, and since 1985 NIAR has been an integral partner. Since then, NIAR has become one of the few state-of-the-art aviation research centers in the United States recognized for contributions to aviation safety and performance.

As you explore the annual report, you will see examples of the significant contributions NIAR makes to the aviation industry on a daily basis.

MISSION: To conduct research, transfer technology and enhance education for the purpose of advancing the nation’s aviation industries that may benefit from aviation-related technologies.

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Dear Colleagues:

The National Institute for Aviation Research at Wichita State University is proud to announce its accomplishments for the 2006 fiscal year. In the past year, NIAR has continued its goal of advancing the aviation industry through research, design, testing and certification.

As the result of continued government and industry support, NIAR’s operating budget increased by nearly 40 percent in the past year to $35,785,370. NIAR’s research and development efforts have also led to a number four rank among all U.S. universities in aeronautical research and development according to the National Science Foundation (NSF). WSU’s research and development efforts have also led to a number four rank among all U.S. universities in aeronautical research and development according to the National Science Foundation (NSF). ... Legislature, the Kansas Congressional Delegation and the aviation industry in Wichita and throughout the United States.

In the past year, NIAR hosted tours and discussions for several influential visitors including a group of Kansas legislators in January. In March, NIAR was the host of a hearing for the Aviation Subcommittee of the U.S. House Committee on Transportation & Infrastructure. The hearing, led by Chairman John Mica and Representatives Todd Tiahrt, Jerry Moran and Vern Ehlers, was held to discuss economic competitiveness in the aviation industry. Attendees included Jack Pelton, Chairman, President & CEO of Cessna Aircraft Company; James Schuster, Chairman & CEO of Raytheon Aircraft Company; Jeffery Turner, President & CEO of Spirit AeroSystems and William Gray, Vice President and General Manager of the F-35 Joint Strike Fighter Program. NIAR would like to thank all of those involved in arranging the hearing for allowing us to host this important event.

NIAR has grown as an organization and so have many of our laboratories. In March the Advanced Joining Laboratory received a grant from the National Science Foundation in order to cover expenses for planning to become part of its Center for Friction Stir Processing (CFSP). Thanks to the efforts of Dr. Dwight Burford and his staff in the Advanced Joining Lab, WSU is well on its way to joining other CFSP member universities: the South Dakota School of Mines, the University of South Carolina, Brigham Young University and the University of Missouri-Rolla.

In April, the Calibration & Quality Laboratory was established in order to support NIAR’s continued guarantee of accurate and reliable certification and test results. The lab will primarily support existing NIAR laboratories such as Structures, Fatigue & Fracture, Full-Scale Structural Testing and Advanced Joining. The Crash Dynamics Laboratory has begun research into aircraft child seat safety installations and mass transit bus crashworthiness. The lab is the primary test facility for B/E Aerospace and gained a new helicopter seat client, ... Airplane and gained a new helicopter seat client, Atlantic Helicopter Industries (AI). The 12-month-old is a CMR Restricted Airline Interaction dummy (CRAR). The 32IRR total number of test dummy is 187. Some of the existing dummies include a FAA Hybrid II 50th percentile male, Hybrid III 50th percentile male, anthropomorphic test dummies (5th percentile female, ... 5th percentile male, and a Euro S.I.D. II.

NIAR’s Aircraft Structural Testing and Evaluation Center (ASTEC), located on the campus of Raytheon Aircraft Company, is also continuously growing. Located at ASTEC, the Full-Scale Structural Testing Laboratory performs certification testing for Raytheon Aircraft Company’s line of transports. The lab also does work for other aviation and non-aviation companies. The Aging Aircraft Laboratory at ASTEC has acquired several new contracts from the U.S. military and other government agencies, including an “Aging of General Aviation Aircraft” study sponsored by the FAA.

At the 2006 CATIA Operations Exchange (COE) Product Lifecycle Management (PLM) Conference, three of NIAR’s CAD/CAM professionals took home first, second and third place in the Top Gun Competition. The competition allows CATIA engineers and designers to test their skills at developing the most accurate and correctly structured component in the least amount of time. The 2006 COE Product Lifecycle Management Conference was held in Orlando, Florida, April 11-13. NIAR’s winners included Vivian Lee, first place; Jesus Salas, second place; and Mark Young, third place in the Top Gun Competition.

To learn more about NIAR’s laboratories and capabilities or to subscribe to the NIAR R&D Brief, CECAM Technology Bulletin or NCAMP Bulletin, visit our website at www.niar.wichita.edu.

Sincerely,

John S. Tomblin, PhD
Executive Director, NIAR
Sam Bloomfield Distinguished Professor of Aerospace Engineering

Funding Sources

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The Advanced Joining Laboratory provides friction stir welding (FSW), friction stir processing (FSP) and friction stir spot welding (FSSW) research to the aviation industry and government agencies. The lab started the fiscal year with a new director, Dr. Dwight Burford. Dr. Burford joined NIAR with 16 years of manufacturing research and development experience in the aircraft industry. Since 2000 his focus has been friction stir weld development and implementation. In September 2005 the Advanced Joining Lab had visitors from Lockheed Martin's Michoud Assembly Facility in New Orleans. The Lockheed engineers used NIAR’s Advanced Joining Lab for a month while the Lockheed facility received repairs after damage from Hurricane Katrina. In January the lab received a $10,000 planning grant from the National Science Foundation Industry/University Cooperative Research Center (I/UCRC), which was used for preparing for joining work within the NSF I/UCRC Center for Friction Stir Processing (CFSP). The lab has received the FAA and several industry members in support of its becoming a member of the CFSP and is expected to gain full rights as a CFSP member in FY07.

2006 Highlights:

- **Research**: FSW and post-weld heat treatment investigations of legacy and new 2000 and 7000 series aluminum aerospace alloys.
  - **Objective**: Determine the extent to which thermal treatments can improve the corrosion resistance of aluminum alloys, e.g. 7075, 7055, 7136, 7249, etc., and their corresponding effect on mechanical properties.

- **Research**: Structures testing of stiffened panels fabricated using FSW and FSSW.
  - **Objective**: Evaluate the static strength performance of FSW and FSSW panels as compared to riveted panels tested in compression, tension and shear. Further evaluate the fatigue behavior and life of panels welded by FSW and FSSW to evaluate the comparative damage tolerance of these panels.

- **Research**: Efficiency and performance of weld tools for FSW, FSP and FSSW.
  - **Objective**: Reduce surface damage in butt joints, lap joints, friction stir processed material, etc. using tools with different scroll patterns to improve weld tool track material properties. Measurable smoothing of the surface finish may be achieved by incorporating a unique tool shoulder feature, termed the WiperTM, on the shoulder face.

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NATIONAL INSTITUTE FOR AVIATION RESEARCH
THE AERODYNAMICS LAB HAS ACCESS TO FOUR WIND TUNNELS AND A WATER TUNNEL. THE LAB PROVIDES PRIVATE INDUSTRY, GOVERNMENT AND EDUCATIONAL INSTITUTIONS WITH THE RESOURCES NEEDED TO MAKE AIRCRAFT SAFER AND MORE EFFICIENT.

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AFTER the completion of a $6 million upgrade, the Walter H. Beech Memorial Wind Tunnel reopened for business in 2006. The lab enjoyed a full test schedule for much of the year, gaining new clients and offering upgraded services to existing clients.

In March the lab performed wind tunnel tests for the Raytheon Small Diameter Bomb (SDB) II. The tests led to a $34 million contract for Raytheon from the U.S. Air Force Air Armament Center, Eglin Air Force Base, Fla., to conduct risk reduction work for the SDB II.

According to Raytheon test engineers, the wind tunnel data collected during this test may be the most comprehensive database for base and ball pressures in the presence of deflected and undetected control surfaces that has ever been acquired by any organization.

The Beech Wind Tunnel will receive another upgrade in the upcoming fiscal year. A new model mounting, positioning and force measurement system will come on-line during the summer of 2007. This new system includes a robotic sting mount and a suite of internal balance custom-built for the lab. This state of the art system will provide the lab with additional precision wind tunnel testing capabilities.

2006 Highlights:
• Conducted several commercial tests, including tests for:
  • Rocketplane XP
  • Raytheon Missile Systems
  • Snow Aviation
  • Arizona Paragliding Systems

2007 Highlights:
• Research: Supported research for detecting structural degradation of a replica wing spar test article.

2006 Highlights:
• Research: Completed aging study for the FAA on small commuter-class aircraft, the Piper Navajo Chieftain and the Beechcraft 1900D.
  Objective: To provide insight into the condition of a typical aged airplane and determine whether a correlation exists between maintenance history and current condition from a safety-of-flight perspective.

• Research: Conducted comprehensive wind tunnel evaluations on B-52 wing sections and the fuselage from an F-16 static test article.
  Objective: To examine areas with expected damage, confirm the extent of the damage and identify any unexpected damage in inaccessible areas.

• Research: Supported research for detecting structural degradation of major airframe components.

2007 Highlights:
• Along with teardown evaluations, the program is greatly expanding into demonstration and validation of inspection and analysis methods for aging military aircraft.
The Calibration and Quality Laboratory was established in April 2006. Walter Lee, formerly of MTS Systems, was hired as Director of Quality and Performance and is responsible for the direction of the Calibration and Quality Lab.

Although NIAR has always guaranteed accurate and reliable test results, the Calibration and Quality Lab was established in order to ensure this guarantee and implement organized procedures for calibrating sensors and systems and setting up tests. The Calibration and Quality Lab will support existing NIAR laboratories such as Structures, Fatigue and Fracture and Advanced Joining. Lee will act as a direct contact for questions regarding test accuracy, calibration procedures and quality assurance.

2007 Goals:
- Implement in-house calibration process
  - Purchase equipment
  - Develop calibration procedures
  - Train personnel to perform calibrations
- Implement quality program that includes procedures for calibration section and testing
- Hire additional personnel

Calibration sensors for the following parameters:
- Force
- Pressure
- Temperature
- Acceleration

The Composites and Advanced Materials Laboratory works with NIAR’s advanced materials centers, the FAA Center of Excellence in Composites and Advanced Materials (NCAMP) and the NASA National Center for Advanced Materials Performance (NARCAMP), and provides composite testing and certification to local and national composite manufacturers.

In 2006 the lab supported development and material characterization efforts of 50 aerospace and non-aerospace related companies. These efforts involved non-metallic and metallic advanced materials. Coupon and element testing was performed for a wide range of research and material qualification programs. The amount of industry-supported research increased by 26 percent from FY 05.

In the past year, the lab’s staff size has increased by nearly 38 percent. The lab employs 14 full-time managers, 23 full-time engineering support staff and 90 undergraduate/graduate students.

2006 Highlights:
- Effects of Manufacturing Defects in Composite Structures: Investigate the effects of manufacturing defects on the performance of graphite/epoxy solid laminates.
- Aging Effects Evaluation of a Decommissioned Boeing 737 Horizontal Stabilizer and a Beechcraft Starship: Evaluate effects of aging on composite aircraft structures by investigating two aircraft structures, a decommissioned Boeing 737 stabilizer with a commercial service history of 18 years and a Beechcraft Starship, after 12 years of service corresponding to 1,827 hours.
- Blind Fastener Usage in Composite Structures: Compare the performance of blind or one-sided fasteners joining laminated composites under different loading types.
- Effects of Process Parameters on the Performance of Repairs Applied to Hybrid Laminate and Sandwich Structures: Investigate the effects of different variables on the static and repeated load performance of scarf repairs applied to composite laminates and sandwich structures. Variables investigated included different lap lengths, laminate moduli, thicknesses and repair materials. The program will also investigate the effects of impact and process parameter deviations on the performance of these joints.

NIAR HAS ALWAYS GUARANTEED RELIABLE AND ACCURATE TEST RESULTS. THE CALIBRATION AND QUALITY LAB ENSURES THAT CLIENTS RECEIVE TRUSTWORTHY RESEARCH DATA.

The Composites and Advanced Materials Laboratory conducts industry-research on advanced materials and structures behavior in certain conditions such as heat and moisture.

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Calibration & Quality

F O R A V I A T I O N R E S E A R C H

N A T I O N A L I N S T I T U T E
The Crash Dynamics Laboratory provides a state-of-the-art service center with technologically-advanced test equipment to aid in the research, design, testing and certification of occupant protection systems. The lab enjoyed a busy year following a $3 million upgrade that was completed in fiscal year 2005. A laboratory record was set with 185 industry-sponsored sled shots.

In April four new anthropomorphic test dummies were purchased for the lab. The new dummies are a 5th percentile female, six-year-old, three-year-old and 12-month-old. The 12-month-old is a Baby dummy, which is used for child safety seat testing. These additions bring the lab’s test dummy family total to 17.

The Fatigue and Fracture Laboratory conducts fatigue experiments to generate S-N curves while fatigue crack propagation data helps assess the fatigue characteristics of materials to be used in metal and composite structures or to quantify fatigue damage and residual fatigue life in older aircraft. The lab currently houses 15 servo-hydraulic load frames for durability and fatigue endurance testing along with advanced equipment for monitoring crack growth and compliance changes in both metallic and non-metallic materials.

**2006 Projects:**

- **AFS-120:** Support the revision of the FAA advisory circular AC-23-13 by adding new fatigue data that will facilitate a better structural health evaluation of an aging general aviation airplane. The results obtained from this research effort are to be included in a revision of AC-23-13 resulting in a single advisory document containing current fatigue substantiation methods.
- **Effects of Dents on Fatigue Life and Fatigue Crack Growth:** Study the effects of dents on fatigue life and fatigue crack growth characteristics of aluminum alloys used by the aircraft industry.
- **Blind Fasteners Used in Composite Structures:** Compare the performance of 5/8” and one-sided fasteners joining laminated composites under different loading types. The load types included pure shear, pull-through and combinations of both.

**Fatigue & Fracture**

The Fatigue and Fracture Laboratory specializes in endurance testing of materials subjected to fatigue damage due to cyclic loading. The goal of this testing is to develop data and methodologies for the durability and damage of materials, such as composites and metallics.
The Full-Scale Structural Testing Laboratory completed and initiated several test projects in the past year. These projects included development, substantiation, certification, static and durability testing of full-scale and component test articles.

**2006 Highlights:**

- **Certification:** Completed Hawker Horizon wing DDT testing to two lifetimes. Wing residual strength testing was also completed.  
  **Objective:** To perform certification full-scale durability and damage tolerance testing for a typical loading spectra and mode per 14 CFR Part 25.
- **Certification:** Finished one lifetime of testing on Hawker Horizon fuselage and empennage DDT test article.  
  **Objective:** To perform certification full-scale durability and damage tolerance testing for a typical loading spectra and mode per 14 CFR Part 25.
- **Certification:** Started design and fabrication of the Rocketplane XP wing static test setup.  
  **Objective:** Compliance with the structural integrity critical loading conditions per FAA/AST requirements and specifications.
- **Verification:** Completed static and cyclic testing on Wetzel Engineering wind turbine blades.  
  **Objective:** To subject the blade assembly to critical design loads.
- **Verification:** Boeing composite coupon repair program.  
  **Objective:** Support development of composite repairs to damaged flight aircraft.
- **Development and Certification:** Currently at one lifetime of cyclic testing of Liberty Aerospace XFL fuselage DDT article.  
  **Objective:** To perform certification full-scale durability and damage tolerance testing for a typical loading spectra and mode per 14 CFR Part 23.
- **Development:** Testing of BCI Wireless cellular pole structural reinforcements.  
  **Objective:** Support customer testing and development of structural reinforcements.

WHILE MOST ANALYTICAL TOOLS ARE UNABLE TO PREDICT A STRUCTURE’S REACTION TO LOADING AND ENVIRONMENTAL CONDITIONS, THE FULL-SCALE STRUCTURAL TESTING LAB CAN ASSESS STRUCTURAL PERFORMANCE AND DURABILITY BY PERFORMING FULL-SCALE STATIC AND FATIGUE TESTS.

The Human Factors Laboratory provides human factors expertise for the design and certification of aircraft, aviation technologies and other complex operating environments. The lab conducts applied and theoretical research projects designed to meet the immediate needs of the aviation and aerospace industries. During the past year, the lab has worked on the projects listed below.

**2006 Highlights:**

- **Unmanned Aerial Vehicles (UAV):** Currently developing human-machine interfaces for command and control of unmanned aerial vehicles. Faculty and students are also conducting several studies designed to address contemporary research issues and immediate engineering needs of UAV designers.
- **Cockpit & Cabin Design:** Providing design expertise and recommendations to aircraft manufacturers for the design and certification of cockpit and cabin designs. Members of the lab employ digital human modeling and virtual reality technologies to develop mock-ups that allow engineers the ability to test and evaluate their designs prior to manufacturing.
- **Cognitive Model-based Training Program:** Working with members of the aviation training community to develop a new method of knowledge assessment. By developing cognitive models of the individual trainee, we are able to create custom syllabi for each student pilot. We are currently conducting several studies to validate the methodology.
- **Aging Pilot Studies:** Conducting a series of studies that seeks to understand the physiological, psychological and behavioral changes that affect general aviation pilots as they age.

**Focus Areas:**

- **Unmanned Aerial Vehicles**
- **Pilot Information Management**
- **Digital Human Modeling**
- **Training**
- **Aging Pilots**
- **Aviation Maintenance**
- **Decision-Making**
- **Aviation Maintenance**

THE HUMAN FACTORS LAB OPTIMIZES THE PERFORMANCE OF HUMANS OPERATING COMPLEX SYSTEMS.
In the past year the infrastructure was improved by the addition of a PC-cluster image generator which has multiplied the lab’s capability to simulate massive geometry and engineering databases in real-time. The VRC has also fine-tuned the process flow to enable photo-realistic interior and exterior design visualization, including the establishment of a partnership with a VR software provider.

- Laminate Statistical Design Allowable Generation for Fiber-Reinforced Composite Materials: Developed lamina variability method (LVM) for generating design allowables of laminated composites using smaller sample sizes while maintaining statistical reliability at the laminate level of the building block of testing.
- Ergonomics and Human Factors: real-time anthropometrical analysis in first person perspective for assembly, accessibility and training evaluations.
- Fracture, Durability and Damage Tolerance of Adhesive Joints: Assessed the durability and damage tolerance of braided composite structures that were subjected to manufacturing and element testing for design and certification purposes.
- Damage Tolerance and Durability of Braided Composite Structures: Investigation of the effects of low velocity impact damages with different energy levels and impactor diameters on adhesive joint characteristics and development of dynamic modeling of such joints. This test method development was reverse engineered with the use of photogrammetry full-field strain measurement techniques.
- In-house customization of commercial run-time software is used to visualize and simulate data sourced in CAD/CAE/CAM of the main Product Lifecycle Management (PLM) providers. The VRC provides services to aviation and non-aviation industries as well as other NIAR labs.
- Digital manufacturing: real-time process plan and work cell simulation for clients.
- Sales/Marketing: real-time product customization and realistic demos for clients.

In 2006 the VRC collaborated on research conducted by the Crash Dynamics Lab and Computational Mechanics Lab in order to post-process real-time LS_DYNA CAE database for projects with the Crashworthiness of Composite Fuselage Structures. Several new full-field strain measurements involving take-to-assembly, disassembly and accessibility were created in order to support the Human Factors Laboratory. The VRC also provided technical support and virtual environment simulation for projects with WSU industrial and aerospace engineering departments projects funded by AADL.

The Virtual Reality Center (VRC) is a state-of-the-art facility unlike any other in Kansas. The lab features seating for 25 and a wide range of technology including an active stereoscopic 15 x 7 1/2 foot screen driven by rear DLP projectors. Other equipment includes: 3-D glasses, manipulation gloves, head-mounted display and optical and electromagnetic motion tracking systems.

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2006 Highlights:
• Crashworthiness of Composite Fuselage Structures: Experimental investigation of the high-strain rate effects on the mechanical properties of laminated composite using enhanced Split Hopkinson Bar Apparatus.
• Design Philosophies for Structures Utilizing Metal and Composites with Large CTE Differences: Develop design data and design philosophies for accommodation of thermal effects within large aircraft composite structures.
• Error and Uncertainty Propagation in Structural Measurements: The objectives of the project were two-fold: (1) to investigate the feasibility of internally including the aluminum beams from the composite fuselage skin, and (2) to investigate the thermally induced stresses on the aluminum beams using experimentally validated analytical models.
• Fracture, Durability and Damage Tolerance of Adhesive Joints: Research conducted in three major areas: (1) use of experimental fracture mechanics to predict the failure behavior of adhesive joints; (2) evaluation of the effects of low velocity impact damages with different energy levels and impactor diameters on adhesive joint characteristics and development of dynamic modeling of such joints. This test method development was reverse engineered with the use of photogrammetry full-field strain measurement technique.

The Virtual Reality Center acts as a visualization and simulation system in areas such as aircraft conception, engineering, and manufacturing processes. The Center houses fully and semi-immersive visualization equipment.

NATIONAL INSTITUTE FOR AVIATION RESEARCH
The CAD/CAM Laboratory offers courses to industry professionals and WSU students. The lab provides on-site training to aviation companies and provides curriculum to a number of schools and companies, continuously expanding its curriculum by working on new courses.

The CAD/CAM Lab provided 65 classes to nearly 700 students in 2006, a growth of 40 percent over the previous fiscal year. The lab also became an education partner of Dassault Systemes. To learn more about the CAD/CAM lab or for enrollment information visit the website at www.cadcamlab.org.


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CATIA V5 Courses offered:
• Part Design & Sketcher
• Assembly Design
• Sheet Metal Design
• Drafting
• Wireframes & Surfaces
• Fitting Simulation & Kinematics
• Pinion Machinery
• Surface Machining
• Functional Tolerancing & Annotation
• Knowledgeware
• Stress Analysis

Courses in development:
• ENOVIA VPM
• CATIA V5 Electrical Design

Partnerships:
• Dassault Systems
• University of Nebraska
• Kansas State University

On-site training provided to:
• Labinal - Corinth
• Confederation College
• Bombardier Transportation
• Cessna Aircraft Company
• The Boeing Company - Wichita

Other courses offered:
• ENOVIA LCA

Supporting companies:
• Airbus North America
• Boeing Wichita
• Cessna Aircraft
• Spirit AeroSystems
• V5 Engineering
• Schoolcraft College
• Airbus

The Research Machine Shop provides quality machining support for research activity at NIAR and WSU.

In the past year the shop has supported many of NIAR’s labs including Aerodynamics, Composites, Structures, Advanced Joining, Fatigue and Fracture and Crash Dynamics. The lab has also completed projects for various WSU departments, industry and government. The lab has grown to three full time employees and two part-time student employees.

2006 Highlights:
• Machined, modified and/or installed projects for Aircraft Icing Laboratory including HAARP-II large model.
• Fabricated or installation models for testing tests at WSU.
• Fabricated a wind tunnel model for RockwellPlane, Ltd.
• Manufactured special specimens for The NORBAM Group in Tulsa, OK.
• Provided replacement parts for old air handler to WSU physical plant due to unavailability of replacement parts.

The Research Machine Shop has had a history of success from the construction of the Walter H. Beech Wind Tunnel in 1946, to the building of composite tools. As industry evolves, the shop continues to be a source of the latest technologies required for the aviation industry.

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National Institute for Aviation Research
The Visual Technology Laboratory (VTL) serves as the creative department of NIAR. Using the latest MAYA 3D modeling, animation and rendering package, the VTL creates elements for various companies, WSU and NIAR. In the past year, the VTL provided graphic elements for Koch Arena programs and WSU basketball and baseball. The lab has worked with marketing and media companies including Get Real, CG Productions, Intake and BG Products.

Lab Manager Bill Johnson and the creative team from the WSU Media Resources Center won a Telly award for their video, "BEST Fever," the sixth annual video featuring the Kansas BEST students. Telly awards honor outstanding local, regional and cable television commercials/programs and video/film productions.

In a new project venture, 3D lighting and animations concepts are being utilized to develop courseware in the Photo Studio and Imagine/Shape modules within Computer-Aided Three-Dimensional Interactive Applications (CATIA), the primary CAD/CAM program used in the aircraft industry.

The lab’s summer 3D animation course for high school students, 3D Camp, is in its third year. Negotiations to expand the program into local school districts are underway.

To learn more about the Visual Technology Lab visit the website at www.vistechlab.com.

2006 Highlights:
- Provided graphic services to the WSU athletic department for basketball and baseball.
- Produced graphic elements for Vornado fan marketing materials.
- Received Telly award for work with Media Resources Center program for Kansas BEST video-character, Squawk.
- Produced animated elements for the 2nd generation "Bobby Likis 10 Most Wanted Car Killers" campaign for BG Products.

To learn more about the Visual Technology Laboratory (VTL) visit www.vistechlab.com.
CECAM mission: to provide the nation with a center for the validation and quality assurance of composites and advanced materials to be applied to the construction of large commercial transport aircraft through (1) research, testing, certification and technology transfer; (2) coordination and cooperation with the FAA, large commercial transport aircraft manufacturers, materials suppliers and airline companies; and (3) education of the aircraft manufacturing and maintenance work force.

In December 2003 NIAR was designated as an FAA Center of Excellence for Composites and Advanced Materials (CECAM), part of the Joint Advanced Materials and Structures Center of Excellence (JAMS). CECAM focuses primarily on the safety and certification of emerging applications of composites and advanced materials in commercial transport aircraft.

CECAM is composed of an academic team of universities that complement each others’ interests and expertise in research areas associated with advanced materials. The center is led by Wichita State University, with core members from Northwestern University, Purdue University, Tuskegee University, the University of Delaware and the University of California at Los Angeles.

Objective: Perform basic and applied research within specific technology areas and facilitate growth and education of the use of advanced materials with emphasis on the needs of the large transport aircraft industry while supporting the safety and certification issues involved with airworthiness assurance.

2006 Highlights:
- Wichita State University
  - Aging of Composite Aircraft Structures - Beechcraft Starship Teardown
  - Production Control Effect on Composite Material Quality and Stability
  - Crashworthiness of Composite - Material Dynamic Properties
  - Effect of Repair Procedures Applied to Composite Airframe Structures
  - Evaluation of Friction Stir Weld Process and Properties for Aircraft Application
  - Methods for the Evaluation of the Fitness of Fiber-Reinforced Composite Surfaces for Subsequent Adhesive Bonding
  - Damage Tolerance Testing and Analysis Protocols for Full-Scale Composite Airframe Structures under Repeated Loading
  - Certification by Analysis
  - Fluid ingress Damage Mechanisms in Composite Sandwich Structures
- Northwestern University
  - Structure Health Monitoring for Life Management of Aircraft
- University of California at Los Angeles
  - Damage Tolerance and Durability of Fiber Metal Laminates for Aircraft Structures
- Purdue University
  - Damage Tolerance and Durability of Adhesively Bonded Composite Structures
- Tuskegee University
  - Nondestructive Test/Writing Assembly for Aircraft Structures
- University of Delaware
  - VARTM Variability and Substantiation

CGAR mission: To enhance aviation-related research, education, technology transfer and utilization in mission critical areas; to respond to the research interests and needs of the aviation industry through synergistic relationships developed between academia, industry and government.

In April 2001 NIAR became a core member of the FAA Center of Excellence for General Aviation Research (CGAR).

The three major criteria of success are:
1. The ability of the center to provide national leadership in resolving air transportation problems.
2. The ability to disseminate results through a continuing education program.
3. The ability to create self-sufficiency so the center is not reliant upon funding support from the FAA.

Participating universities include Wichita State University, Embry-Riddle Aeronautical University, the University of North Dakota, Florida A & M University and the University of Alaska. Embry-Riddle is the lead university and handles the management of the organization. NIAR has a leadership role in composite materials and crashworthiness in this center. However, all universities are viewed as equal contributors to research activities.

2006 Highlights:
- Detection and Prevention of Carbon Monoxide Exposure in General Aviation Aircraft
- Enhanced Jet Exhaust Mixing to Reduce Jet Aircraft Engine Noise
The NASA National Center for Advanced Materials Performance (NCAMP) was developed in August 2004. NCAMP provides the nation with a localized center for composite and advanced material validation and quality assurance. The goal of NCAMP research is to integrate the advanced material technology into actual aircraft and industry practice.

As part of reaching those goals, NCAMP has chosen five resin systems for qualification. Each resin has three prepreg systems. The materials were weighed for selection into the shared database based on the needs of the aviation industry.

- Cytec 5215: (out-of autoclave system) 
  - T40-800 Unitape Gr 145 33%, CPT approx. 7.5 mils
  - 6K 5HS fabric with T650-36% RC, CPT approx. 14.9 mils
  - 3K70PW fabric at 193 gsm 38% RC, CPT approx. 7.95 mils
- Advanced Composites Group (ACG) MTM45-1: (out-of autoclave system) 
  - G30-500 193 gsm 3K plain weave fabric 36% RC
  - G30-500 145 gsm uni 32% RC
  - 6781 S-2 glass 35% RC
- Toray 2510 - AGATE Legacy Material (involves minor additions to the existing database only)

Over its first year, NCAMP was also able to secure supporters in industry, government and academia. Today that list includes 38 companies representing 44 states in the U.S. Together these companies have committed to cost-sharing in the form of labor and material costs for fabricating test panels for the development of the shared databases.

In order to maintain the pedigree of the data generated from the qualification programs, NCAMP has established rigorous quality assurance standards. These standards include creating material specifications and process control documents for the raw materials, such as carbon fiber and prepreg, along with procedures to monitor material property variability. To learn more about NCAMP, please sign up for the e-bulletin at: www.niarc.wichita.edu/coe/ncamp_news.asp.

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The Aircraft Design & Manufacturing Research Center (ADMC) was established in October 1995 as a state/university/private sector partnership. The goal was to establish a consortium of university and industry partners who, working together, could apply their collective expertise to address the technology needs of aircraft manufacturers and subcontractors.

ADMC combines the talents and expertise of The Boeing Company, Bombardier/Learjet, Cessna Aircraft Company, Raytheon Aircraft Company, Spirit Aerosystems, several small businesses and university researchers from Wichita State University, the University of Kansas, Kansas State University and Pittsburg State University. Together, faculty and students can focus on industry problems in Kansas.

ADMC, partially funded by the Kansas Technology Enterprise Corporation (KTEC), is a successful state/university/industry partnership. It is recognized nationally as a model for cooperative research.

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NASA National Center for Advanced Materials Performance

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ADMRC 2006 Highlights:

Wichita State University
- Correlation of Key Variables in the Composite Cure Process
- Drilling of Composite Materials
- Thermal Spray Coatings for Composite Structures in Aviation
- Virtual Reality System with Haptic/Audio Devices for Assembly and Maintenance Training and Certification
- Rapid Fabrication of Modular Composite Lay-up Tools

Kansas State University
- Effects of Corrosion and Oxidizing on the Fatigue Behavior of Varying Gauge Aluminum Sheet

University of Kansas
- Analysis of IEEE 802.11 b/g Protocol Robustness for Essential Data Applications
NIAR Combines a diverse range of research projects proposed and selected by industry with highest priority given to reduced cycle time-to-market, reduced cost, enhanced quality and safety for improved competitiveness.

The NIAR/Industry/State (NIS) research program was created by the Kansas State Legislature in 2004 to support the efforts of Kansas aviation manufacturing industry to compete in the global technological environment. While this research program is operated through NIAR, all research projects are identified and selected by an executive committee composed of representatives from The Boeing Company, Bombardier/Learjet, Cessna Aircraft Company, Raytheon Aircraft Company and Spirit AeroSystems. WSU’s associate vice president for research, the executive director of NIAR and the dean of the College of Engineering serve in a project management capacity.

In its first year, the program received $1 million in funding, which supported 10 research programs. The second (FY04) and third (FY05) were funded by the Kansas State Legislature in the amount of $2 million.

2006 Highlights:
- Design Philosophies for Structures Utilizing Metal and Composites with Large CTE Differences
- Repair of Composite Structures
- Blind or One-Sided Fastener Usage in Composite Structure (Production & Repair Applications)
- Analysis of Braided Composite Structure
- Crackinitiation of Composite Fuselage Structure
- Fatigue Thresholds and Related Topics
- Tolerancing Overview of Application to Support Airframe Final Assembly
- Characterization of Fatigue Crack Development and Growth from Dents in 7475-T7351 Machined Wing/Planks and Crack Growth Correlation Between CRACK59, AFGROW, and Empirical Data
- Adhesion Joint Characterization and Testing
- Aviation Network Security
- Interim Test of Noise-Characteristics and Performance Evaluation
- Acoustic Material Database
- Blister Code Investigation
- Child Safety Seat Perspectives
- Composite Bearing Allowables Baseline
- NDE Simulations of Aircraft Structure
- Potting Compound Strength/Density Enhancement
- Flammability Characterization of Materials for Aircraft Interiors
- Tolerancing Overview of Application to Support Airframe Final Assembly
- Characterization of Fatigue Crack Development and Growth from Dents in 7475-T7351 Machined Wing/Planks and Crack Growth Correlation Between CRACK59, AFGROW, and Empirical Data
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- Acoustic Material Database
- Blister Code Investigation
- Child Safety Seat Perspectives
- Composite Bearing Allowables Baseline
- NDE Simulations of Aircraft Structure
- Potting Compound Strength/Density Enhancement
- Flammability Characterization of Materials for Aircraft Interiors

In a non-traditional campus environment such as Wichita State University, NIAR is uniquely positioned to employ a diverse staff. NIAR’s location on the campus of Wichita State University provides the opportunity to employ a talented, diverse staff. Our diversity ranges from our ethnicity to our education. From-qualified research scientists, engineers and associates to professional administrative staff and eager student assistants, our employees are the reason why NIAR is capable of providing in-depth research, innovative design, accurate testing and reliable certification to meet the changing needs of our clients. The efforts of these employees have paved the way for NIAR to achieve excellence in all of its endeavors. In a new ranking of university aerospace research and development, NIAR ranked fourth among the nation’s prestigious universities according to FY 04 data from the National Science Foundation.

The resources available to our team consist of two facility sites totaling 120,000 square feet and 12 primary laboratories.

HUMAN RESOURCES
- 61 PhDs
- 27 Masters
- 19 Bachelors (over 90% pursuing advanced degrees)
- 81 Undergraduate Research Assistants
- 41 Laboratory Technicians
- 6 Administrative Staff
- 308 Total Staff

NIAR is a non-traditional campus environment such as Wichita State University that is uniquely positioned to employ a diverse staff.
Established in 1983, the WSU Regional Kansas Small Business Development Center (KSBDC) provides free consultation services and affordable training in a 24-county region of north and south-central Kansas. The center serves entrepreneurs ready to start new businesses and owners of established businesses ready to grow.

The three full-time and two part-time professional consultants provide expert assistance with the three M’s: marketing, management and money. They work individually with clients in areas that include business planning, access to capital, cash flow development, marketing, human resource issues and strategic planning.

The center offers workshops on topics that include starting a business, writing a business plan, state and federal taxes, choosing a business legal structure, QuickBooks, low and no cost marketing, business contract basics, government contracts, customer service and strategic planning.

Dr. Manon Stevens provides oversight for a budget that is funded by WSU and Cloud County Community College and by grants from the U.S. Small Business Administration and the Kansas Department of Commerce. Since starting as regional director in 1999, Dr. Stevens has significantly increased the service area and output of the Center. Ingram’s Magazine recognized the WSU KSBDC for serving more clients than any other SBDC in Kansas or Missouri every year for the past five years.

ECONOMIC VITALITY AND FUTURE OF THE AVIATION INDUSTRY.

New businesses started ............................................................... 59
Full-time jobs created ................................................................ 119
Part-time jobs created .............................................................. 100
Secured 188 loans ........................................................... $8,300,000
ECONOMIC IMPACT OF WICHITA STATE REGIONAL KSBDC CY 2005

Clients

3. Advanced Composites Group
4. Avion Engineering
5. Aromark Technologies
6. Airex Technology
7. Aircraft Undercarriage Systems
8. Aircraft World
10. Aircraft Systems
11. Aircraft Technology
12. Aircraft Tooling Technologies
13. Aircraft Undercarriage Systems
14. Aircraft Engineering
15. Aircraft Design
16. Aircraft Manufacturing
17. Aircraft Manufacturing Co.
18. Aircraft Manufacturing Group
19. Aircraft Manufacturing Industries
20. Aircraft Manufacturing Services
21. Aircraft Manufacturing Systems
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The National Institute for Aviation Research is funded in part by the Kansas Technology Enterprise Corporation. NIAR is an unincorporated division of Wichita State University, which is a state owned entity separately managed and distinct from the Kansas Technology Enterprise Corporation.

NOTICE OF NON DISCRIMINATION
Wichita State University does not discriminate in its programs and activities on the basis of race, religion, color, national origin, sex, age or disability. The following person has been designated to handle inquiries regarding non-discrimination policies:
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