The front cover of this year’s report features two key technologies that are currently being researched heavily at the National Institute for Aviation Research: friction stir welding and composites.

The prominent photo is simulated aluminum and an actual stir weld. The NIAR logo is a photograph of actual composite material. Both are technologies that are beginning to reshape the aviation industry.

For more information about stir welding and composites research at NIAR, see the Advanced Joining & Processing Lab on page 9 and the Composites & Advanced Materials on page 14.
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Dear Colleagues:

The National Institute for Aviation Research (NIAR) at Wichita State University has enjoyed another exciting year of advances and accomplishments in research, design, testing, certification and training. Through our partnership with local, national and international businesses, government agencies and academic institutions, NIAR continues to provide critical resources for the aviation industry and beyond.

NIAR is proud to announce that WSU now ranks third among all U.S. universities in aerospace engineering research and development. According to the most recent National Science Foundation data, WSU has improved its fourth place standing from the previous reporting year and ranks above many other prestigious universities in the United States.

And we’re continuing to expand our resources. In December, NIAR gained a much-needed 14,000 square feet of additional research space. The building, located west of NIAR’s main facility, houses additional environmental testing equipment, the Composites Laboratory machine shop and additional space for the Structures and Fatigue & Fracture Laboratories.

In January, Sedgwick County approved a $54 million bond issue for the National Center for Aviation Training at Jabara Airport. Upon completion of the 222,000 square foot facility in early 2010, NIAR’s CAD/CAM, Composites & Advanced Materials and Advanced Joining & Processing labs will occupy a significant amount of space at the facility to perform research and training in collaboration with the Wichita Area Technical College. NIAR will also support non-destructive inspection training and research at this new facility.

A new sting mount system has been installed and calibrated in the Walter H. Beech Memorial Wind Tunnel, just in time for the tunnel’s 60th anniversary this year. The system will provide additional testing capability for tunnel clients whose wind tunnel models are designed exclusively for sting mount systems.

In March, Embraer joined the list of WSU/NIAR Center for Friction Stir Processing (CFSP) sponsors. The CFSP is headquartered in the Advanced Joining & Processing Lab at NIAR. As a multi-institutional Industry/University Cooperative Research Center (I/UCRC), the National Science Foundation’s CFSP brings together the premier friction stir processing academic institutions in the U.S. and focuses on addressing the needs of aerospace, aeronautic, energy, military and commercial industries in developing friction stir processing.

The Crash Dynamics and Computational Mechanics Laboratories completed a study for the National Science Foundation in association with the Center for Child Injury Prevention Studies (CChIPS). This study evaluated the performance of a wide variety of child safety seats and provided an in-depth assessment of the performance of child safety seats and the response of anthropomorphic test dummies. It was the first of its kind to conduct a systematic assessment of changes in performance of child safety seats through a series of simulated side impact tests.

The Human Factors Lab continues its work with General Atomics Aeronautical Systems, Inc. (GA-ASI), now under contract to the U.S. Air Force, to further develop the software interface and validate the anthropometric and ergonomic design of the Advanced Cockpit Ground Control Station for unmanned aircraft systems. The Air Force commissioned the development of GA-ASI’s new pilot and sensor operator’s station in 2006.

In July, the U.S. Air Force Research Laboratory Composite and Hybrids Branch announced the selection of Renegade Materials FreeForm®14 Polyimide to be coordinated by the National Center for Advanced Material Performance (NCAMP). The program will generate a material properties database for qualification of a high-temperature polyimide composite for use in both airframe and engine applications. NCAMP will also identify fabricators with the capability and experience to process polyimide materials to participate in the panel fabrication activity. FAA oversight of this program will result in the pedigree necessary for the materials to be used in certified aerospace applications.

Much more has happened at NIAR this year, so take a look through the rest of the report for news and updates on all of the laboratories. To keep up with NIAR happenings throughout the year, subscribe to the NIAR R&D Brief, CECAM Technology Bulletin or NCAMP Bulletin, visit the website at www.niar.wichita.edu.

Thank you for your support as NIAR strives to maintain state-of-the-art facilities and capabilities to continue meeting the ever-changing needs of our valued clients.

Sincerely,

NIAR Executive Director,
Sam Bloomfield Distinguished Professor of Aerospace Engineering
FY 2008 OPERATING BUDGET: $35,851,865

IN MILLIONS

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INDUSTRY: 41%
STATE OF KANSAS: 16%
UNIVERSITY: 3%
KTEC: 3%
FEDERAL: 37%
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<tr>
<th>JULY 2007</th>
<th>AUGUST</th>
<th>SEPTEMBER</th>
<th>OCTOBER</th>
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<tr>
<td><strong>JAMS</strong></td>
<td>NCAMP</td>
<td>NIAR Executive Director John Tomblin and Director of Research and Development Tom Aldag attended the National Business Aviation Association Convention, the world’s largest civil aviation trade show, in order to prospect new clients and develop relationships.</td>
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**NOVEMBER**

NIAR gains 14,000 square feet of research space with the completion of the Machining, Environmental and Structural Testing Annex (MESA), located behind NIAR’s main facility on the WSU campus.

**DECEMBER**

Sedgwick County approves a $54 million aviation training center to be located at Jabara Airport and provide additional space and training opportunities for NIAR’s Composites, CAD/CAM, Advanced Joining and NDI labs.

**JANUARY 2008**

Kansas governor Kathleen Sebelius recommends $2.5 million funding for NIAR. After legislative session ends, the state budget includes $5 million for aviation industry advancements and another $5 million for the National Center for Aviation Training.

**FEBRUARY**

WSU/NIAR ranks third in the nation in aerospace R&D expenditures. WSU/NIAR improved on its previous 4th place ranking.

**MARCH**

Ground is broken for National Center for Aviation Training. NIAR will teach courses and perform research in composites, advanced joining, non-destructive testing and CAD/CAM in the new facility, expected to open in mid 2010.

**APRIL**

The National Science Foundation’s Center for Friction Stir Processing (CFSI) held its spring technical conference at NIAR. WSU/CFSI site gained a new industry sponsor, Embraer.

**MAY**

The U.S. Air Force Research Lab is funding the qualification of a non-methylenedianiline (MDA) polyimide material for use in both airframe and engine applications. Both the Air Force and NCAMP, who is coordinating this effort, believe that polyimide-based composite materials are a viable substitute for many aerospace parts currently made out of titanium.

**JUNE**

The WSU School of Art and Design completes a mural on the NIAR Composites Laboratory wall.
NIAR’s talented and diverse staff of 300+ employees makes it possible to provide the ground-breaking research, innovative design, accurate testing and reliable certification that aviation and non-aviation clients rely on to meet their ever-changing needs. From our executive staff (shown below) to our research scientists, engineers and student assistants (inside front cover), the NIAR team is qualified and educated. Within NIAR, there are 60 Ph.D.s, 17 master’s degrees, 102 bachelor’s degrees (with several pursuing advanced degrees) 13 associates degrees, 6 technical degrees and more than 100 undergraduate student assistants. The staff is at work in 16 primary laboratories that encompass 135,000 square feet.

Left to right: Ray Swenson, Sr. Administrative Assistant; Liz Smith, Administrative Specialist; Laura Rhoades, Communication Coordinator; Tracee Friess, Marketing/Communication Manager; Tom Aldag, Director of Research and Development; Dr. John Tomblin, Executive Director; Jerry Antes, Director of Operations and Budget; Gabrielle Dodosh, Executive Assistant to John Tomblin; Juanita Parsons, Sr. Administrative Assistant; Joanna Brown, Administrative Specialist; Robin Stevens, Administrative Specialist. Not pictured: John Moore, Sr. Advisor to the Executive Director.
Through the Executive Industry Advisory Council (IAC), NIAR takes advantage of its location in the “Air Capitol of the World” to provide researchers with input from key players in the local aviation industry. The information offered by these individuals helps us outline and prioritize future research topics, equipment updates and laboratory additions. The IAC consists of senior level management at Boeing Integrated Defense Systems, Bombardier/Learjet, Cessna Aircraft Company, Hawker Beechcraft Corporation and Spirit AeroSystems.
NIAR collaborates each year with a variety of local, national and international clients in aviation and non-aviation industries and in government and academic sectors. The following is a list of NIAR’s FY08 clients. Regardless of whether the contract is for $100 or $1 million, the satisfaction of these clients is our goal, and each supports NIAR’s continued growth and success.

AAI Acquisitions Inc.
AAR Composites
Adam Aircraft Industries
Advanced Composites Group
Aero Instruments, Inc.
Aero-Mach Labs, Inc.
Aerospace Systems & Components, Inc.
Airbus North America Engineering, Inc.
AMETEK Advanced Industries
ARCCA Inc.
Arizona Paradrope Systems Aviation Consulting & Engineering Solutions Inc.
B/E Aerospace
Bernd Group
Big Dog Motorcycles
Boeing Company
Bombardier Aerospace
Burnham Composites, Inc.
Cessna Aircraft Company
CG Tech
Cirrus Design Corp.
Composites Universal Group
CSI Aerospace, Inc
Dassault Falcon Jet Corp.
DIAB Inc.
D-J Engineering, Inc.
Eclipse Aviation
Electromech Technologies Engineering.com
Epic Air, LLC
Fiber Dynamics, Inc.
Federal Aviation Administration
Flint Hills Solutions, LLC
Garmin International, Ltd.
GKN Aerospace Service
Goodrich Aircraft Interior Products
GSS LLC
Harper Trucks, Inc.
Hawker Beechcraft Corporation
Hexcel Corporation
ISOLAIR, Inc.
J B Dwerlkotte Associates
Liberty Aerospace
Lockheed Martin Corp.
Maintenance Group Inc.
Mansberger Aircraft Inc.
Mid Continent Controls, Inc.
Millennium Concepts, Inc.
MILTEC Corporation
MSC Software
MTS Systems
Neltec
Newport Adhesives and Composites, Inc.
Nordam Group
OMA SUD Sky Technologies
Park Advanced Composite Material Inc. (Nelcote)
Park Electrochemical Corp.
Pepin Associates, Inc.
Phantom Hill Productions
PlasticFab
Polaris Industries, Inc.
Quickie Tie-Down Enterprises
Radiance Technologies
RECARO Aircraft Seating Inc.
Rocky Mountain Composites
Scaled Composites, LLC
Sedgwick County Workforce Development
Senior Aerospace Composites
Sikorsky Aircraft
Specialty Materials Inc.
Spirit AeroSystems Inc.
Supervan Systems Ltd.
TDA Research Inc.
TENCATE Advanced Composites Inc.
Thermoid HBD
Toho Tenax of America
Toyota Motor Sales, USA, Inc.
Triumph Aerospace Systems
V5 Engineering, Inc.
Vectorply
Vought Aircraft Industries Inc.
Web Industries Atlanta Inc.
The Advanced Joining & Processing Laboratory brings together the knowledge and expertise necessary to identify and address needs in friction stir welding, friction stir processing and friction stir spot welding. The team provides strong knowledge, expertise and experience to handle challenges from concept through production implementation.

Year Established: 2004

Full-Time Employees: 3  Part-Time Employees: 14

Representative Clients:

Representative Projects:
• Path Independence of Friction Stir Welding
• Design Data for In-Situ Integral Fasteners
• Laser Peening of Friction Stir Welded Structure
• Member projects for the NSF Center for Friction Stir Processing
• Other proprietary client projects

Capabilities:
• Multiple joint configurations including butt and lab joints
• Joining of all aluminum alloys in thicknesses ranging from 0.020 in. to greater than 1 in.
• Joining and processing high-temperature metals such as nickel-aluminum-bronze, steel, and titanium
• Prototype development and pilot production
• Weld paths ranging from simple (1D) to complex curvature (3D) up to 10 feet in length
• Material and structural testing and analysis of structures
• Multi-axis FSW research and development
• Self-reacting and retractable pin
• Corrosion testing
• Automatic microhardness testing/mapping
• Metallography, mechanical testing and analysis
• Friction stir spot welding

Equipment:
• MTS ISTIR PDS 5-axis motion, 7-axis force monitoring friction stir welding machine, 120-inch x 40-inch x 25-inch work envelope
• ABB IRB 7600-500 robot (on order)
• Two MTS 22-kip load frames
• Leco AMH-53 automatic microhardness tester
• Microscopes with digital imaging
• Metallographic sample prep lab

www.niar.wichita.edu/advancedjoining
The Aerodynamics Laboratory consists of a flow visualization water tunnel and the premier Walter H. Beech Memorial Wind Tunnel. The lab also has access to WSU’s 3x4 foot subsonic wind tunnel and two supersonic wind tunnels. These facilities are used primarily for aviation-related testing, but test many other types of items throughout the year as well.

Year Established: 1948

Full-Time Employees: 2  Part-Time Employees: 4

Representative Clients:
Local aircraft industry, WSU grant research, small aviation businesses, antenna manufacturers, motor-sports equipment manufacturers

Capabilities & Equipment:
7 x 10 foot subsonic Walter H. Beech Memorial Wind Tunnel
- 240 mph air speed max
- External and internal balances for force and moment testing
- 296 pressure channels
- Sting system with automatic roll head
- Flow visualization with 3 watt laser sheet, smoke, tufts, china clay
- Digital video and still cameras

2 x 3 foot flow visualization water tunnel
- Five (5) color dye injection flow visualization
- Digital video and still cameras

www.aero-labs.org
The Aging Aircraft Laboratory supports the federal government and the aviation industry with investigation into the effects of age on commercial and military aircraft.

Year Established: 2002

Full-Time Employees: 7 Part-Time Employees: 6

Representative Clients:
Federal Aviation Administration, Department of Defense, Lockheed Martin, Boeing Company

Representative Projects:
- KC135 wing disassembly
- C-5A aft fuselage panel
- KC135 teardown examination
- C-5A aft crown skin testing, inspection and analysis
- F-16 STH teardown examination
- A-10 BHEC specimen generation
- B-52 landing gear and flight control teardown and inspection
- FAA Metallurgical/ Fractographic Evaluation of Structural Components

Equipment:
- 21-cubic ft. dry blast paint stripping booth for removal of organic coatings
- Magnaflux L-10 coil
- Parker Research AC/DC yoke
- Liquid penetrant inspection system
- Magneto optic imaging (MOI) system
- Staveley workstation
- Nortec 2000S eddy scope
- Sonic 1200 ultrasonic unit
- Meiji Inc 7-45x optical microscope
- Hirox Co. 50-300x optical microscope
- Rene Co. digital optical micromete
- Joel scanning electron microscope
- Chemical coating removal facility

www.niar.wichita.edu/agingaircraft
The CAD/CAM Laboratory teaches CATIA V5 and related products in an education and training environment to local, regional, and national customers.

Year Established: 1985

Full-Time Employees: 12    Part-Time Employees: 16

Representative Clients:
Boeing, Spirit AeroSystems, Cessna Aircraft, Hawker Beechcraft, Bombardier/Learjet, Bombardier/Light Rail Vehicles

Equipment:
60 PCs ranging from 32bit to 64bit, from dual processors to quad processors

Courses offered:
• CATIA Basic Concepts
• CATIA Part Design & Sketcher
• CATIA Assembly Design
• CATIA Drafting
• CATIA Wireframe & Surfaces
• CATIA Prismatic Machining
• CATIA Surface Machining
• CATIA Fitting Simulation & Kinematics
• CATIA Functional Tolerancing & Annotation
• CATIA Stress Analysis
• CATIA Knowledgeware
• CATIA Sheet Metal Design
• CATIA Electrical Space Reservation
• CATIA Electrical Design
• CATIA Electrical Harness Design
• ENOVIA DMU Viewer
• ENOVIA VPLM Basic Concepts
• ENOVIA VPLM Advanced Concepts
• ENOVIA VPLM Product Design
• ENOVIA VPLM VPM Navigator
• Maya

Courses in development:
• CATIA Composites
• CATIA Tubing and Piping
• CATIA Advanced Machining
• CATIA 2D/3D Layout
• CATIA Ergonomics

Partnerships:
• Dassault Systemes
• V5 Engineering
• Technigraphics
• MSC
• CGTech Vericut
• ICAM

www.cadcamlab.org

Shawn Ehrstein
Director
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shawn@cadcamlab.org

Brian Brown
Associate Director
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The Calibration & Quality Laboratory is an internal lab, primarily serving NIAR laboratories. The lab’s focus is two-fold: 1) calibration of MTS load frames and other equipment used in NIAR’s laboratories and 2) calibration of anthropomorphic test dummies used for seat testing in the Crash Dynamics Lab.

Year Established: 2006

Full-Time Employees: 2

Representative Clients:
NIAR Laboratories: Advanced Joining & Processing, Composites & Advanced Materials, Fatigue & Fracture, Structures, Full-Scale Structural Testing, Environmental Testing

Representative Projects:
In addition to the lab’s daily responsibility of quality assurance for NIAR laboratories, the Calibration & Quality Lab has been in charge of the installation and calibration of load frames and additional equipment in NIAR’s new structural testing annex.

Equipment:
- Tovey 11-kip frame for ASTM E-74 force calibrations
- Tovey 110-kip frame for ASTM E-74 force calibrations
- Tovey portable system for ASTM E-4 force calibration of load frames
- Boeckeler Model 1338 digital micrometer for ASTM E-83 calibration of extensometers
- Boeckeler Model DLG-310 digital linear gage for calibration of load frame LVDTs
- Fluke 5520A/6 multi-product calibrator, with METCAL & MET/tracking software
- G.E. hydraulic deadweight tester – 200 to 20,000 psi
- Starrett HE400 optical comparator

www.niar.wichita.edu/calibration

Walter Lee
Director
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Researchers and technicians in the Composites and Advanced Materials Laboratory perform lay-up and bonding operations to understand the effects of heat, moisture, contamination and repairs on advanced materials. The lab also provides regularly scheduled hands-on training workshops in composites topics and supports the academic programs of the WSU College of Engineering.

Full-Time Employees: 51  Part-Time Employees: 77

Representative Clients:
Boeing, Cessna, Hawker Beechcraft, Lockheed Martin, Adam Aircraft, Bombardier/Learjet, NASA, FAA

Representative Projects:
• Bonded Repair of Composite Airframe Laminate and Sandwich Structures
• Adhesive Joint Characterization and Standards
• Effects of Defects and NDI Standards
• Material Qualification and Equivalency
• Industry-Directed Special Projects and Element Allowables

Equipment:
• 7,420 sq. ft. laboratory
• Autoclave (3’ x 5’, 1000 degrees F, 400 psi)
• 5 environmental chambers for temperature and humidity conditioning
• Dynamic mechanical analysis units
• Differential scanning calorimetry
• Thermogravimetric analyzer
• Optical microscope with video analysis
• Stereoscope x350 with hand-held inspection unit
• Filament winding machine (4-axis)
• Programmable walk-in oven (8’ L x 5.5’ W x 6’ H, 500 degrees F)
• Programmable oven (4’ L x 3’ W x 6’ H, 500 degrees F)
• Ultrasonic NDI unit to perform pulse and echo and TTU scans with curved panel capability
• RTM resin pumps
• Walk-in freezers (-20 degrees F)
• Lay-up room
• Machine shop specialized for composite material processing
• Instron Dynatup 8250 with environmental chamber
• X-ray diffractometer
• Coordinate measuring machine
• Pheonix 4000 scanning electron microscope and energy dispersive system
• Fully-automated specimen polisher and grinders

www.niar.wichita.edu/composites
The Computational Mechanics Laboratory personnel have access to two high-performance computing centers within the WSU network. Research is focused on the development and application of numerical methods in the areas of crashworthiness, injury biomechanics, aircraft structures, numerical optimization techniques and virtual product development.

**Full-Time Employees:** 3  **Part-Time Employees:** 14

**Representative Projects:**
- Mass Transit Bus Crashworthiness - Federal Transit Administration
- Certification by Analysis of Aircraft Interiors - FAA
- Development of HII ATD FEA Model
- Virtual Development and Certification of Aircraft Interiors - N-I-S
- Bird Strike Analysis for Aerospace Applications
- Biomechanical Design Parameter Study for Overhead Projection Units

**Equipment:**
- 5 HP xw9300 workstations with 4x Opteron 280 2.39 GHz processors, 4-6 GB RAM and 230 GB hard disk, O.S. Windows XP 64 bit
- 5 HP xw8400 workstations with 8x Xeon X5355 2.66GHz processors, 16 GB RAM and 230 GB hard disk, O.S. Windows XP 64 bit
- 6 Dell Precision 650 with 2x Intel Xeon 2.80 GHz processors, 2GB RAM and 230 GB hard disk, O.S. Windows XP
- 11 Dell Precision 650 with 2x Intel Xeon 3.06 GHz processors, 2GB RAM and 230 GB hard disk, O.S. Windows XP
- 12 Node Dell Cluster with a total of 24 processors, 24 GB RAM
- 3 Hewlett Packard J5600 Visualize Unix workstations
- 2 HP ZX6000 Itanium2 Unix workstations

www.niar.wichita.edu/compmech
The Crash Dynamics Laboratory is a premier dynamic testing facility providing research, testing and certification of aircraft and non-aviation components under dynamic impact (simulated crash) conditions.

Year Established: 1992

Full-Time Employees: 4  Part-Time Employees: 4

Representative Clients:
Aircraft seat manufacturers, automotive and military vehicle seat manufacturers, internal funded research, crash research centers

Facilities & Equipment:
- MTS crash simulator model 888.20 with computer controlled, servo-hydraulic accelerator sled
- SpeedCAM VISARIO high resolution color camera (1000 frames/sec, on-board, off-board)
- Kodak Ektapro 1000 HRC (1000 frames/sec, off-board, color)
- Kodak Ektapro 1000 EM 1000 (1000 frames/sec, on-board)
- DSP Technology VX2850B (transient and signal acquisition/processing system)
- DSP Technology IMPAX-SD© Version 6.0 data collection control and processing software
- ACCEL© pulse evaluation software, WSU 1998
- HSV© high speed video viewer, WSU 1996

Anthropomorphic Test Dummies:
- 50th percentile male, 49 CFR 572
- 50th percentile male, H-III50M (model 78051-218-R99) 49 CFR 572
- 50th percentile male, FAA-H-III50M (model FAA-H3-M001)
- 5th percentile male, H-III95M (model 880995-000), EuroSID-2 (model 455-0000)
- CRABI 12-month child, 49 CFR 572
- HIII 3-year-old child, 49 CFR 572
- HIII 6-year-old child, 49 CFR 572
- HIII 5th percentile female, 49 CFR 572

Representative Projects:
- Mass Transit Bus Crashworthiness
- Biomechanical Design Parameter Study for Overhead Projection Units
- Certification by Analysis
- Performance Evaluation of Child Seats in Lateral Sled Tests at Varying Seepds - NSF

www.crashstudies.org
The Environmental Testing Laboratory provides the aviation industry locally, nationally and internationally with the technical requirements needed to meet environmental standards requested by Federal Aviation Administration technical standard orders using RTCA/DO-160 as a reference.

Year Established: 2006

Full-Time Employees: 3

Representative Clients:

Equipment:
- 4 shielded enclosures:
  - 20ft x 20ft anechoic chamber
  - 25ft x 17ft reverb chamber
  - 10ft x 12ft control room
  - 13ft x 8ft amplifier room
- 12,000 lb. shaker table
- Indirect lightning system with observation room
- 40kW AC/DC power input test system
- Temperature/humidity/altitude chamber (capability up to 100,000 ft)
- Fungus chambers
- Salt fog chamber

Capabilities:
RTCA/DO-160 certification for:
- Section 4 Temperature & Altitude (excluding Decompression and Overpressure Test)
- Section 5 Temperature Variation
- Section 6 Humidity
- Section 7 Operational Shock
- Section 8 Vibration
- Section 9 Explosive Atmosphere (scheduled for early 2009)
- Section 10 Waterproofness (scheduled for December 2008)
- Section 11 Fluids Susceptibility (scheduled for early 2009)
- Section 12 Sand & Dust (scheduled for early 2009)
- Section 13 Fungus Resistance (TBD)
- Section 14 Salt Fog
- Section 15 Magnetic Effect
- Section 16 Power Input
- Section 17 Voltage Spike
- Section 18 Audio Frequency Conducted Susceptibility – Power Input
- Section 19 Induced Signal Susceptibility
- Section 20 Radio Frequency Susceptibility
- Section 21 Emission of Radio Frequency Energy
- Section 22 Lightning Induced Transient Susceptibility
- Section 23 Lightning Direct Effects (TBD)
- Section 24 Icing (TBD)
- Section 25 Electrostatic Discharge ESD
- Section 26 Fire, Flammability (TBD)

www.niar.wichita.edu/environmental
The Fatigue and Fracture Laboratory conducts static and fatigue experiments to generate material strength allowables and evaluates the endurance of materials subjected to cyclic loading. The laboratory supports both metal and composite testing and research funded by various government agencies and airframe manufacturers.

Year Established: 2003

Full-Time Employees: 8 Part-Time Employees: 22

Representative Clients:

Facilities & Equipment:
- MTS TestStar IIIm test controllers and MTS Flextest GT test controllers with multi-channel data acquisition capabilities
- 55 kip servo-hydraulic MTS load units
- 5.5 kip servo-hydraulic MTS load units
- 22 kip servo-hydraulic MTS load units
- Several channels of fractomat, clip gages and stereoscopes to monitor fatigue crack growth
- Uniaxial and biaxial extensometers to measure strains
- ARAMIS photogrammetry system, a non-contact optical 3D deformation measuring system to characterize displacements and strains in components
- Environmental chambers to conduct static and fatigue testing in temperatures ranging from -200 F to 600 F

Representative Projects:
- Bonded Repair of Composite Laminate and Sandwich Structures
- Aging of Composite Airframe Structures: Aging Effects Evaluation of a Decommissioned B737 Horizontal Stabilizer
- Aging of Composite Airframe Structures: Beechcraft Starship Teardown Evaluation
- Data and Methodologies for Structural Life Evaluation of Small Airplanes
- Stress Concentration Investigation Under Fatigue Loading
- Mechanical Strength Testing of Graphite Epoxy Laminates with a Modified Cure Cycle
- Material Qualification of Stretched and Unstretched Graphite Epoxy Discontinuous Fibers
- NDI Bondline Evaluation of Repaired Graphite Epoxy Laminates Using Autoclave and an Alternate Compaction Method
- Cargo Barrier Flexural Properties
- Fatigue of Graphite Epoxy Composite Sandwich Coupons
- Effects of Defects on the Performance of Graphite-Epoxy Laminates
- Effects of Defects Testing: Composite Skin Gouge Allowable Damage Limit Screening Tests
- Fatigue and Residual Strength of Bolted Metal/Composite Joints for Structural Repair
- Aluminum 2024 and 7050 Crack Retardation Parameters
- Dynamic Properties of Seat Cushions
- Blind Fastener Usage in Composite Structures

www.niar.wichita.edu/fatigue

Lamia Salah
Program Manager
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The Full-Scale Structural Testing Laboratory supports the government and aviation industry with the assessment of structural performance and durability of commercial and military aircraft by performing full-scale structural testing and research activities.

Year Established: 2004

Full-Time Employees: 19    Part-Time Employees: 5

Representative Clients:
Department of Defense, Boeing, Spirit AeroSystems, Lockheed Martin, Sikorsky Aircraft, Hawker Beechcraft, Radiance Technology, MILTEC Research and Technology

Representative Projects:
NDE reliability tools, control surface testing, C5 aft fuselage panel, Hawker Horizon certification testing, Boeing wing development testing, numerous structural health monitoring research projects

Capabilities:
- Full-scale and component testing (static, durability and damage tolerance)
- Pressure cyclic testing
- Hail strike testing
- Material testing
- Tireburst/explosive effects testing

Equipment:
- 4 load control systems with 280 channels that can be used on 13 separate load stations
- 14 data acquisition systems that can record over 2,500 channels of data
- Secured data ports for customer data transfer
- CATIA V5 capabilities
- More than 420 hydraulic cylinders starting at 1” bore up to 6” bore
- Approximately 400 servo valves ranging from 1 gpm to 10 gpm
- 1,200 gallon hydraulic reservoir with four each 60 gpm pumps for supplying hydraulic fluid throughout the test floor variable to 3,000 psi
- 500 load cells ranging from 50 lbs. - 200,000 lbs.
- 4 load frames with stroke and load control that can be used for material and component testing up to 200,000 lbs.
- Five large durability test base fixtures for rapid development of durability test setup for aircraft up through business size jets
- Pressure control equipment for fuselage cyclic and static pressure testing that includes both a 6” shop air supply from the local plant and a stand-alone 655 cubic foot per minute 125 hp air compressor
- Hail gun
- Both TIG and arch welding capability for test fixtures
- Lathe, milling machine, plasma cutter and various large saws for support of test setups
- Forklifts – 2 each capable of lifting 3,000 lbs. and one capable of lifting 10,000 lbs.
- Broderson crane capable of lifting approximately 12,000 lbs.
- 45 ft. man lifts with articulating booms

www.niar.wichita.edu/fullscale

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The Human Factors Laboratory provides research and expert knowledge in aerospace psychology, cognitive psychology, human factors and human-computer interaction.

Year Established: 1990

Full-Time Employees: 3 Part-Time Employees: 2

Representative Clients:

Courses Offered: Aerospace Psychology

Projects:
• Identification of Sources of Variability and Human Error During Bolt Hole Eddy Current Inspection
• Human Factors Evaluation of Input Devices and Interface for the TRC Remotely Operated Weapons System
• Human Factors Evaluation of UAV Operator Stations
• Human Factors Evaluation of an Immersive Medical Environment

Capabilities:
• CATIA-based ergonomic and anthropometric evaluations
• Interface design and evaluation
• Assessment of cognitive and physical workload
• Computational modeling of human performance
• Use of state-of-the-art FAA- and JAA-approved full-flight simulators for aviation projects

Equipment:
Eye Tracking, CATIA V5 (commercial version) with Human Builder and Kinematics

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The Research Machine Shop exists to support research at NIAR, WSU and within the aviation industry. The staff’s intimate knowledge of the wind tunnels and other research tools greatly increases the shop’s value and efficiency.

Year Established: 1944

Full-Time Employees: 4

Representative Clients:
Nordam Transparency Division, Cessna, Spirit AeroSystems, NIAR laboratories, WSU College of Engineering

Projects:
• Friction stir welding research support
• Beech Wind Tunnel upgrades and support for several tests
• Crash Dynamics Lab upgrades and support for several tests
• Composites Lab tooling and specimens
• Fatigue and Fracture Lab tooling and specimens
• Nordam Transparency Division tooling and specimens
• Aircraft icing research project support

Facilities & Equipment:
• 5,000 sq. ft. of shop space
• Mastercam X3 software
• CATIA V5 R18 software
• HAAS VF-2 four-axis VMC 30” x 16” x 20” travel
• HAAS VF-4 five-axis VMC 50” x 20” x 25” travel
• FADAL VMC 8030, 80” x 30” x 30” travel
• BostoMatic 1000, five-axis CNC, 40” x 17” x 17” travel
• HAAS 12” rotary table
• HAAS 9” rotary table
• Grey planer mill 96” x 30” x 30” with Bridgeport mill head
• K& T #2 rotary head die mill
• K&T K4 horizontal with Bridgeport vertical head accessory
• Tree 2UVR vertical milling machine
• Hardinge high-speed tool room lathe
• Colchester 15” x 50” lathe with tracer
• South Bend 24” x 100” lathe with tracer
• Thompson surface grinder 12” x 36”
• Wood working machines, cabinet and pattern capabilities
• Welding; mig, stick arc and oxy-acetylene
• Hawkeye borescope with Sony video camera/capture

www.niar.wichita.edu/shop
The Structures Laboratory provides the highest standards in material and structural testing for the aviation industry and government-funded research projects.

Full-Time Employees: 16  Part-Time Employees: 27

Representative Clients:
Hawker Beechcraft, Sikorsky Aircraft, Lockheed Martin, Spirit AeroSystems, Boeing, Cessna, GKN, Hexcel, Rocky Mountain Composites, Nelcote, Toyota, Advanced Composites Group

Representative Projects:
- Scale effects compression after impact room temperature and elevated temperature testing
- Off-axis core shear properties of honeycomb core plate shear testing
- Equivalency testing
- Adhesive, foam core, sandwich and composites qualification
- Static, fatigue and fluid resistance testing on thermoformable thermoplastic and RTM toughened matrix epoxy
- ARAMIS photogrammetry testing of a tank under negative pressure
- Compression after impact testing to determine environmental knockdown effects

Capabilities & Equipment:
- Aluminum Secondary Modulus (Bearing)
- Damaged hole repair program
- Adhesive characterization – FM73 allowables, slow cycle fatigue, porosity and extended cure study
- Multiple 22, 55 and 110-kip load frames with environmental testing chambers
- Slow cycle fatigue machines
- 35-kip structural actuators
- Impact tower
- Laser extensometer
- MTS clip-on displacement gages
- Uniaxial and biaxial MTS extensometers
- MTS high temperature chamber (up to 2552° F) and high-temperature uniaxial extensometer
- Strain Smart (multichannel strain indicating software)
- Strain calibrators
- ARAMIS (offers 3D optical deformation and strain analysis)
- Istra (a highly sensitive, non-contact 3D electronic speckle pattern interferometry device to measure thermal expansion and full-field strains)
- 60,000 in-lb torsion test fixture
- 2x4 foot compression test fixture

www.niar.wichita.edu/structures
The Virtual Reality Center develops applied research and provides technical expertise in PLM/virtual reality and associated technologies for WSU, NIAR, aviation industry and non-aviation projects.

**Year Established:** 2002

**Full-Time Employees:** 1  **Part-Time Employees:** 1

**Representative Clients:**
General Atomics Aeronautical System Inc., NIAR Computational Mechanics Lab, NIAR Human Factors Lab, NIAR CAD/CAM Lab

**Representative Projects:**
- NIS Project 08-025: Virtual Aircraft Interior Development and Certification (in conjunction with NIAR Computational Mechanics Lab and CAD/CAM Lab)
- Human factors analysis for improved GCS display subsystem for GA-ASI UAV (developed with NIAR Human Factors Lab under sub-contract)
- Support for NIAR’s Computational Mechanics Lab involving real-time post-processing of several crash simulations from LS-DYNA/Madimo CAE database for projects at FTA and FAA
- Technology showcases presented for Hawker Beechcraft, Cessna, Spirit AeroSystems, Boeing IDS, Bombardier/Learjet, Airbus and others

**Capabilities for Real-Time Simulations:**
- Virtual prototyping and design review of conception and design databases originated in MCAD (mechanical computer-aided design) and in CAID (computer-aided industrial design) applications
- Digital engineering and scientific visualization of massive databases originated in CAE (computer aided engineering) applications for pre- and post-processing in analysis and aircraft certification
- Ergonomics and human factors: real-time anthropometrical analysis in first-person perspective for assembly, accessibility and training evaluations
- Digital manufacturing: real-time process plan and work cell simulation
- Customer service and marketing: real-time product customization and realistic demos for clients

**Equipment:**
- 1,800 sq. ft. visualization room with seating for 25
- 15 x 7 ft. flat screen with active stereoscopic view and rear projection
- Passive stereo head-mounted display with resolution of 1280x1024 at 60Hz and diagonal field-of-view of 60 degrees
- Optical motion capture with 10 high-speed cameras
- Extended range magnetic motion tracking for head, hands and wand
- Manipulation gloves
- Control system with wireless touch panel
- Advanced PC-based cluster and SGI Onyx300 (for legacy data)
- State-of-the-art digital simulation software including DS CATIA V5, DS 3DVIA Virtools, CEI Ensiteh Gold, EON Reality and PTC Division Reality

[www.niar.wichita.edu/vrc](http://www.niar.wichita.edu/vrc)
The Visual Technology Laboratory creates 3D models and animations for commercials, advertisements and promotions for WSU, NIAR and local businesses.

Full-Time Employees: 1

Representative Clients:
WSU Media Resource Center, WSU Athletics, NIAR CAD/CAM Laboratory

Representative Projects:
• Provide assistance for NIS Project 08-025: Virtual Aircraft Interior Development and Certification
• Produce sponsor animations for the 2007-2008 men’s basketball seasons (17 total animations)
• Produce animated elements for Kansas’ Best video for the WSU Media Resource Center
• Produce 15-second opening animation for a Council of Elders video for the Media Resource Center
• Write and lay out textbook for the CATIA PhotoStudio workbench
• Market PhotoStudio course and generate enrollment
• Design new CATIA/Enovia textbook cover designs for the CAD/CAM Laboratory
• Develop content for NIAR lobby plasma screen using Virtools

www.vistechlab.com

Bill Johnson
Manager
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The Aircraft Design & Manufacturing Research Center (ADMRC) was established in October 1995 as a state/industry/university partnership. Envisioned was a consortium of university and industry partners who, working together, would apply their collective expertise to address the technology needs of aircraft manufacturers and subcontractors.

ADMRC combines the talents and support of The Boeing Company, Bombardier/Learjet, Cessna Aircraft Company, Hawker Beechcraft, 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 members and researchers can focus on industry problems in Kansas.

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

**FY 2008 Projects:**

**Wichita State University**
- Thermal Spray Coatings for Composite Structures in Aviation
- Drilling of Composite Materials
- Correlation of Key Variables in the Composite Cure Process
- Application of Virtual Reality and Simulation for Assembly Planning and Costing
- Portable High Rotational Speed-Friction Stir Welding (HRS-FSW) Technology and Prototypes for Fabrication and “In Situ” Repairs

**University of Kansas**
- Analysis of IEEE 802.11a/b/g Protocol Robustness for Essential Data Applications
- Development of Adaptive Electrostrictive Nanocomposites for HIRF/EMI Protection and Elimination of Lightning Strike Across Fuel Panels Via Adaptive Impedance Composites
- The Development of a Vibration-Based Energy Harvesting System for Structural Health Monitoring Sensor Suites Utilizing Post-Buckled Precompressed Piezoelectric Elements

www.niar.wichita.edu/admrc
The **Center of Excellence for Composites and Advanced Materials** (CECAM) provides the nation with a center for the validation and quality assurance of composites and advanced materials to be applied in 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 forces.

CECAM is part of the FAA's Joint Advanced Materials and Structures Center of Excellence (JAMS) and focuses primarily on the safety and certification of emerging applications of composites and advanced materials in commercial transport aircraft.

CECAM 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.

The center’s objective is to 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.

**FY 2008 Projects**

**Wichita State University**
- Crashworthiness of Composites – Material Dynamic Properties
- Production Control Effect on Composite Material Quality and Stability
- Evaluation of Friction Stir Weld Process and Properties for Aircraft Application
- Aging of Composite Airframe Structures: Aging Effects Evaluation of a Boeing Decommissioned CRFP 737 Horizontal Stabilizer
- Aging of Composite Airframe Structures: Beechcraft Starship Teardown
- Damage Tolerance Testing and Analysis Protocols for Full-Scale Composite Airframe Structures under Repeated Loading
- Methods for the Evaluation of the Fitness of Fiber Reinforced Composite Surfaces for Subsequent Adhesive Bonding
- Effect of Repair Procedures Applied to Composite Aircraft Structures
- Technology Assessment of the Airworthiness of Unmanned Aerial Systems
- Certification by Analysis
- Full-Scale Damage Tolerance of Sandwich Structures
- Fluid Ingression Damage Mechanism in Composite Sandwich Structures
- Development and Safety Management of Composite Certification Guidance

**Purdue University**
- Damage Tolerance and Durability of Adhesively Bonded Composite Structures

**University of California – Los Angeles**
- Damage Tolerance and Durability of Fiber-Metal Laminates for Aircraft Structures
- Impact Damage Formation on Composite Aircraft Structures

**Northwestern University**
- Structural Health Monitoring for Life Management of Aircraft

**University of Delaware**
- VARTM Variability and Substantiation

**www.niar.wichita.edu/cecam**
Wichita State University is a research site for the National Science Foundation’s Center for Friction Stir Processing (CFSP). The CFSP is a multi-institutional Industry/University Cooperative Research Center started in October 2004. The center brings together the premier friction stir welding and processing academic institutions in the United States and focuses on addressing the needs of aerospace, aeronautic, energy, military and commercial industries in developing friction stir processing.

The center’s mission is to advance, develop and promote research into the principles and technology of Friction Stir Processing science and engineering through fundamental research, development, education and technology exchange among academic, industry and government entities. It is also the mission of the center to increase the quantity and quality of the professionals prepared to work in the area; to involve the faculty of the universities in research in areas of common interest to Sponsors and the universities; and to perform research which will allow global Friction Stir Processing facilities to be competitive in the world economy.

The WSU research site is headquartered in NIAR’s Advanced Joining & Processing Lab. In order to be a CFSP research site, Wichita State must maintain five industry and/or government sponsors that contribute at least $150,000 in yearly membership fees.

CFSP Research Sites:
- South Dakota School of Mines & Technology (headquarters)
- University of South Carolina
- Brigham Young University
- Missouri University of Science and Technology
- Wichita State University / National Institute for Aviation Research

WSU’s Industry/ Government Sponsors:
- Bombardier/Learjet
- Cessna Aircraft Company
- Embraer
- The Federal Aviation Administration
- General Motors
- Hawker Beechcraft
- Spirit AeroSystems

FY 2008 Projects:
- Performance Evaluation of Discontinuous Friction Stir Welding
- The Effect of Surface Treatments and Sealants on the Faying Surface of Friction Stir Spot Welds
- Magnesium Friction Stir Welding Casting/Extrusion Joint Evaluation
- Analysis of Friction Stir Welded Lap Weld Utilizing Friction Stir Welding Tool Software 2.0

www.niar.wichita.edu/cfsp
The mission of the FAA's Center of Excellence for General Aviation Research (CGAR) is 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.

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.

Founding universities include Wichita State University, Embry-Riddle Aeronautical University, the University of North Dakota and the University of Alaska. Florida A&M University and Middle Tennessee State University are affiliate members. 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.

FY 2008 Projects:
Wichita State University
- Enhanced Jet Exhaust Mixing to Reduce Jet Aircraft Engine Noise
- Detection and Prevention of Carbon Monoxide Exposure in General Aviation Aircraft
- Operation Loads Monitoring of Firefighting Airplanes

Embry-Riddle Aeronautical University
- Helicopter Terrain Awareness Warning System (TAWS) and Enhance Vision Systems (EVS)
- Evaluation of Training Course Variants for the “Qualification for Technically Advanced Aircraft”
- Wildlife Strike Database and Website Maintenance and Expansion of Graphics Applications to Web Search for General Aviation
- Joint Training Standards Development for New Technology GA Aircraft
- Conduct of Upset Recovery Flight Training for General Aviation Safety
- Training Standards Development for General Aviation Aircraft
- Technical Services for Databases and Websites
- Development of an Aviation Weather Database Highlighting Weather Encounters (Phase I)
- Establish a North American Bird Strike Advisory System (NABSAS)
- Evaluating the Effectiveness of ADS-B in the Collegiate Flight Training Environment
- Structural Usage Monitoring and Flight Regime Recognition Algorithm
- Gap Analysis/Risk Analysis for UAS Propulsion Systems
- Regulatory Gap Analysis for Detect, Sense and Avoid
- Command, Control and Communication for Unmanned Aircraft Systems

University of Alaska - Anchorage
- Remote Airport Lighting Systems (RALS)
- Visual Guidance-Remote Airfield Lighting

University of North Dakota
- Business Jet Loads Data Acquisition
- Evaluating the Effectiveness of ADS-B in the Collegiate Flight Training Environment
- Octane Enhancers from Crop Oils (Aviation-Grade Ethanol for Improved Performance and Safety in Civilian and Military Aircraft)
- Helicopter Advanced Navigation Research Flight Training
Stemmed from the NASA AGATE shared composite material property database program, the goal of the National Center for Advanced Materials Performance (NCAMP) is to take the composites industry to a self-regulating level similar to that achieved by the metals industry. This involves working with industry organizations such as:

- Composite Materials Handbook 17 on data archival;
- American Society for Testing and Materials D30 committee on composite test methods;
- Society of Automotive Engineers on aerospace material specification development;
- Performance Review Institute on product assessment and certification and
- Nadcap on audit criteria.

NCAMP aims at creating a framework covering material property data acquisition, qualification and property control that will be acceptable to the FAA and Department of Defense. The framework must be self-sustaining financially and technically, while being managed by the aforementioned nonprofit organizations with minimal FAA and Department of Defense oversight. This goal requires a strong level of support and participation from industry and government.

NCAMP is now jointly funded by NASA and the Air Force Research Laboratory. AFRL is funding NCAMP to generate material property data and qualify Renegade’s FreeForm-14 polyimide composite materials at conditions up to 500°F wet and 550°F dry. AFRL is also funding NCAMP to screen for compatible film adhesives for use in cocure and cobond applications with the prepregs undergoing NCAMP qualifications. Industry support also continued to grow. The list of industry-funded NCAMP qualifications now includes Newport 4708, Nelcote E752 and Tencate TC250.

The NASA-funded material qualifications and equivalencies are also moving along steadily. The qualification and equivalency testing is complete for the ACG MTM45-1 6781 glass and the ACG MTM45-1 G30-500 plain weave material. NCAMP is also currently testing the Hexcel 8552 IM7 qualification as well as the ACG 12K unidirectional material. The remaining Hexcel 8552 AS4 unidirectional and plain weave panels, as well as the Cytec 5215 and 5250-5 programs are in the FY09 NCAMP schedule.

Companies Fabricating Test Panels

- Gulfstream Aerospace
- Albany Engineered Composites
- ATK Space Systems
- Boeing Helicopters
- Scaled Composites
- Goodrich Aerostructures
- Bombardier Aerospace
- AAR Composites
- Cirrus Design Corporation
- Hawker Beechcraft
- Spirit AeroSystems, Inc.
- Cessna Aircraft Company
- Bell Helicopter Textron, Inc.
- Northrop Grumman Corporation
- General Atomics Aeronautical Systems, Inc.
- Lockheed Martin Aero
- Comtek Advanced Structures
- Quickstep Technologies
- Cytec Engineered Materials
- Burns Composites

To learn more about NCAMP, sign up for the e-bulletin by sending an e-mail to tracee.friess@wichita.edu.
The NIAR/Industry/State (NIS) research program was created by the Kansas State Legislature in 2004 to support the efforts of the Kansas aviation manufacturing industry to compete in the global 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, Hawker Beechcraft Corporation 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.

NIS received $4.75 million for the 2008 fiscal year to support 19 research projects.

FY 2008 Projects
- Repair of Composite Structures (Including Sandwich)
- Blind or One-Sided Fastener Usage in Composite Structures (Production and Repair Applications)
- Quiet Interiors Development
- Friction Stir Welding and Related Topics
- Potting Compound Strength/Density Enhancement
- Adhesive Joint Characterization and Testing
- Aviation Network Security
- Integrated Vehicle Health Monitoring Requirements Definition
- Composite Bearing Allowables Baseline
- Ground Anti-Ice Development
- Fuel Tank Inserting
- Virtual Reality Crashworthiness (Certification by Analysis)
- Electromagnetic Characterization of Composite Fuselages
- Metadata Enabled Thinking Systems Tools
- CATIA Workspace Enhancements Trade Study
- Microcracks in Composites
- Effects of Defects on Composites Materials (NDI Development)
- Engine Inlet Ice Protection System
- Influence of Environmental Knockdown Factors in Composite Design Structural Margins

www.niar.wichita.edu/nis
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 both entrepreneurs ready to start new businesses and owners of established businesses ready to grow.

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, winning government contracts, customer service and strategic planning.

Dr. Marcia 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. She received the 2006 State Star Award from the Kansas Small Business Development Center Network.

www.ksbdc.biz

Economic Impact of Wichita State Regional KSBDC CY 2007

<table>
<thead>
<tr>
<th>Category</th>
<th>Figures</th>
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</thead>
<tbody>
<tr>
<td>Clients served</td>
<td>542</td>
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<tr>
<td>Workshops offered</td>
<td>165</td>
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<td>Workshop attendees</td>
<td>1,704</td>
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<td>New businesses started</td>
<td>67</td>
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<tr>
<td>Full-time jobs created</td>
<td>208</td>
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<tr>
<td>Part-time jobs created</td>
<td>179</td>
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<tr>
<td>Full-time jobs retained</td>
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<tr>
<td>Part-time jobs retained</td>
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<tr>
<td>New sales generated</td>
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<tr>
<td>Economy investments</td>
<td>$3,760,000</td>
</tr>
<tr>
<td>Secured 122 loans</td>
<td>$17,580,000</td>
</tr>
</tbody>
</table>

WSU KSBDC CLIENTS

Sales growth 2006 - 2007: 40.6%
Sales growth KS business 2006 - 2007: 3.8%
WICHITA STATE UNIVERSITY

As the official home to the National Institute for Aviation Research, the campus of Wichita State University is the perfect setting to foster top-notch education, cutting-edge research and the people who make it happen.

WSU’s sprawling 330 acre campus, boasting one of the largest university sculpture collections in the nation, is located within the city of Wichita, Kansas, known as the “Air Capital of the World.” Each year almost 15,000 students from 48 states and more than 100 countries come to Wichita to study as Wichita State Shockers within the University’s six colleges.

In addition to its main campus, Wichita State features two full-service satellite facilities located throughout the city. And, as the state of Kansas’ only metropolitan university, WSU offers its students a virtually endless array of opportunities ranging from the availability of experts in practically every industry to one of the region’s largest cooperative education internship program.

All of this, combined with the people and expertise of NIAR, makes the WSU community one of true Thinkers, Doers, Movers & Shockers.
National Institute for Aviation Research
A Kansas Technology Enterprise Corporation
Center of Excellence

Wichita State University
1845 N. Fairmount
Wichita, KS 67260-0093
Tel: 316.978.6427
Fax: 316.978.3175

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:
Director, Office of Equal Employment Opportunity, Wichita State University,
1845 Fairmount, Wichita, Kansas, 67260-0145. 316.978.3371