Integrated Technologies, Inc.

UW-FAA Center of Excellence on Advanced Materials.

1-29-2004

Fabrication

Advanced Materials

Engineering **Machining** **Testing**

Outline

- **Background**
- **Capabilities**
- **Experience**
- **Vision**

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Background

Intec was formed in 1989.

Maryann Einarson	**- President**
Brian R. Coxon	**- Director of Engineering**
Robert C. LaMantea	**- Director of Sales & Marketing**
Rod Wishart	**- Operations Manager**

Client List (Selected)

Boeing (Hughes) Space & Communication
Allied Signal
Bell Helicopter
Boeing
Phillips Petroleum
Cytec
Rhone - Poulenc Chemical
Rockwell - Rocketdyne
E.I. DuPont de Nemours and Co.
Shell Development
Alenia (GEC) Marconi
Toray Composites America
General Electric
Hexcel
Aviation Partners
Teledesic
Lawrence Livermore Labs
Lockheed - Martin
Northrop - Grumman
Aviation Partners Inc.
Pratt & Whitney
K2
Furon
Rohr Industries
BF Goodrich-Tramco
TRW
Sea Launch
YLA Incorporated
3M
Honeywell

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Corporate Philosophy

Intec's goal is to maintain a "materials technology center" offering our clients the full range of services for development, evaluation, characterization and use of materials.

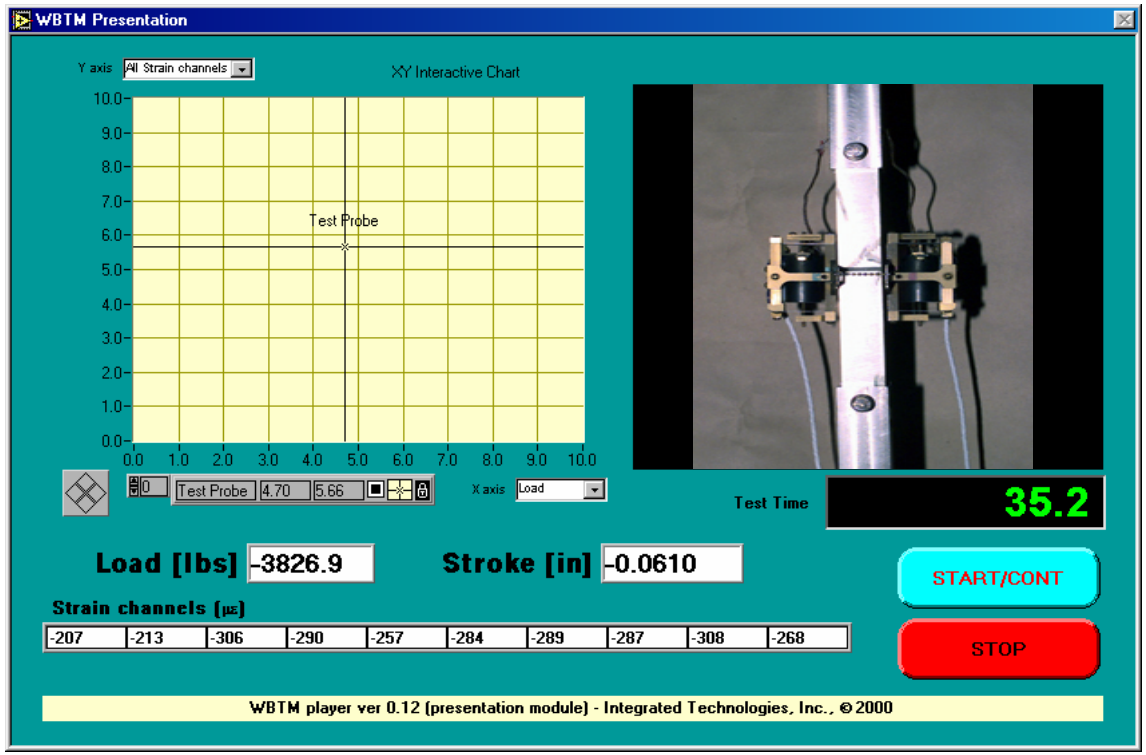
1) **Materials/Process Development**
2) **Materials Characterization**
3) **Component Design, Fabrication, Testing and Machining**
4) **Preliminary Design & Product Development**
5) **Consulting Services**

Capabilities

-Testing-

- **Automated static testing (tens, comp, shear, toughness, etc.)**
- **Fatigue, damage tolerance and crack growth**
- **Loads up to 2.5 million lbs. (data channels 400+)**
- **Environments (-400°F to 1,000°F, hydraulic grips to 600°F)**
- **High speed video, real time Moiré, photoelasticity**
- **Ultrasonic, microscopy and physical property laboratories**
- **Thermal analysis (DMA, TMA, DSC, CTE, CME)**
- **Load Floor – Strong Back**
- **Low and high velocity instrumented impact of large structural panels**

Web Based Monitoring Capabilities



WBTM uses a synchronized video/sound signal along with digital test data (load, stroke, & strain) to provide clear picture of the test and test data as it is occurring.

Selected Certifications

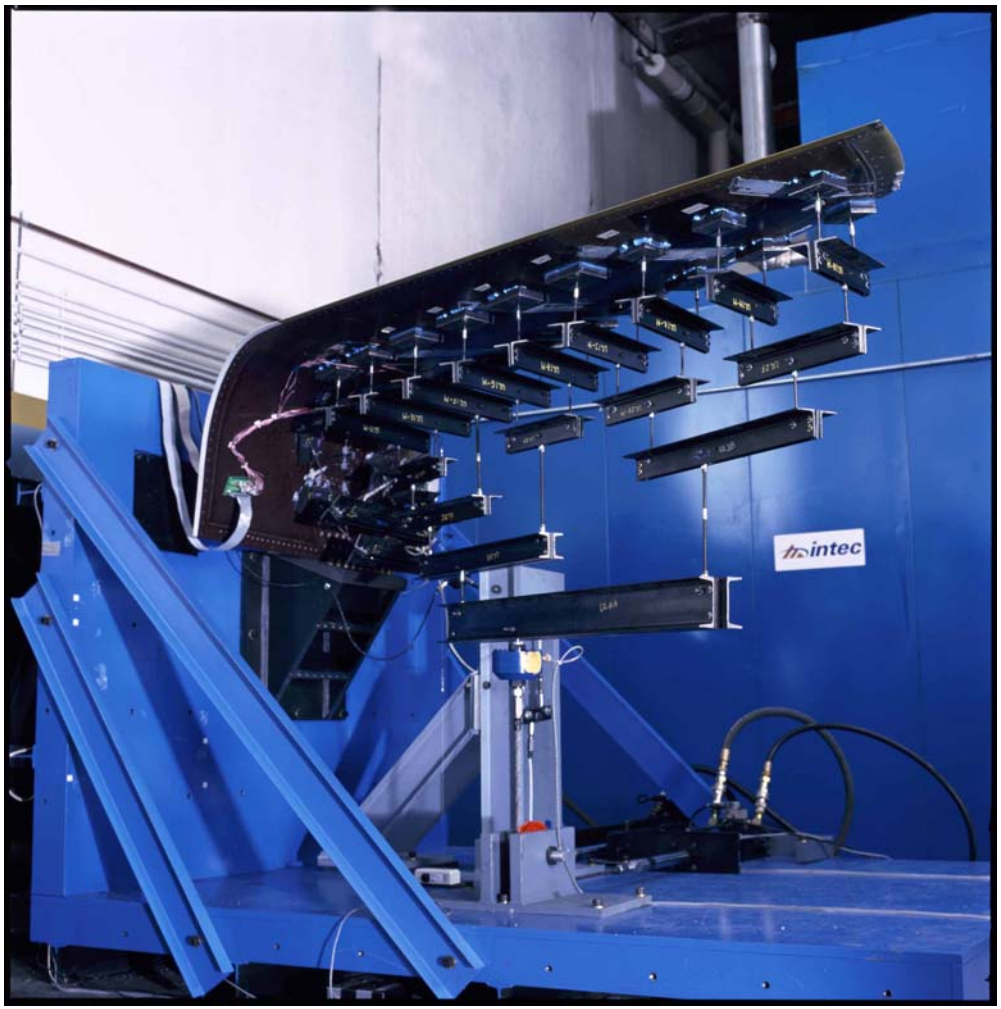
-Testing - Manufacturing

- **NADCAP Certification**
- **Boeing D1-4426 “CQS” Quality Standard**
- **USAF MTAPP**
- **CCR, Defense Logistics Agency**
- **EDC PTAC**
- **Sikorsky (Lab 9 Composites Testing Facility)**
- **Cessna Aircraft**

Intec maintains a high level of quality by proactive uses of our ISO 9001compliant quality systems Additionally, Intec conforms to the requirements of MIL-I-45208A as the sections apply to our facility. Intec maintains the highest level of calibration with reference to MIL-C-45662 and calibration is performed on a periodic basis.

Calibrations at Intec are performed to standards traceable to the National Institute of Standards and Technology (NIST).

737 BBJ Winglet Test Setup



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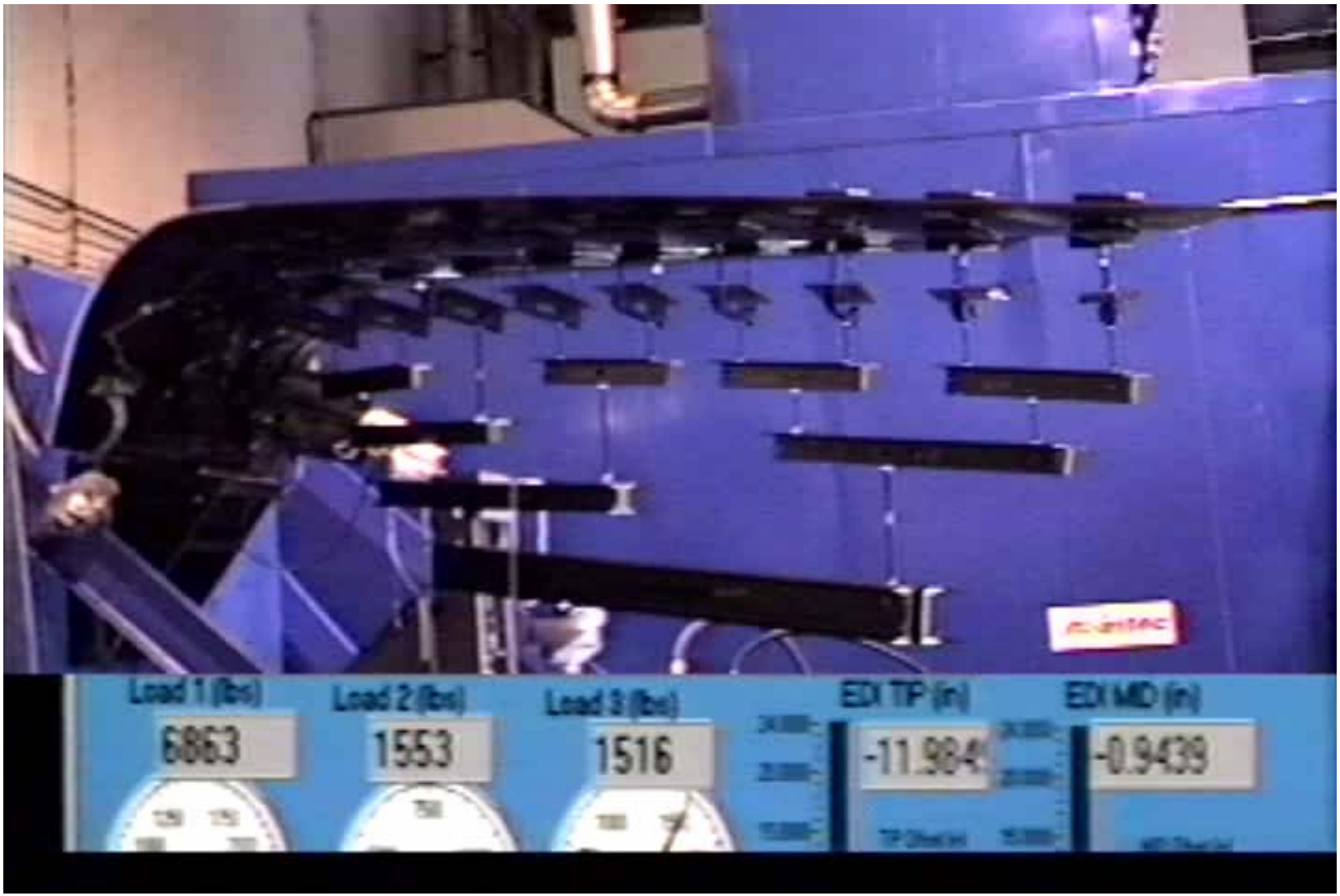
The certification tests for APB's 737-BBJ blended winglet.

Multiple actuators applied load through 3 wiffle trees with load pads to simulate aerodynamic loads.

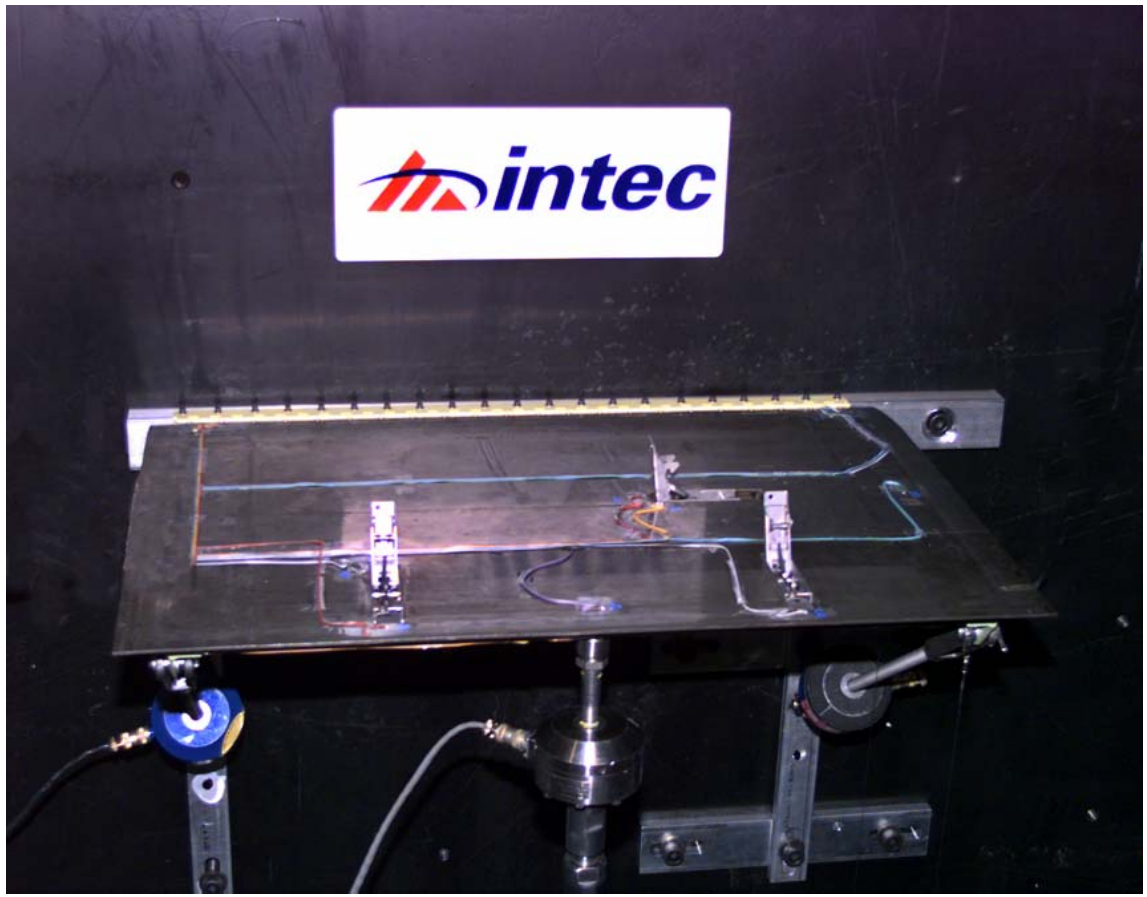
Reaction fixtures were designed for more than 500,000in-lbs bending moment with less than 0.02" overall deflection.

The specific aim of this test was to show compliance with FAR 25.305 (a)(b) and 25.307.

737 BBJ Winglet Test to Failure

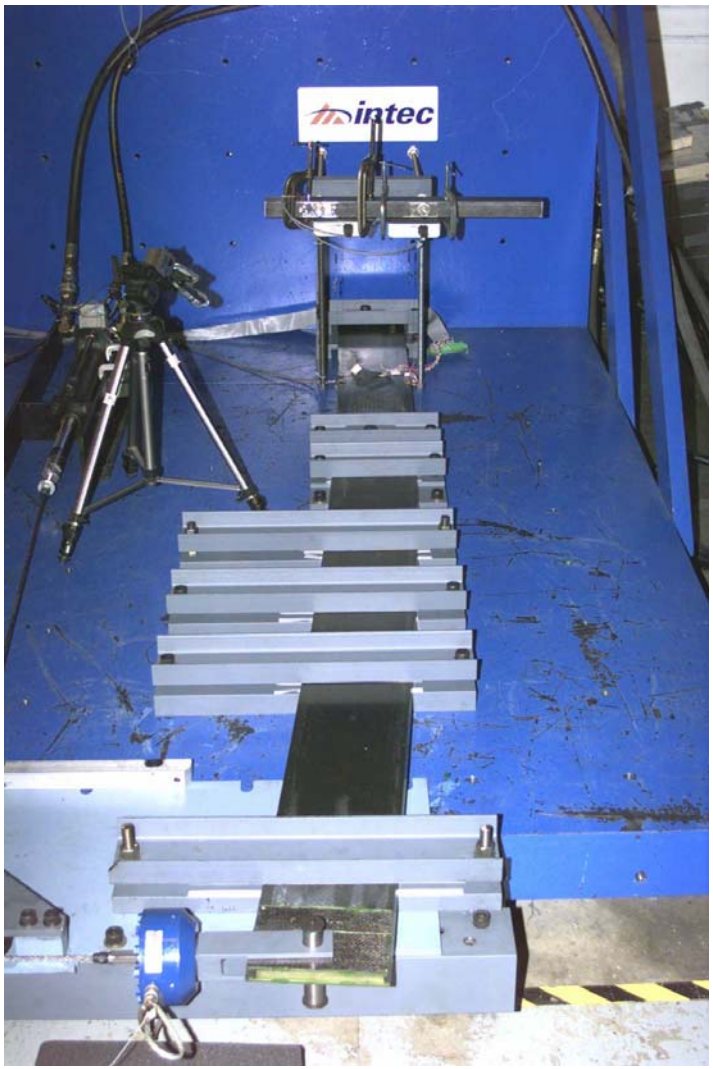


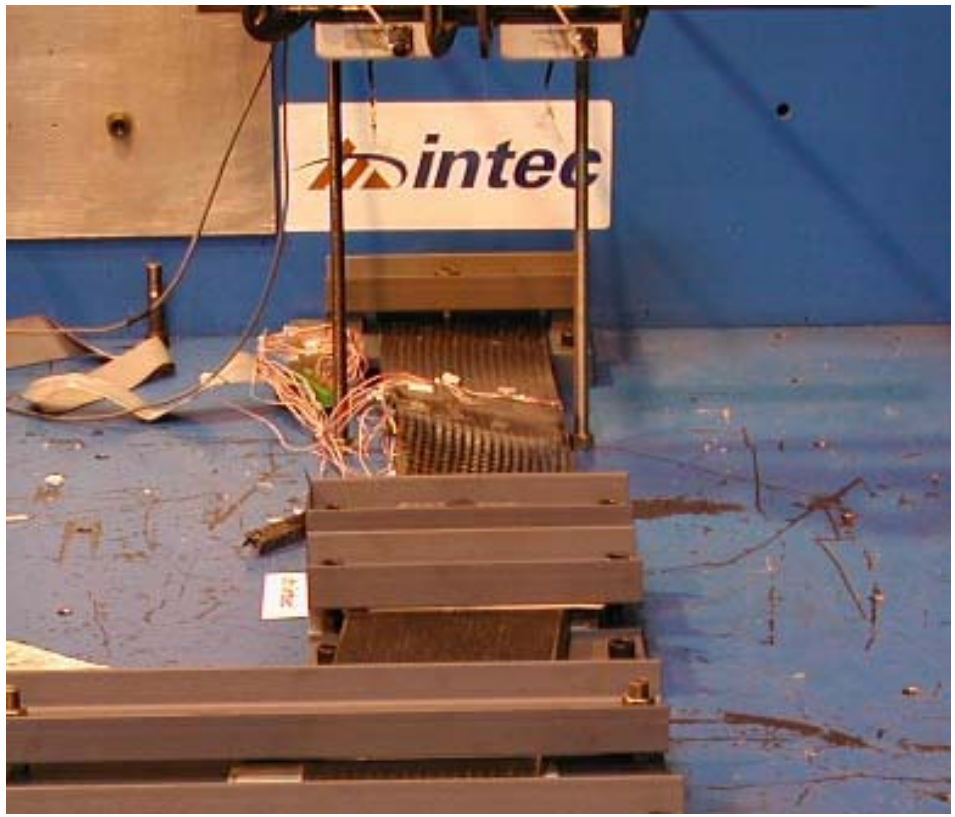
V-22 Tiger Door Test Setup



Intec has been pursuing the use of high-temperature graphite titanium sandwich structure as a lower cost, lower weight alternative to super plastic formed titanium structures in elevated temperature applications.

General Aviation Spar Test Setup





Close up of failure

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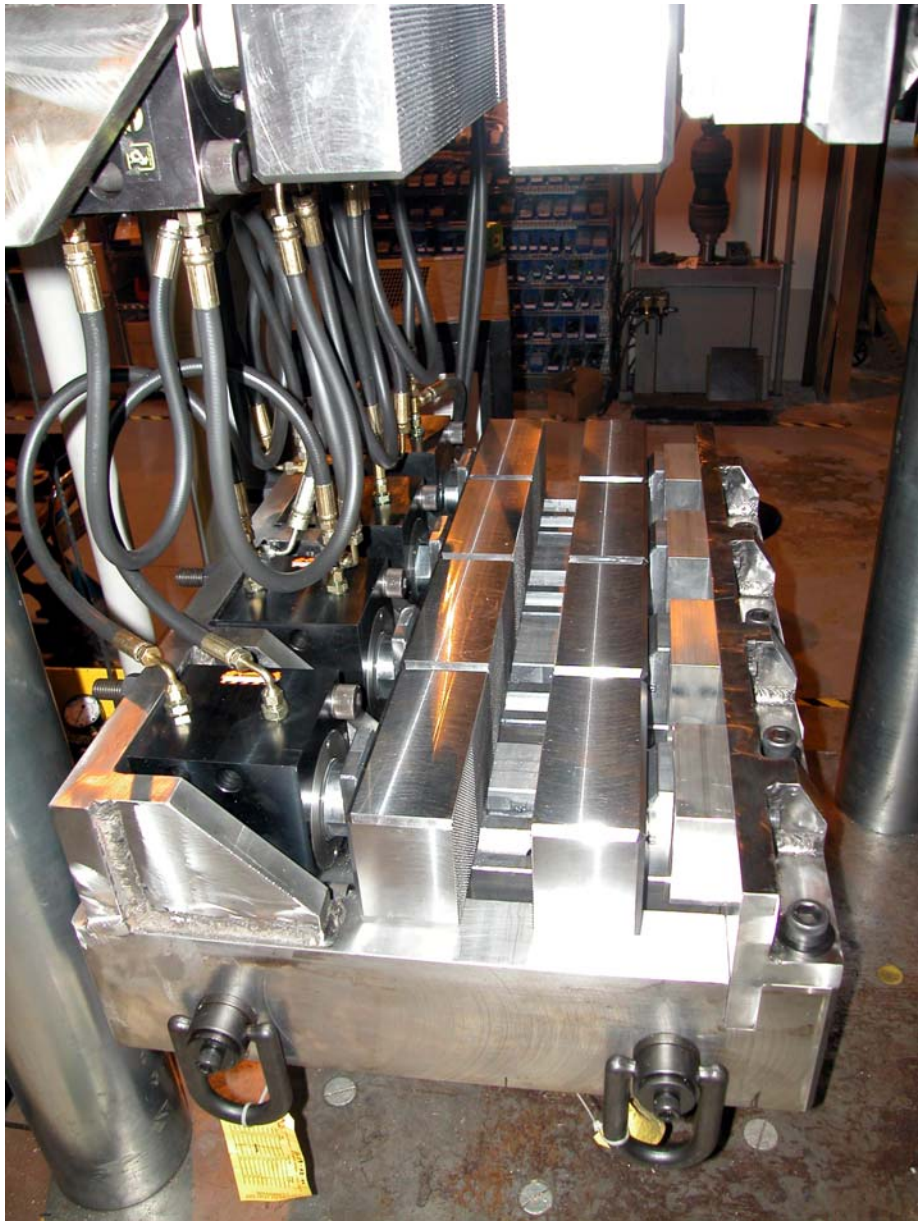
600 KIP Hydraulic Test Frame

Testing

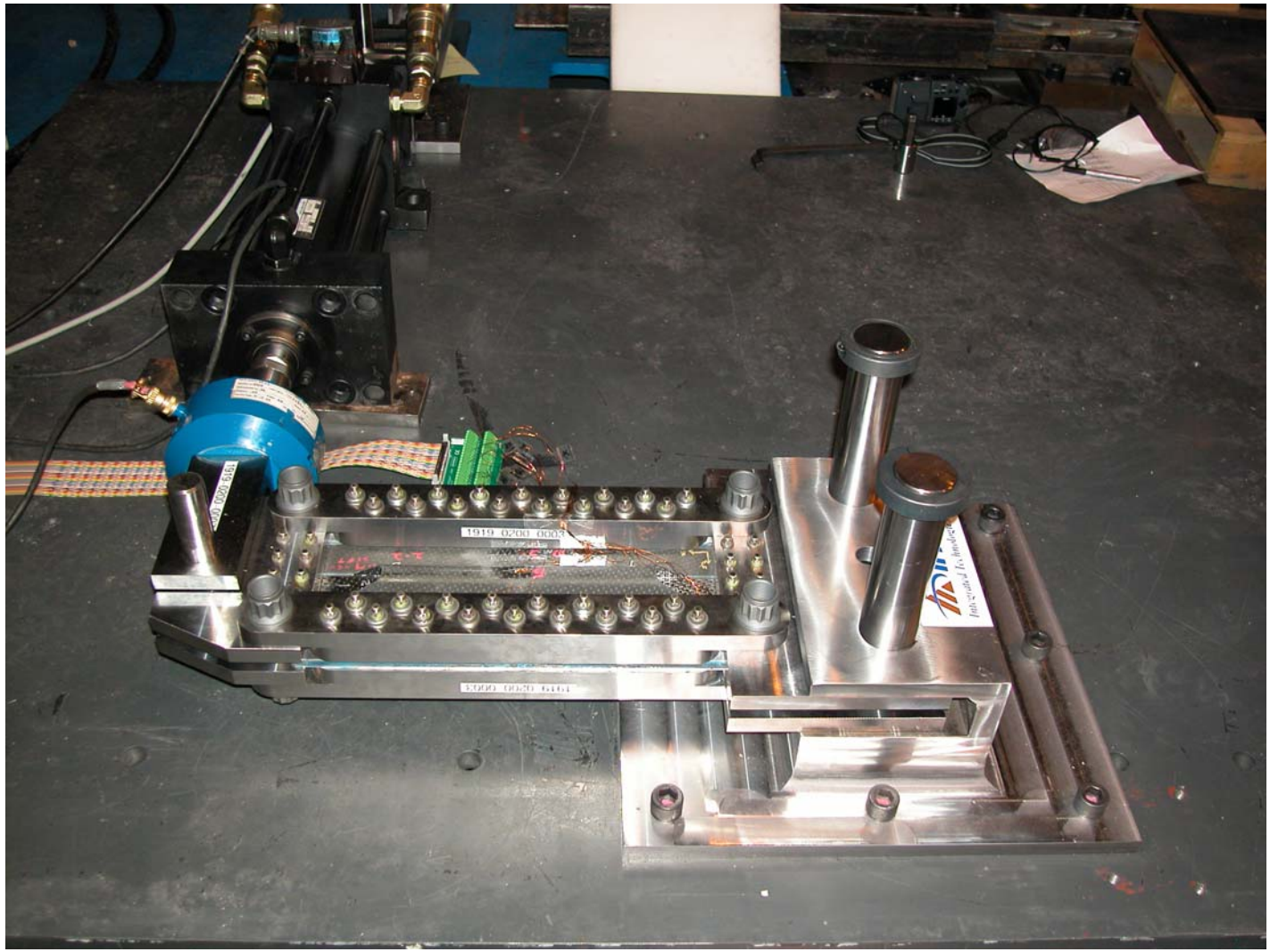
Hydraulic Test Frames

Specialized Fixturing

Specialized Fixturing



Specialized Fixturing

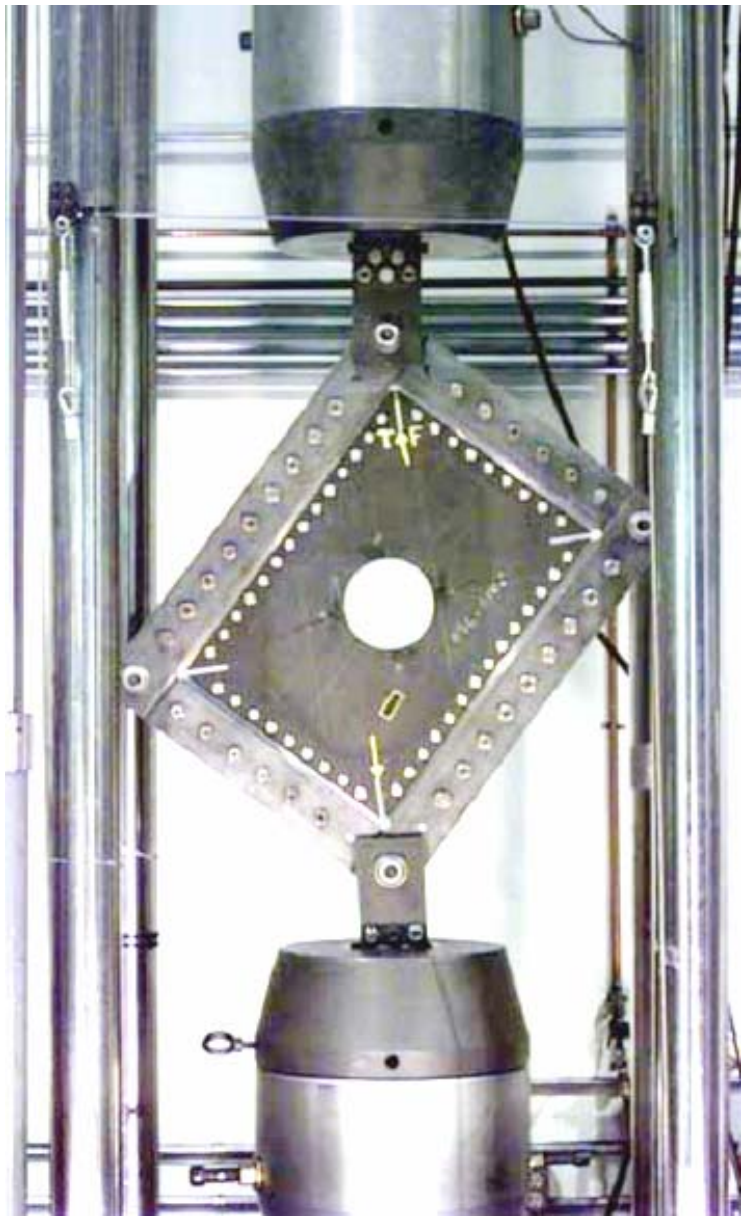


Transverse Tension Fixture

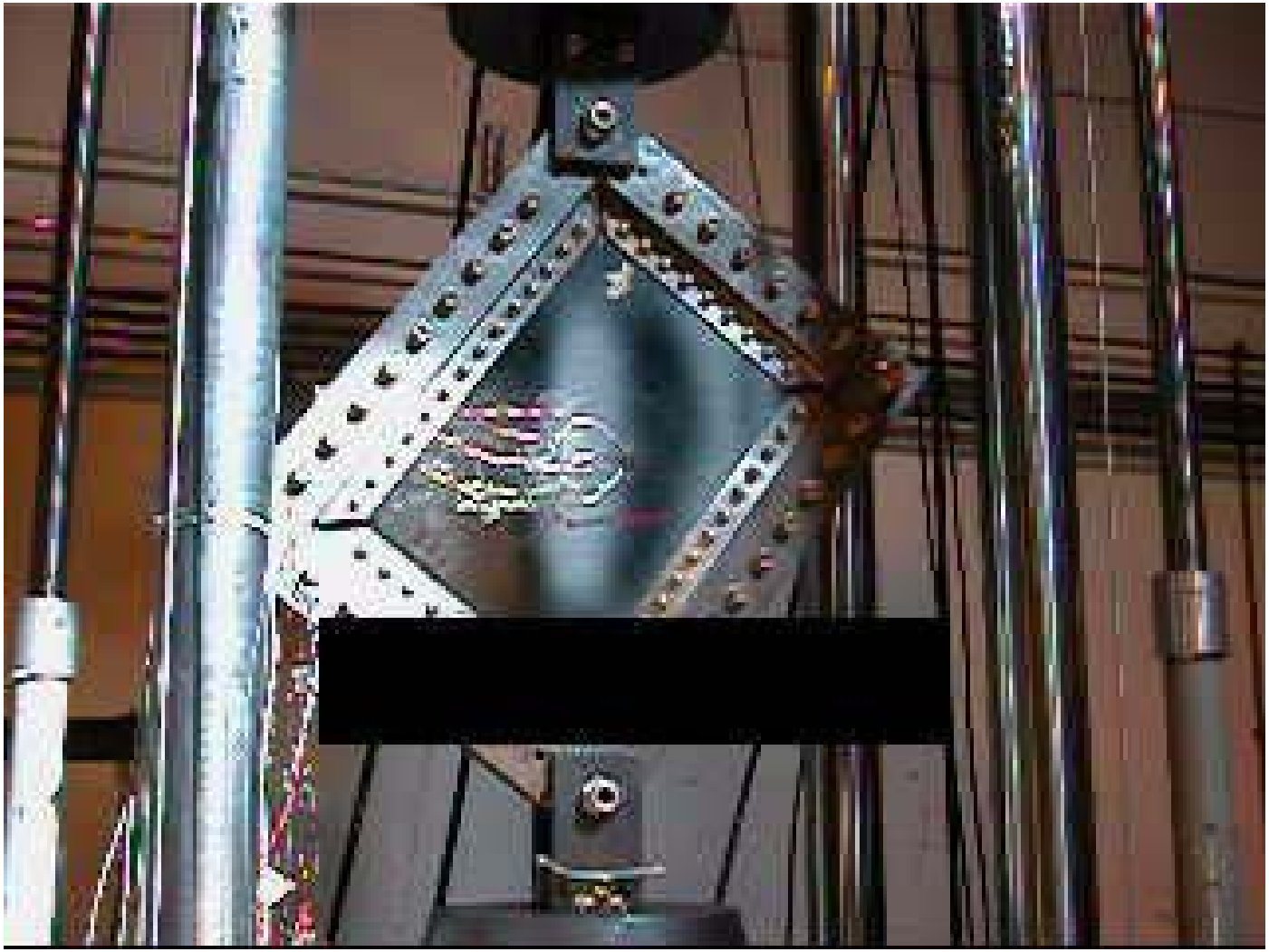
Transverse tension fixture

Specialized Fixtures
K2 Snowboard Binding

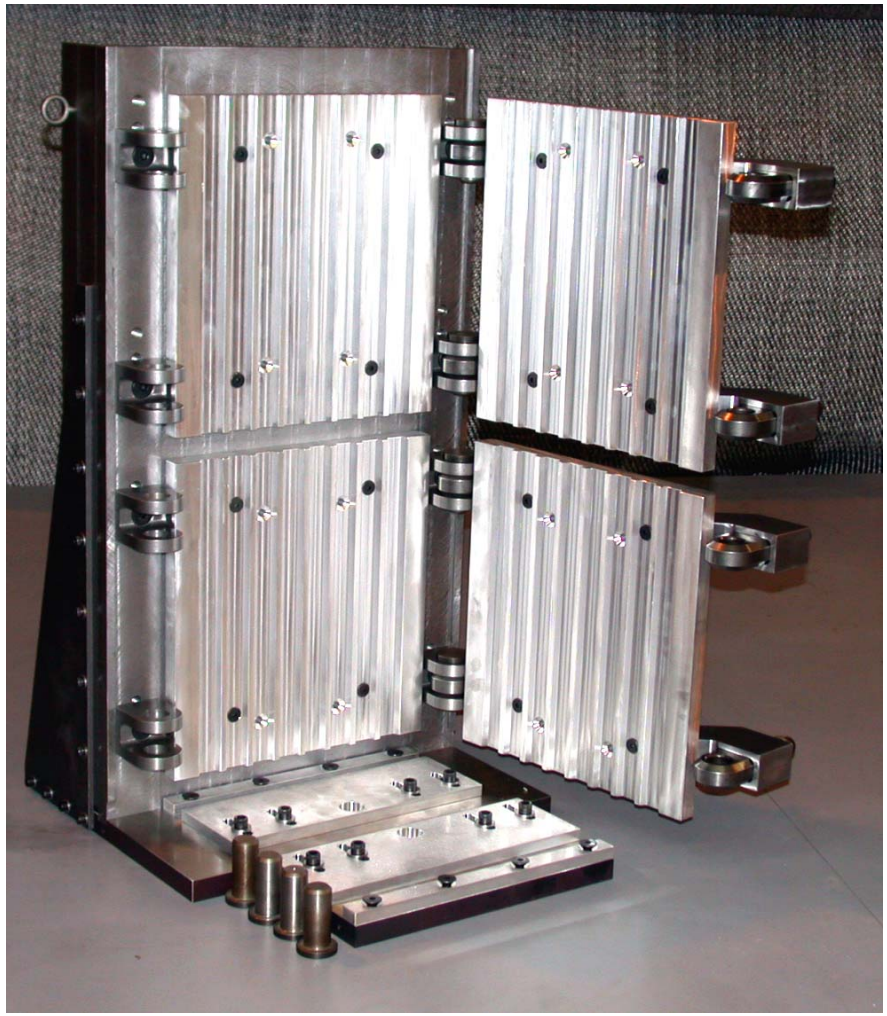
Large Shear Panel Test Fixture



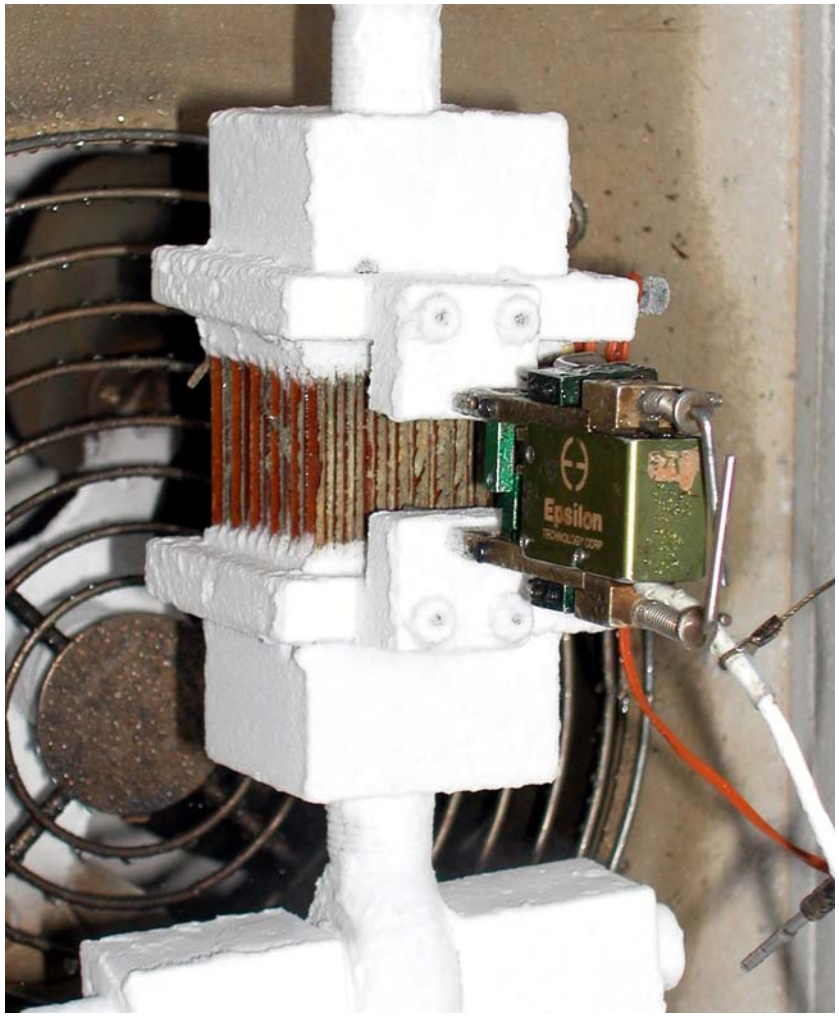
Large Shear Panel Test Fixture



Large Notch Panel Test Fixture



Test Fixtures

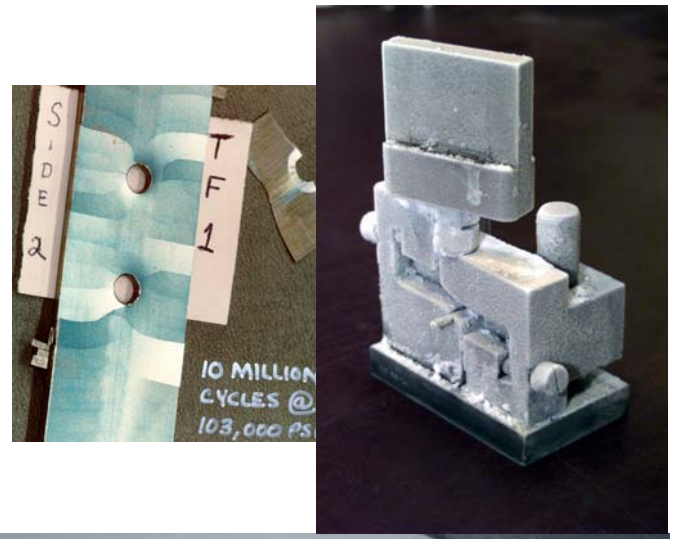


MTS TestStar IIs

Composites Testing

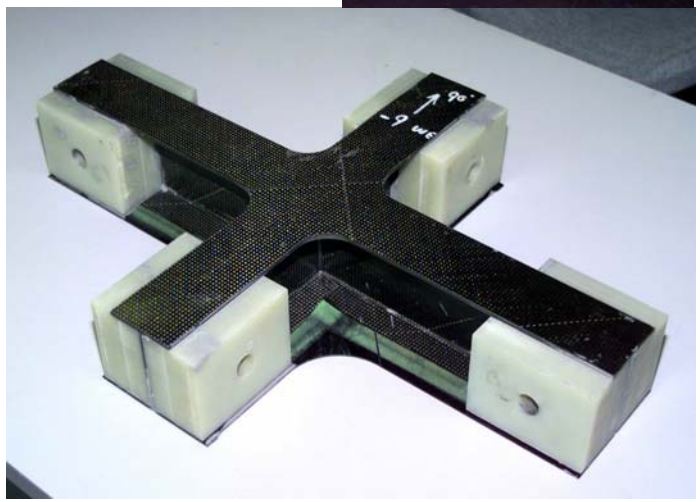
Mechanical:

- Static, fatigue, spectrum, creep, impact, fracture toughness, multi-axis, and full-scale loads to 2.5M lbs., coupon level and component level testing with more than 600 channels of data



Coupon Testing:

- Metallic and fibrous composite materials
- Automated static testing (tensile, compression, shear, etc.)
- Fatigue, crack growth and damage tolerance testing
- Manufacturing of all test coupons and panels



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Composites Testing

Environments:

- Thermal cycling and environmental exposure (-420°F to 2500°F)

Thermal analysis:

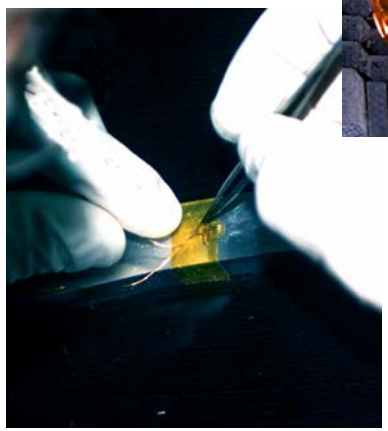
- DSC, DMA, TGA, FTIR, TGA, CTE

Physical Properties

- Void, density, volume fraction, flammability, out gassing, ultrasonic pulse echo and TTU

Photography

- Stills, high resolution digital, microscopy, high speed video, shadow moiré, in-plane moiré, photoelasticity



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Composites Testing - Sea Launch

- Pre-conditioning and environmentally controlled tests

(-320°F to 1800°F)

- Strain gage selection and mounting, over 600 data channels

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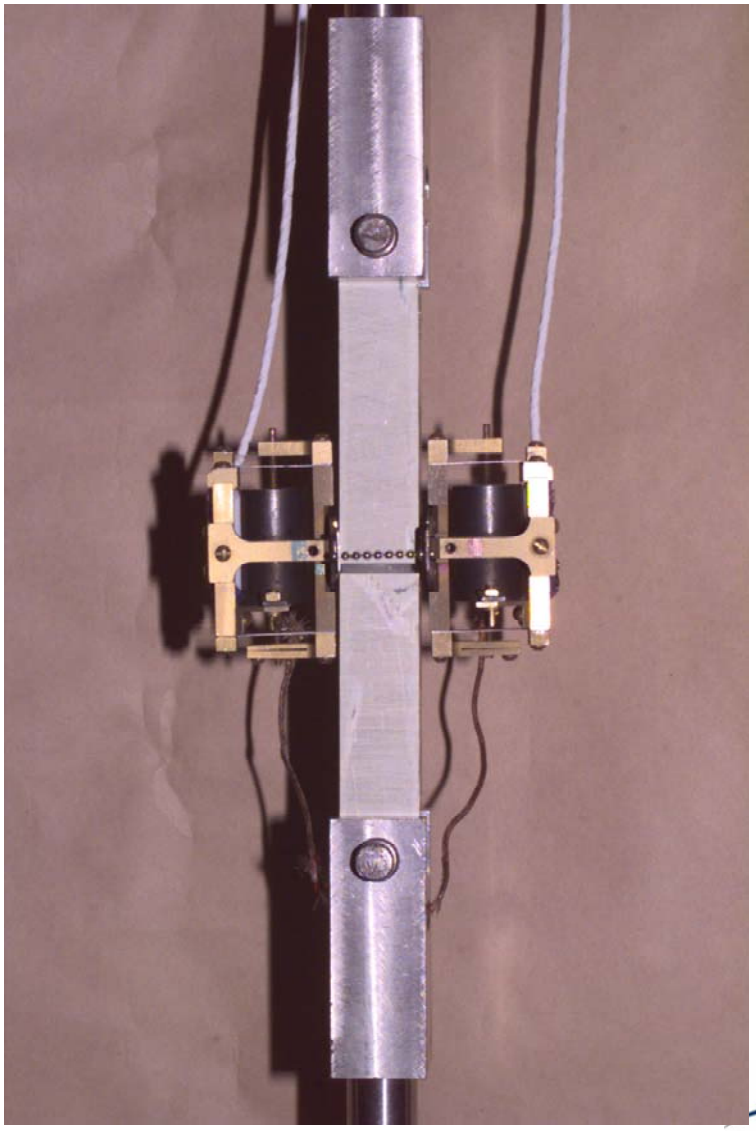
KGR-1 Test Setup



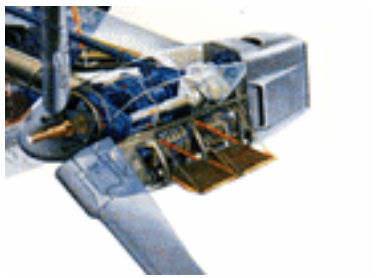
Capabilities
-Senior Engineering Staff-

- More than 30 years experience
- Materials, analysis, design, management
- Technology development
- Preliminary design
- Product development
- Production design
- CAD
- FEM

Capabilities

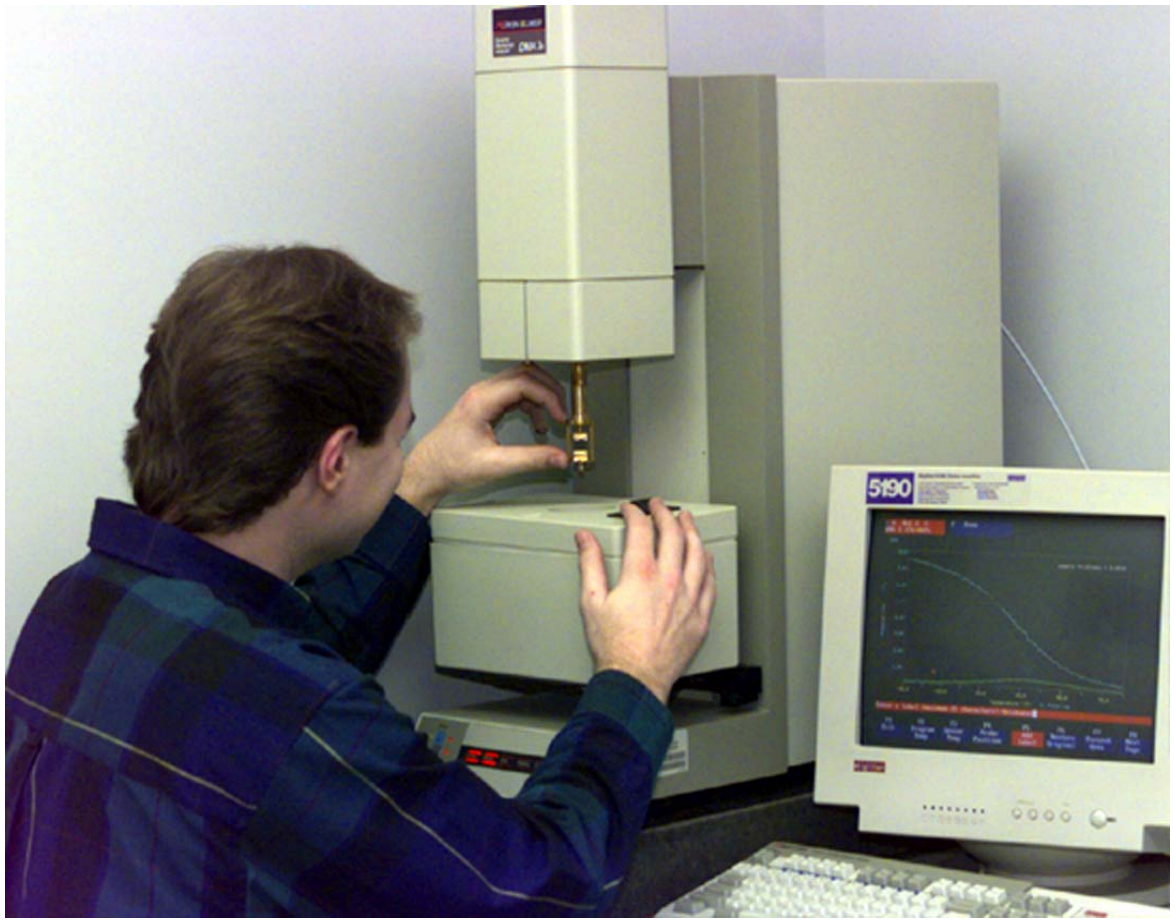
-Senior Engineering Staff-

V-22 TiGr Engine Nacelle Door

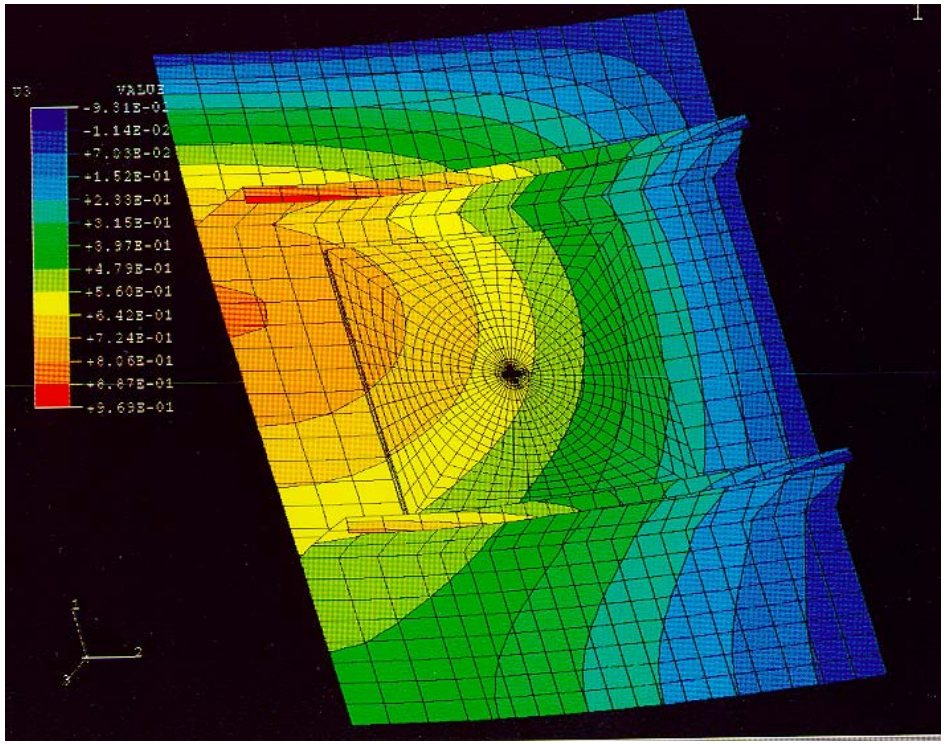


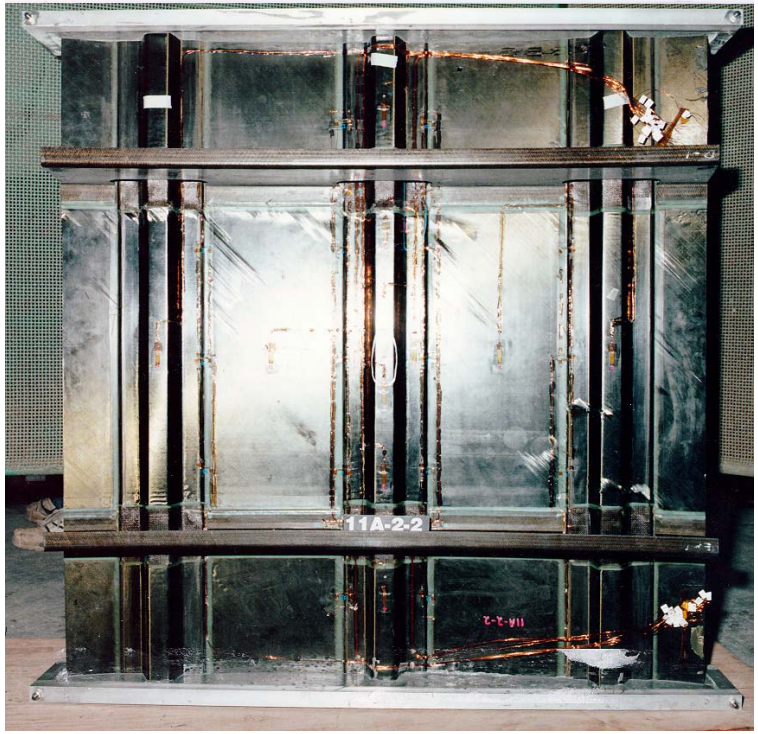
Design & Engineering

Prediction of Cracking in Composites



FEM Model and Photo





Three Stringer Compression Specimen

Capabilities
Design & Fabrication

- Tool design & fabrication (including composite tooling)
- 6’ dia. x 15’ research autoclave, 450°F - 150 psi
- Sandwich structures, graphite, glass, Kevlar, thermoplastic & thermoset parts
- High modulus graphite, net OD & ID tubes
- Prototype & component design
- Process development & optimization
- Product development
- 5 axis, 24,000 rpm, (12’ x 5’ x 36” envelope) composite machining

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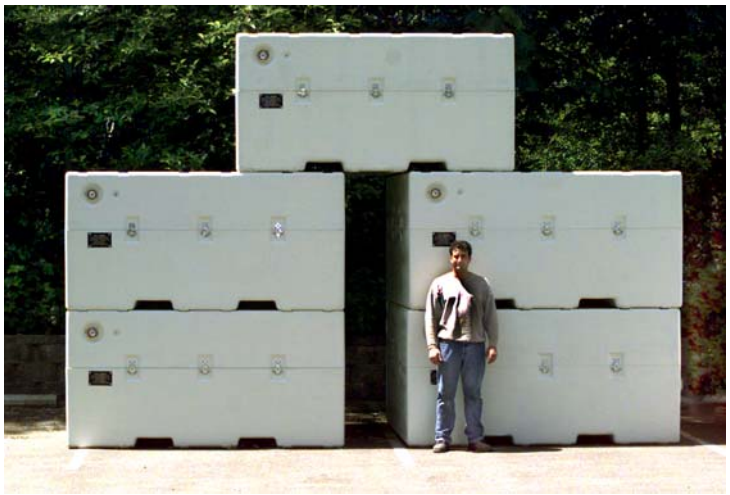
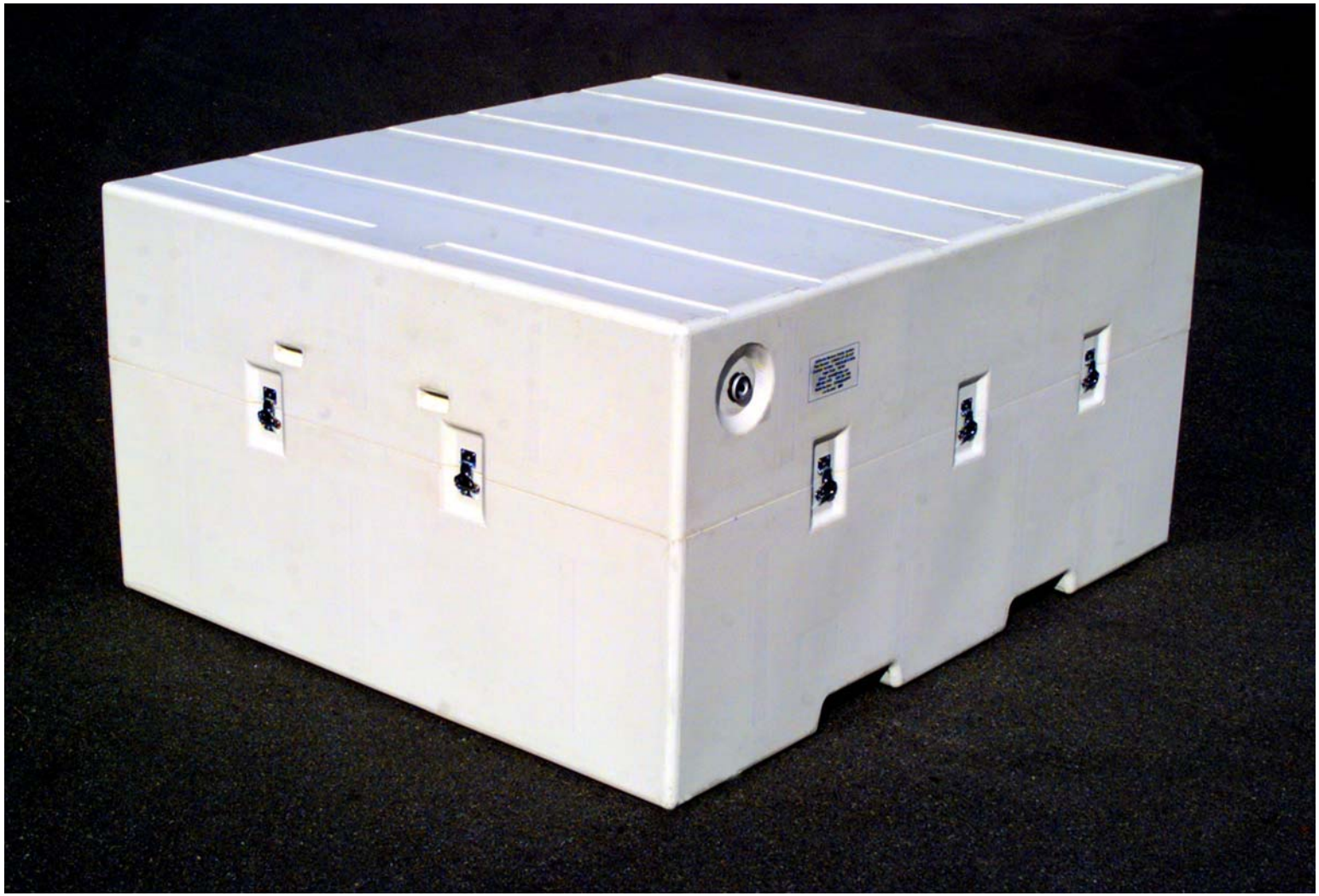
Engineered Container Systems

Our engineering group is well experienced in designing containers that specifically meet weight, shock, durability, and environmental isolation requirements.



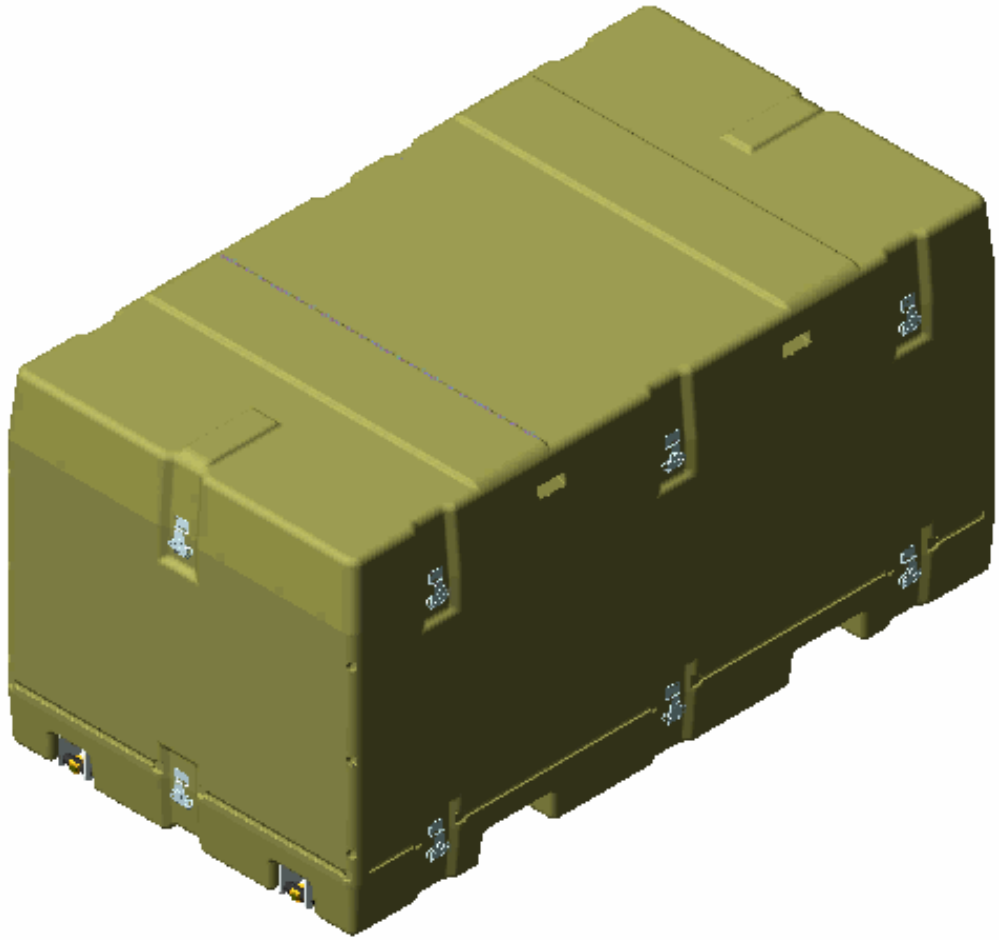
Engineered Container Systems



Container Systems
Advanced Reconfigurable Container
“ARC”

Container Systems
Advanced Reconfigurable Container
“ARC”

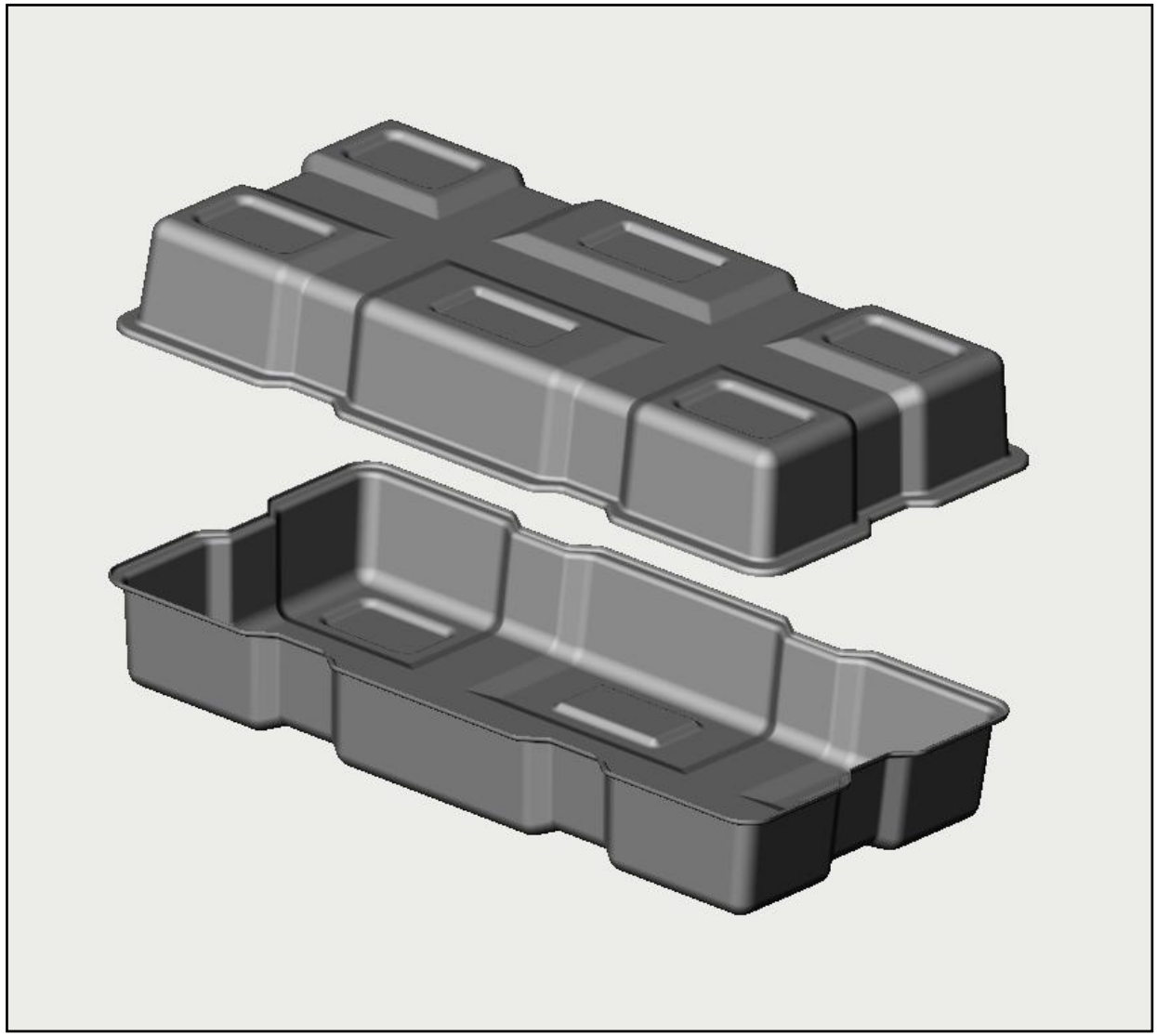
Engineered Containers



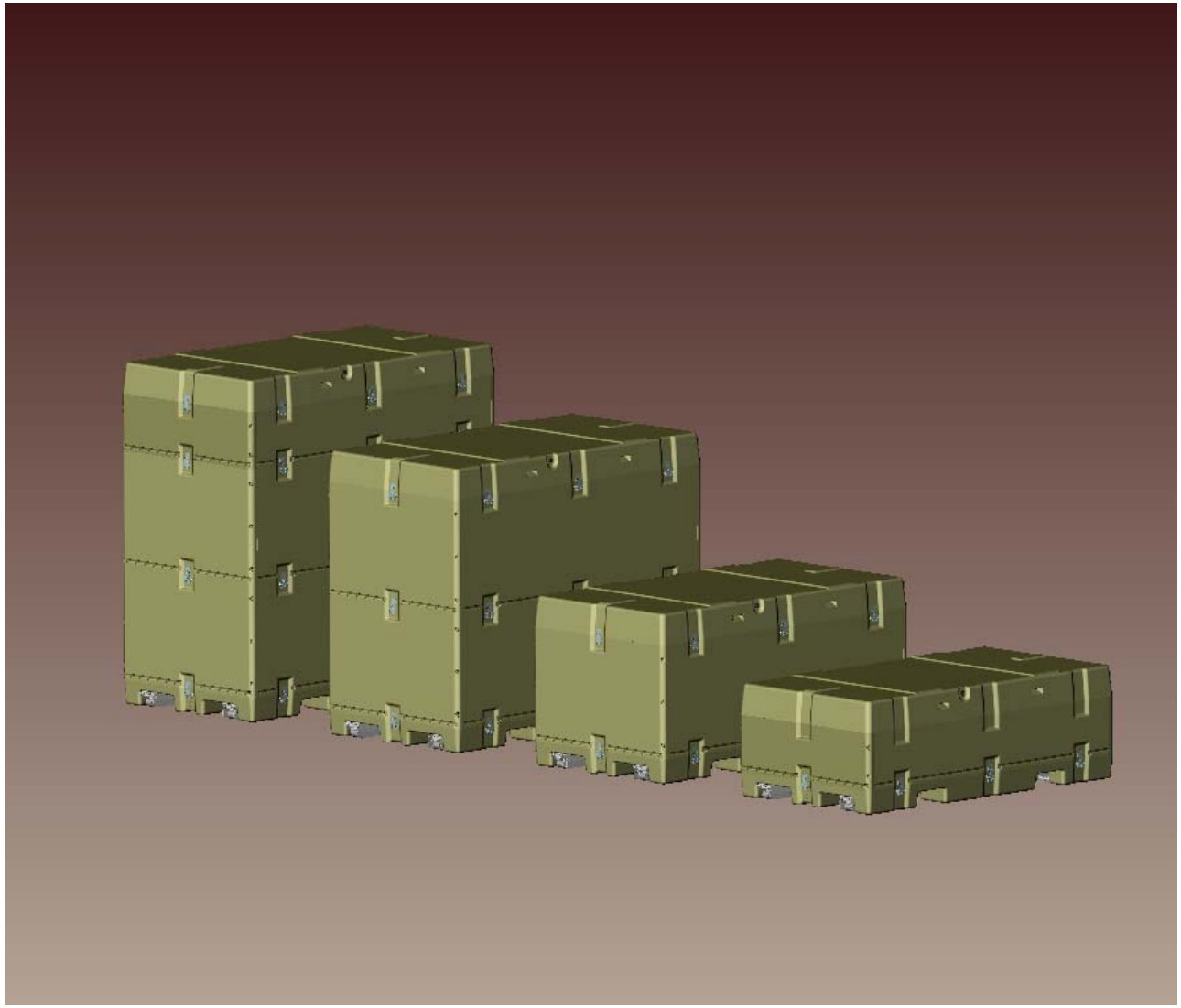
JASSM Cruise Missile Container

Engineered Containers

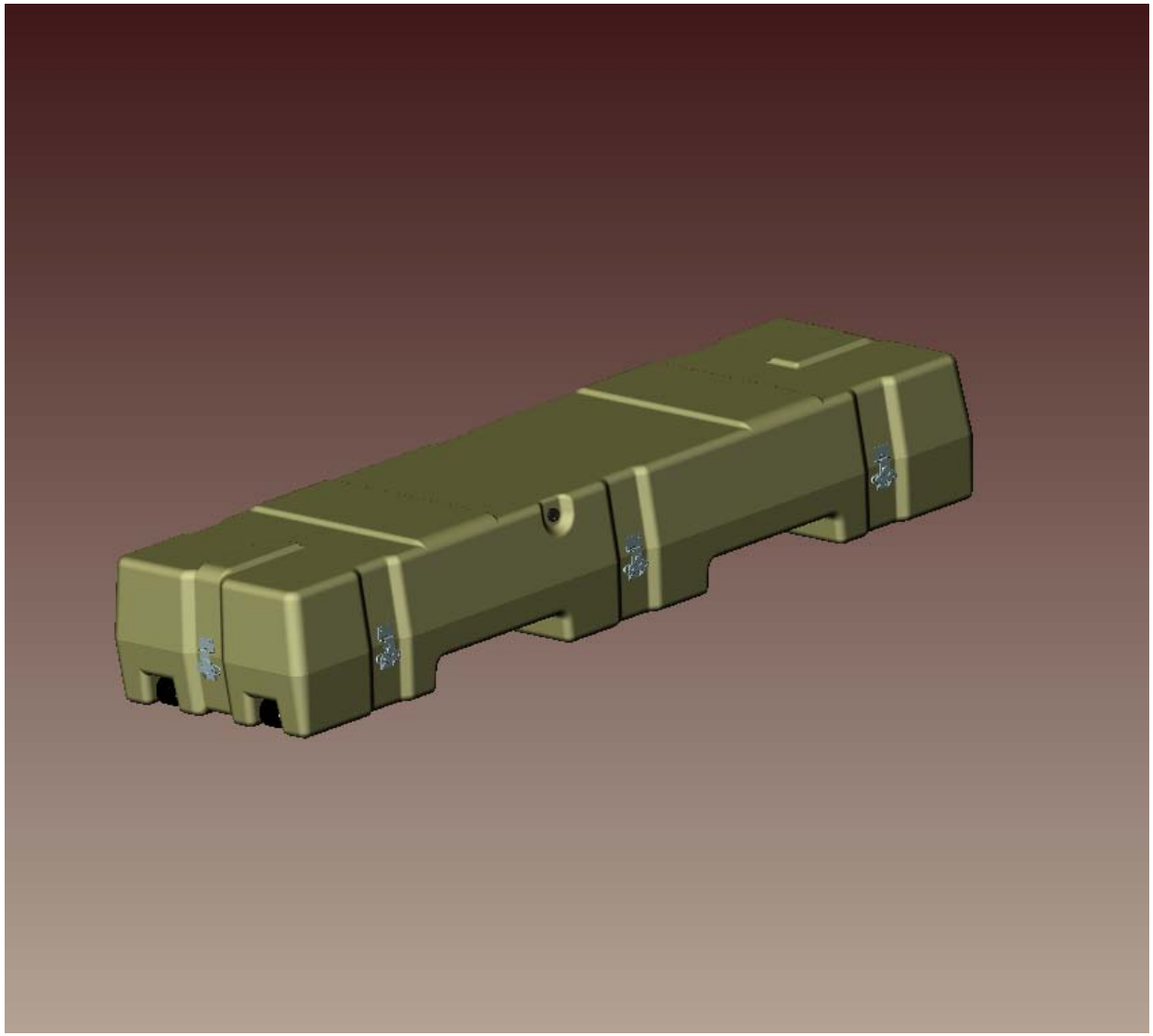
Engineered Containers



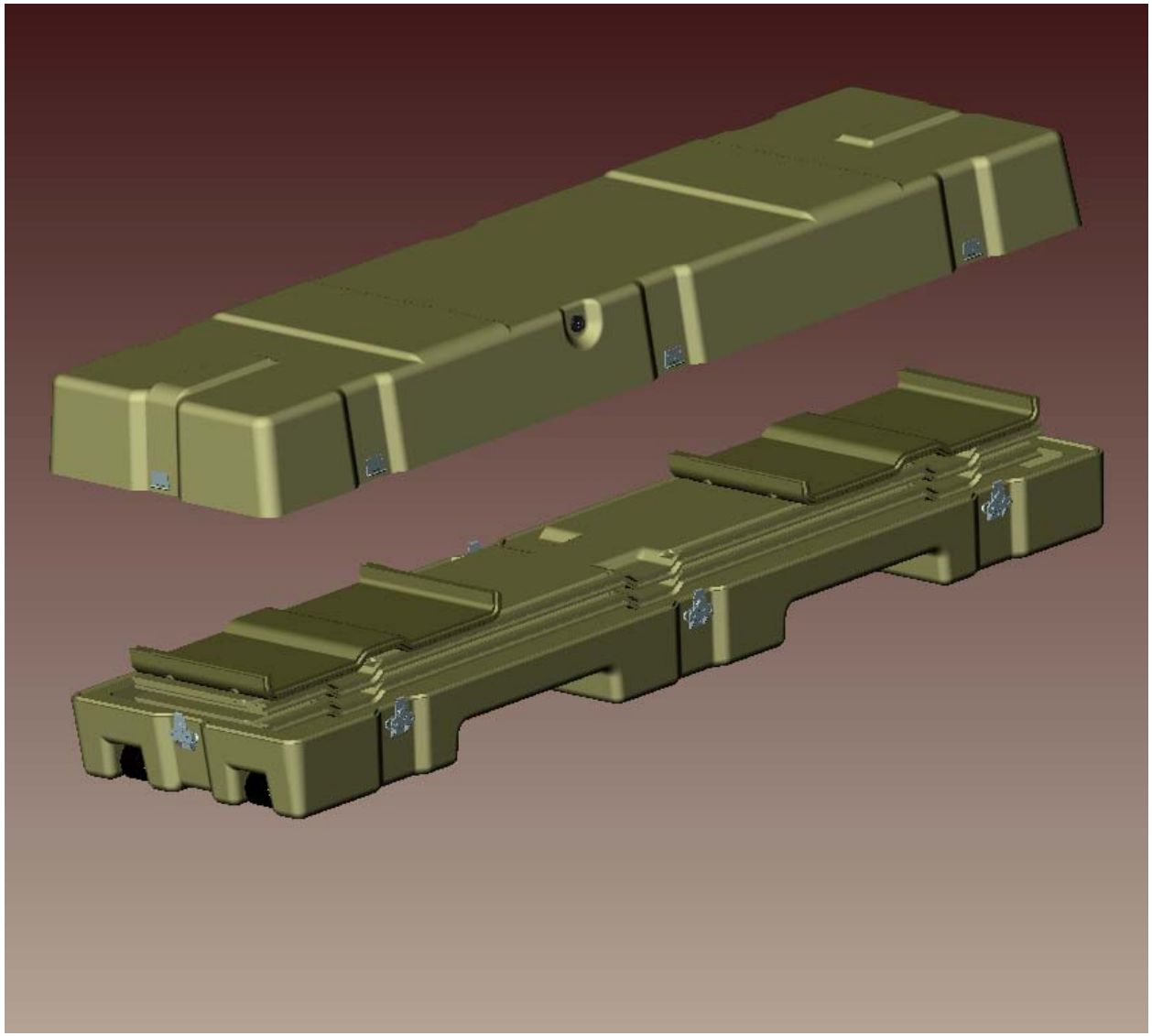
Engineered Containers



Engineered Containers



Engineered Containers



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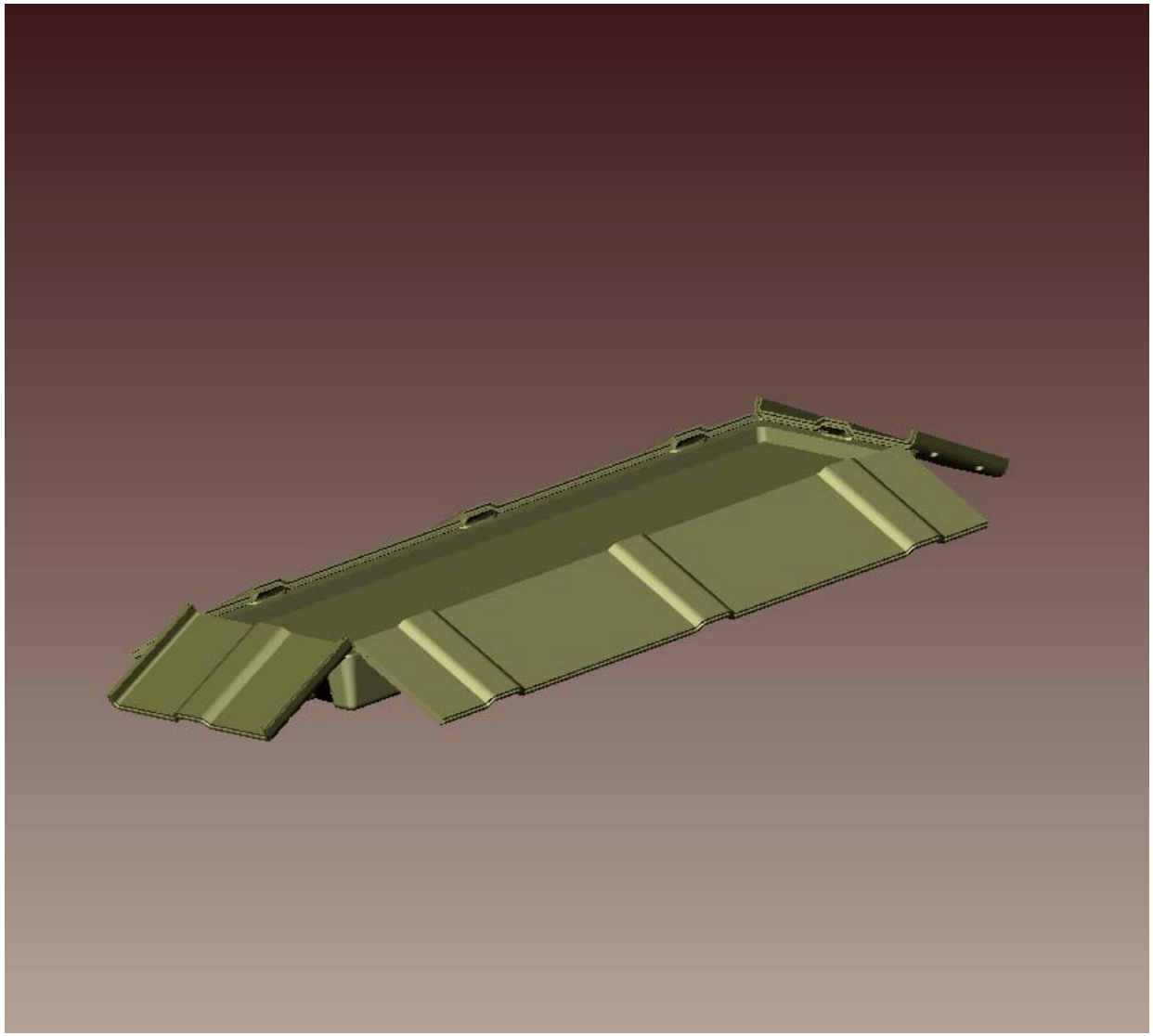
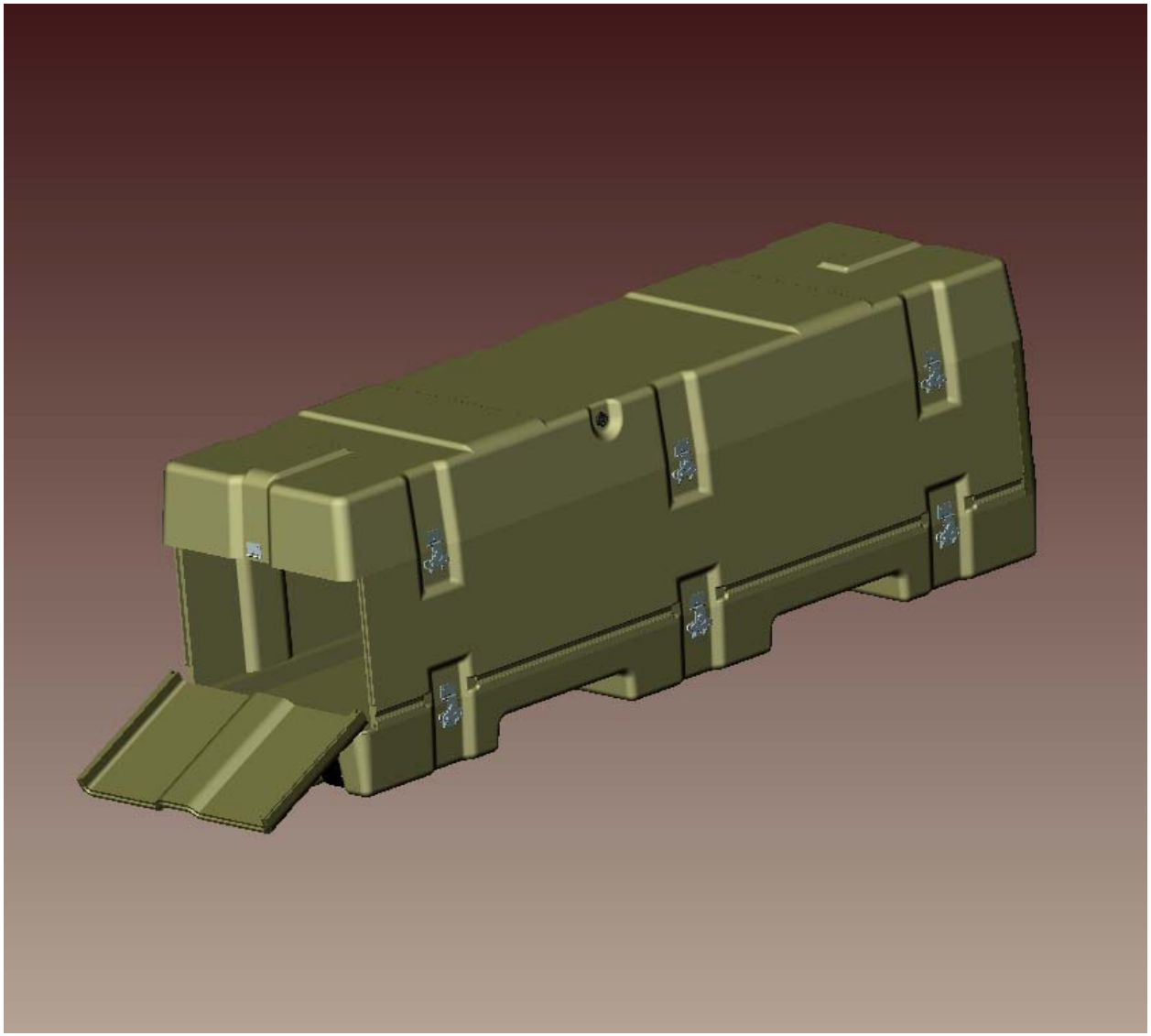
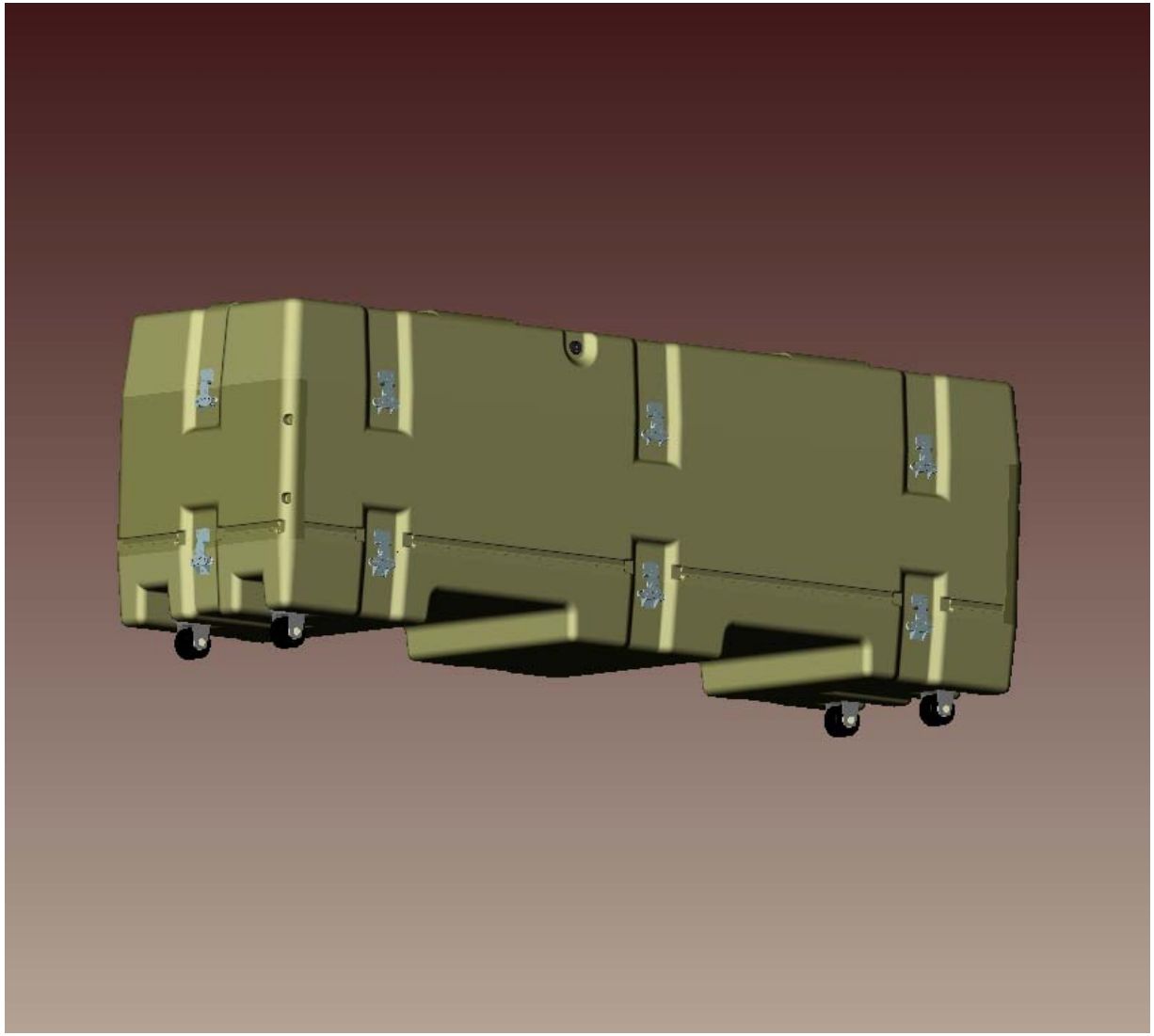


Engineered Containers

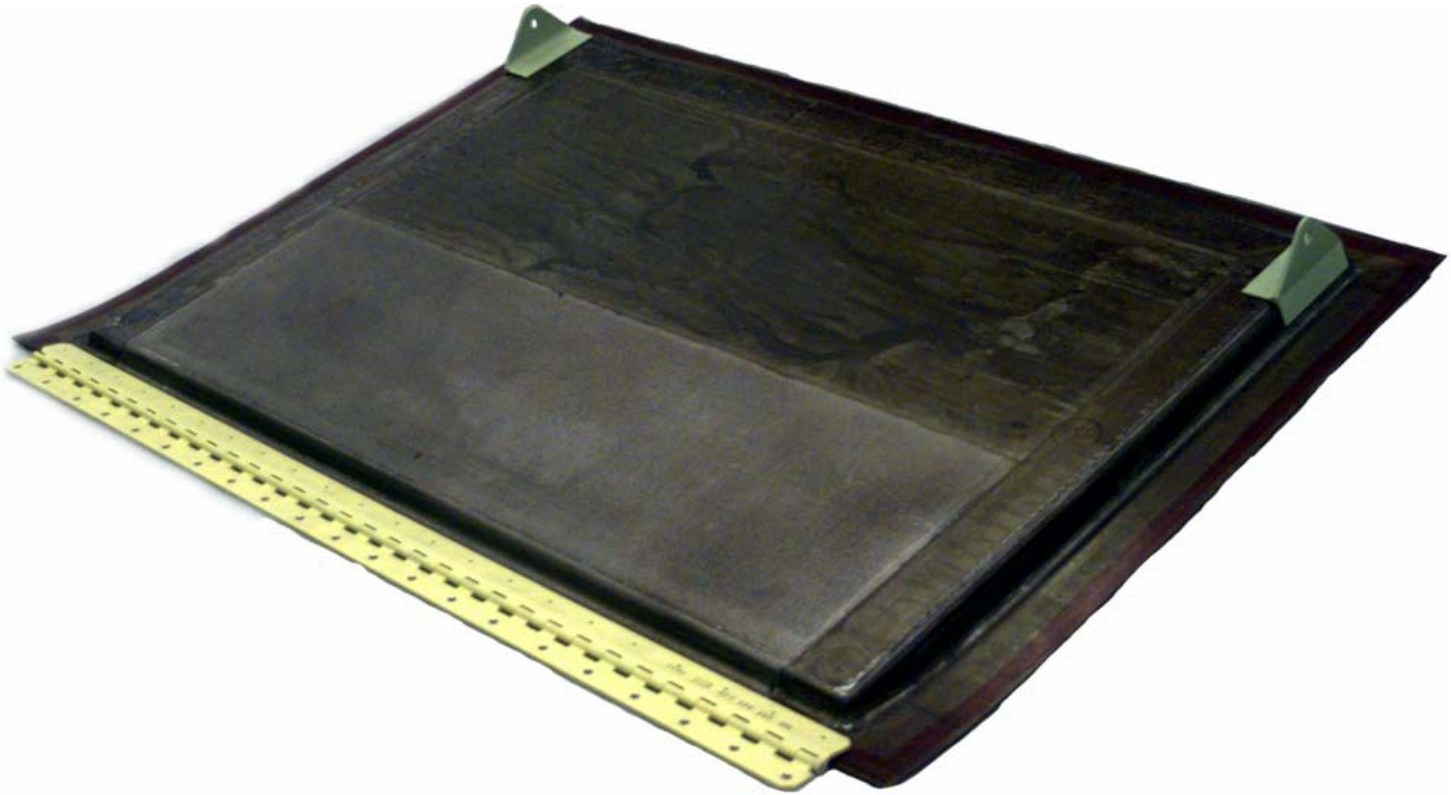


Engineered Containers

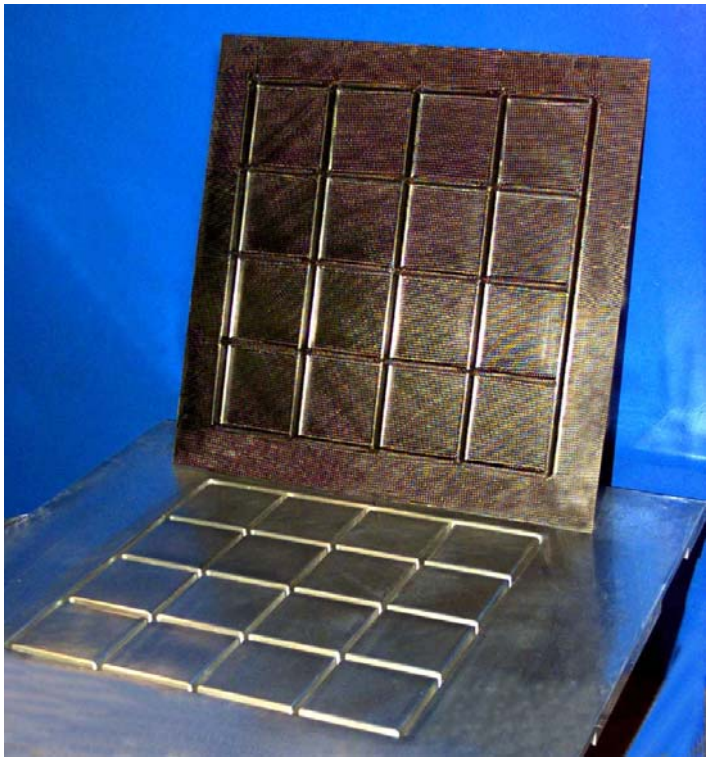


Engineered Containers

Bell V-22 TiGr Nacelle Door



Grid Stiffened VARTM Panel



Fabrication of Aircraft Parts

Fabrication Types:

Skin stringer

Sandwich

Hybrids

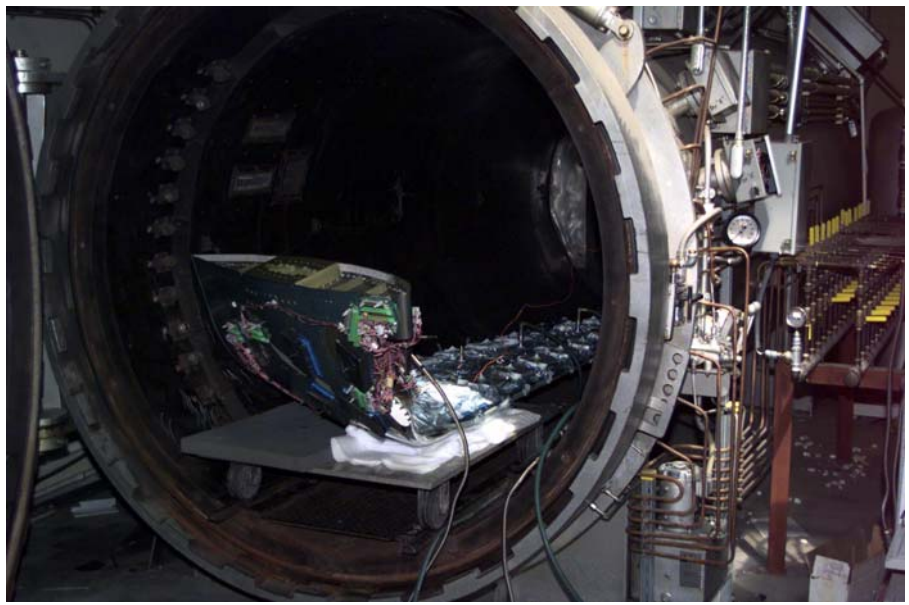
Thermoplastic Extrusion

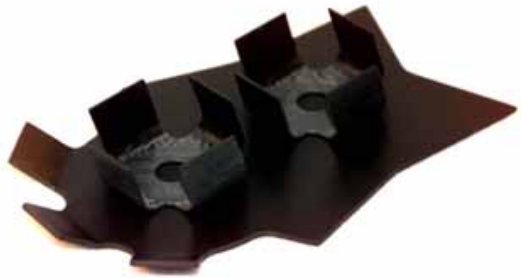
Thermoset Extrusion

Thermoplastic Pultrusion

Thermoset Pultrusion

RTM skin stringer





Prototype and Production Parts

Fabrication:

Fixed & rotary wing aircraft and satellite hardware & parts

Master model making

Reusable and disposable mandrels

Tubes, clips, ducts, and structural shapes

Repair: parts, components, and structures

Prototype and Production Parts

Fairchild Dornier Envoy 7

Soloy Corp Engine Nacelle

Raytheon Hawker 800

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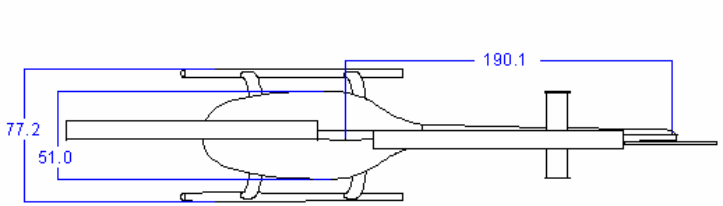
Boeing 747 Winglet Fabrication

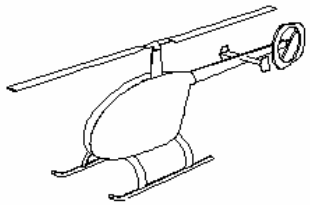
Prototype and Production Parts

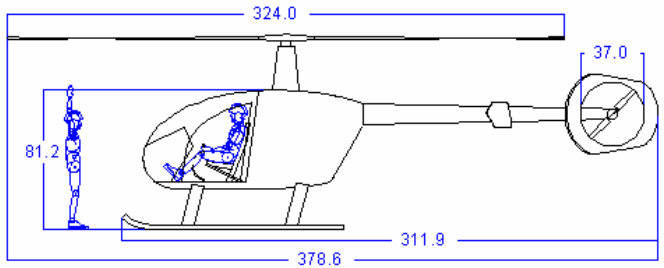
Prototype and Production Parts

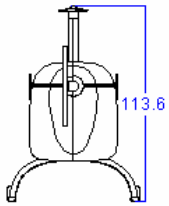
EAGLE 600

Conceptual Design Program









Units = Inches

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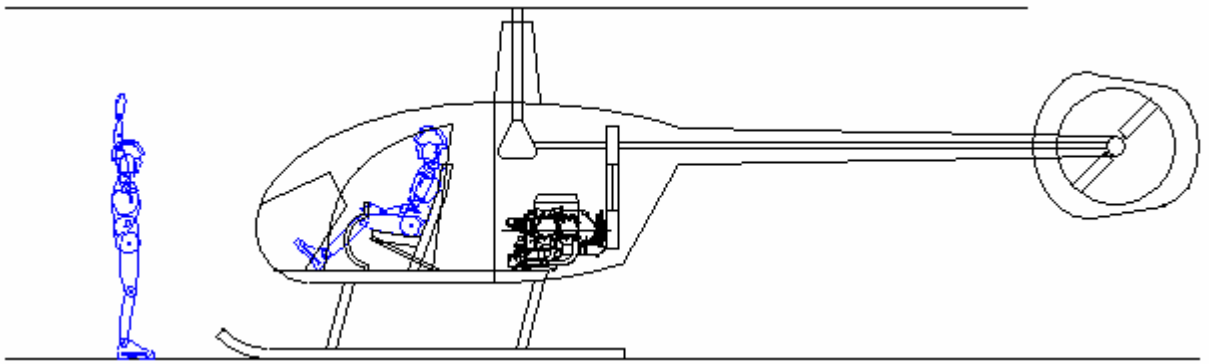
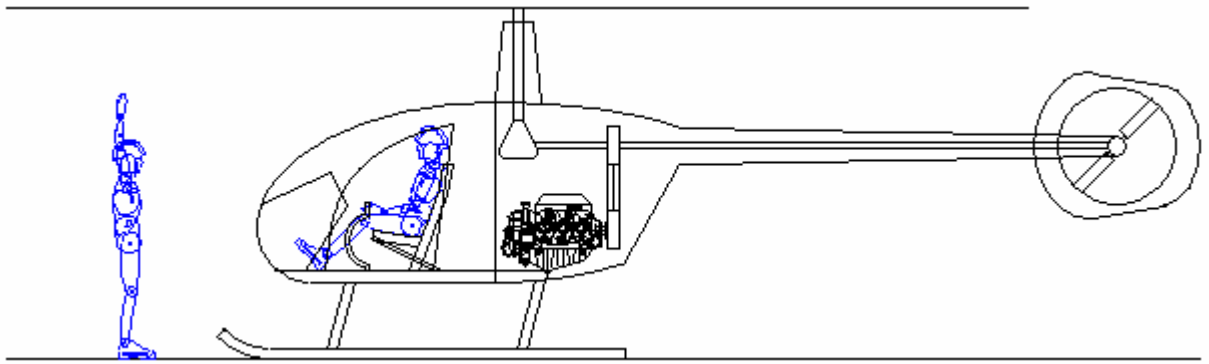
Internal Layout – Options

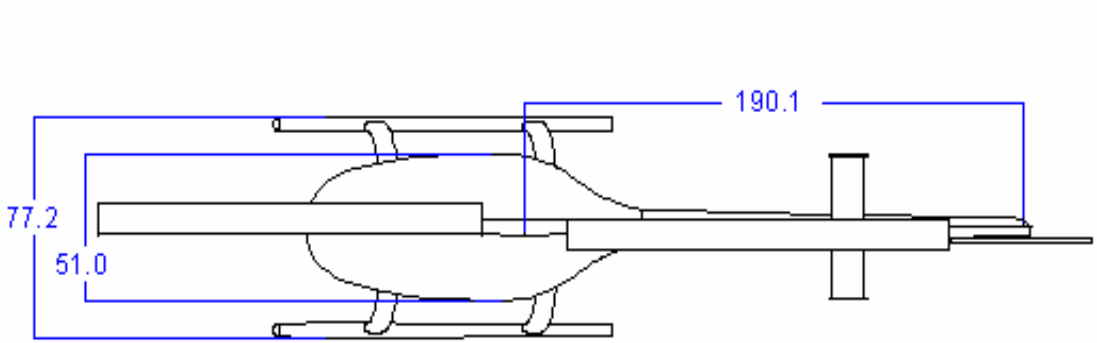
- **Lycoming HIO-360-D1A**

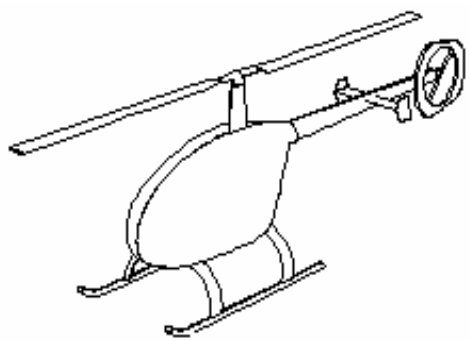


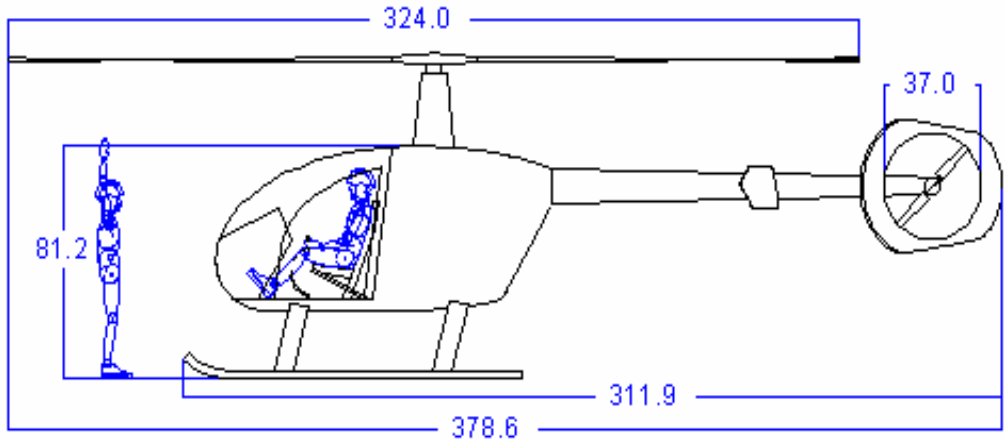
- **Continental IO-360D**

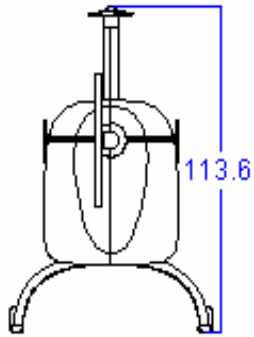


Layout









Units = Inches

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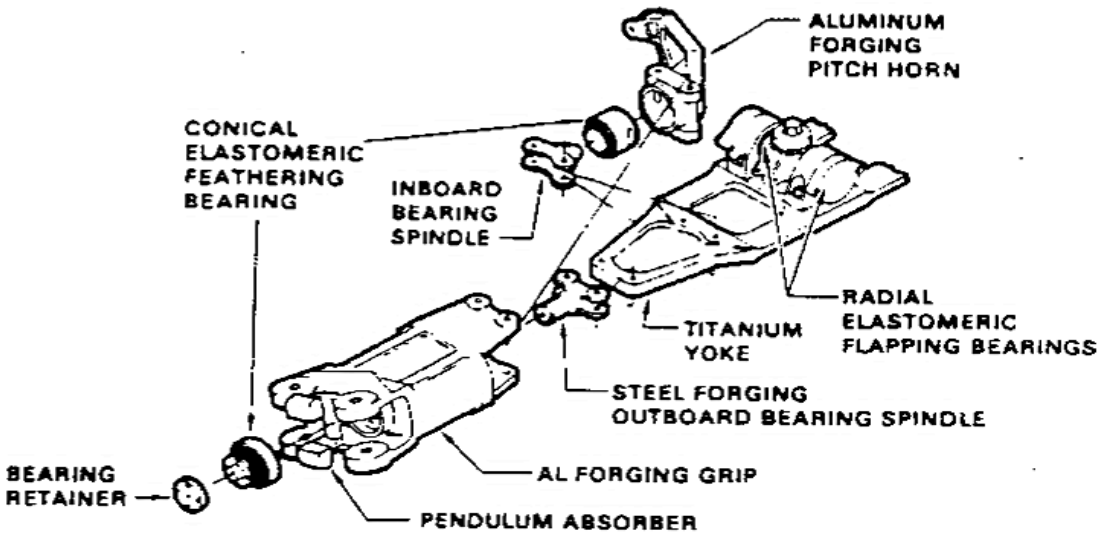
Positive Head Moment

- **Choices considered were a fully articulated 3-bladed hub or 2-bladed teetering hub with offset elastomeric flapping hinges and hub spring**
- **To reduce hub complexity, use 2 blades - resulting hub design is similar to that successfully used on Bell 222**



Prototype and Production Parts

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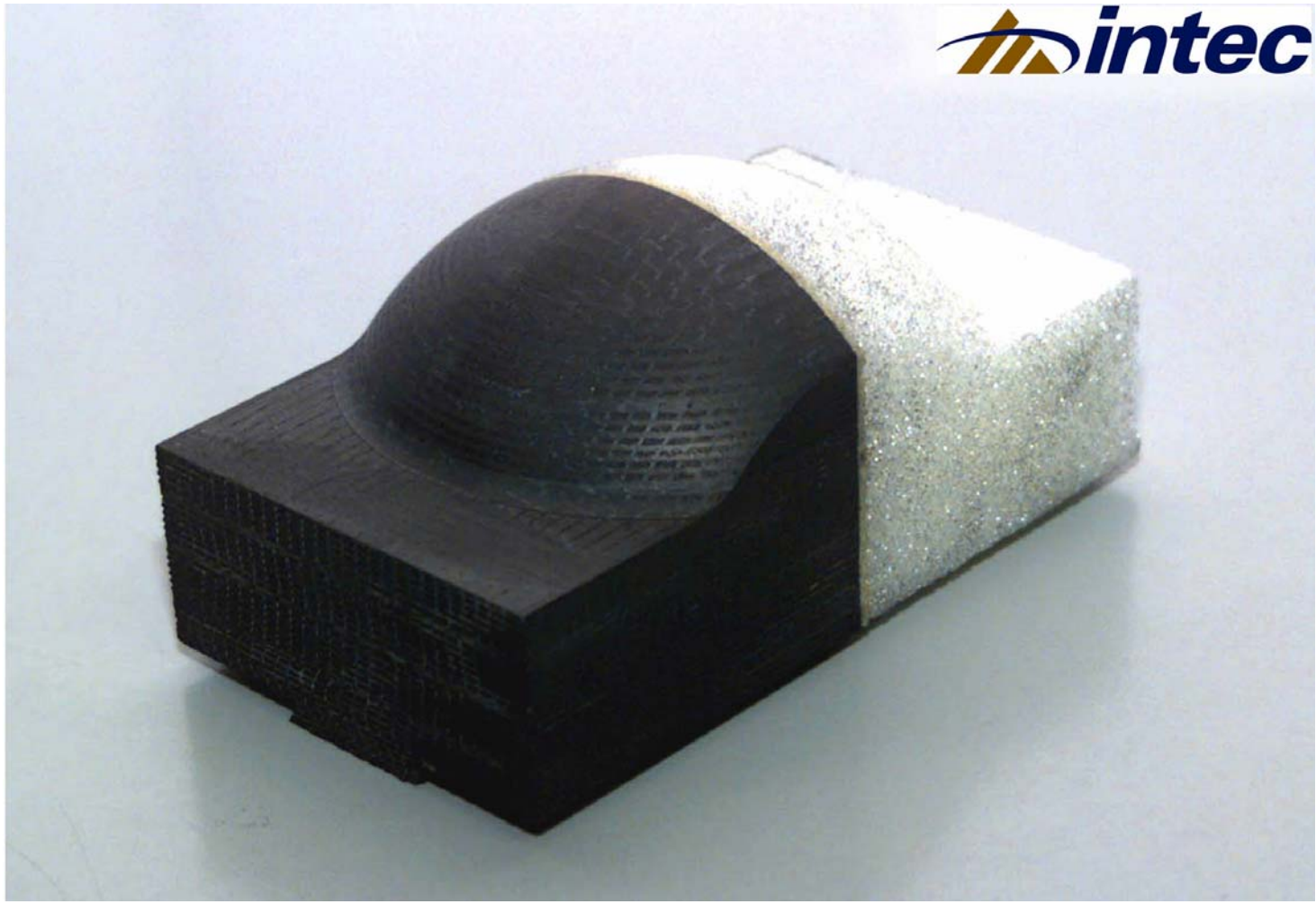
Prototype and Production Parts



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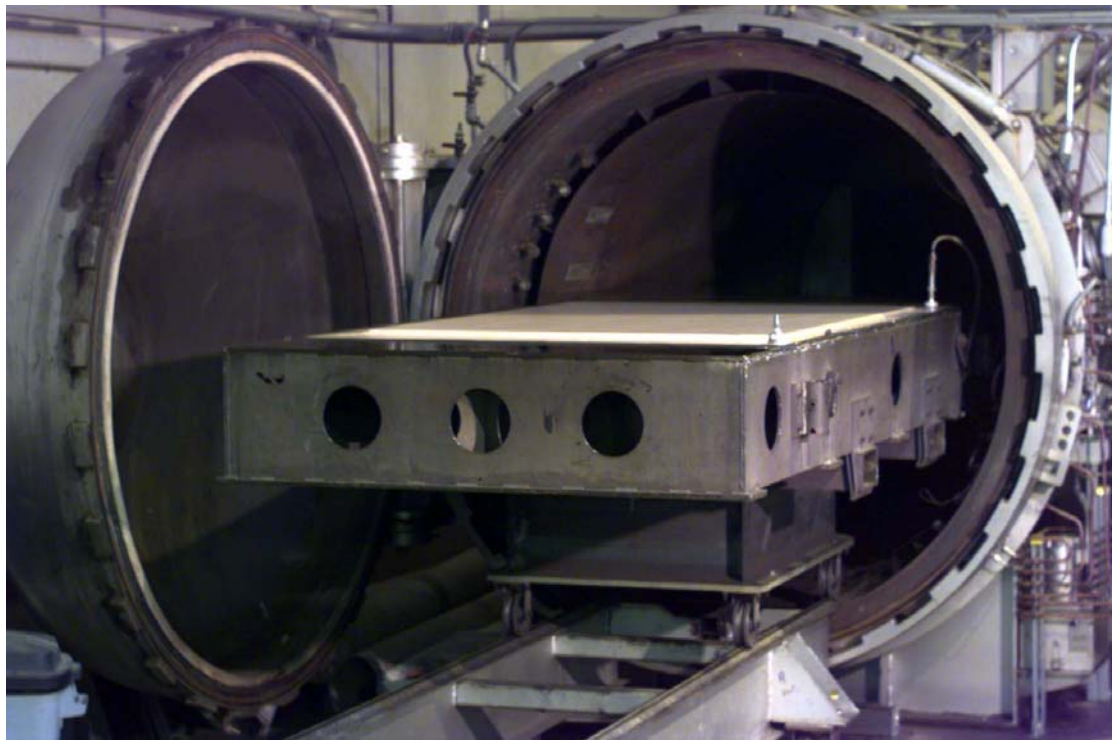
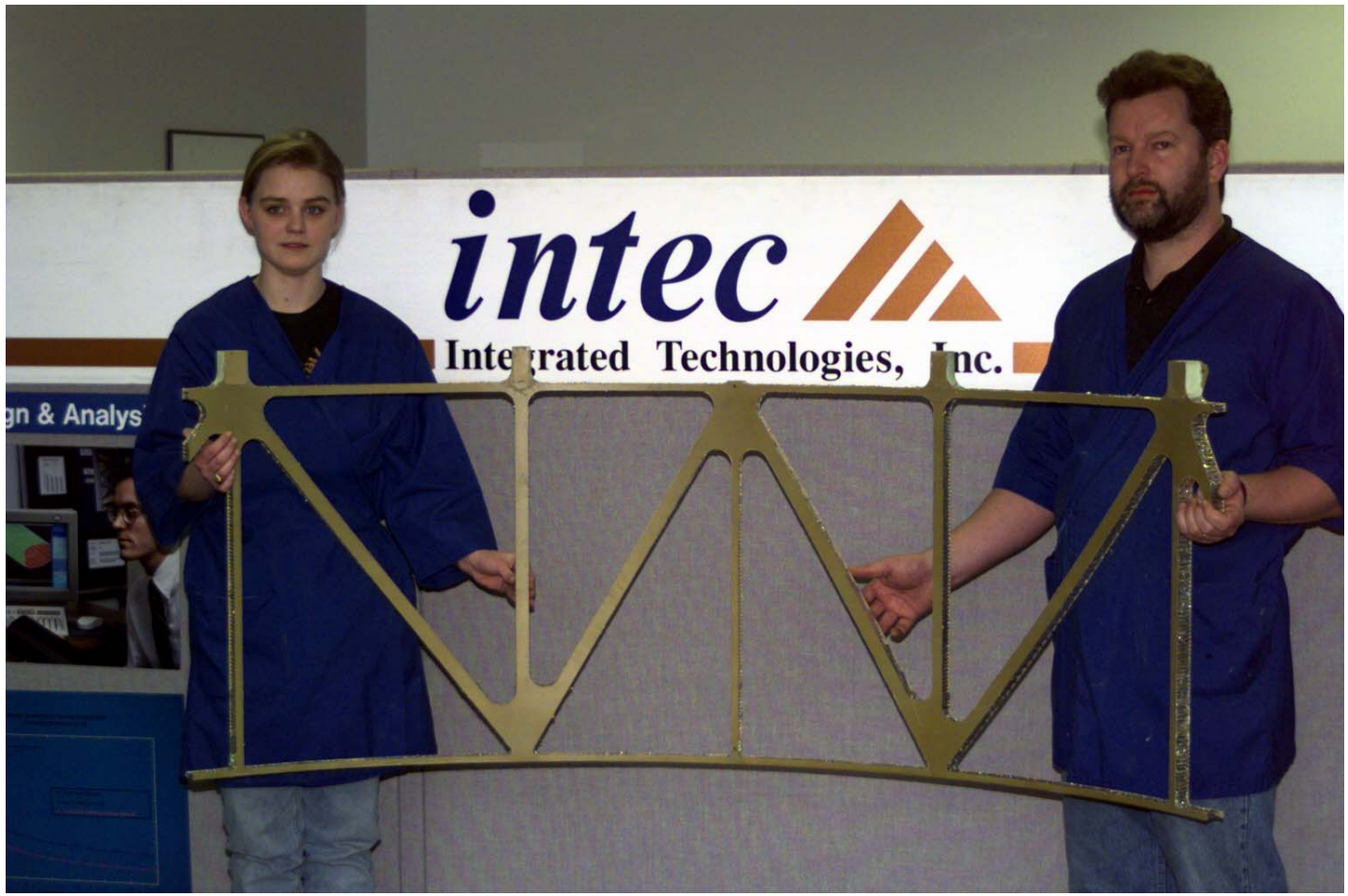
Large Components with Integrated Doublers

6’ x 15’ Autoclave
150 PSI - 500°F



60” x 140” INVAR Tool for Low CTE Panel Fabrication

Aluminum Sandwich Satellite Corner Wall



UHM 8552 / Korex 127” X 60” Sandwich Panel for Satellite Ribs

Large Flat Panels using INVAR Tooling

Titanium / Graphite Hexapod Brackets

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Fabrication of Specialized Aerospace Parts

Thermal, EM and Structural Solutions Example:

- Satellites (Extreme Environments)
- Thermal Management, & EM Shielding
- Structural Stability (CTE, Specific Stiffness)
- Military Electronics (Extreme Environments, Low T & EM Tolerance)
- Thermal Management
- Extreme EM shielding, Targeted EM absorption
- Structural Stability (CTE, Specific Stiffness)

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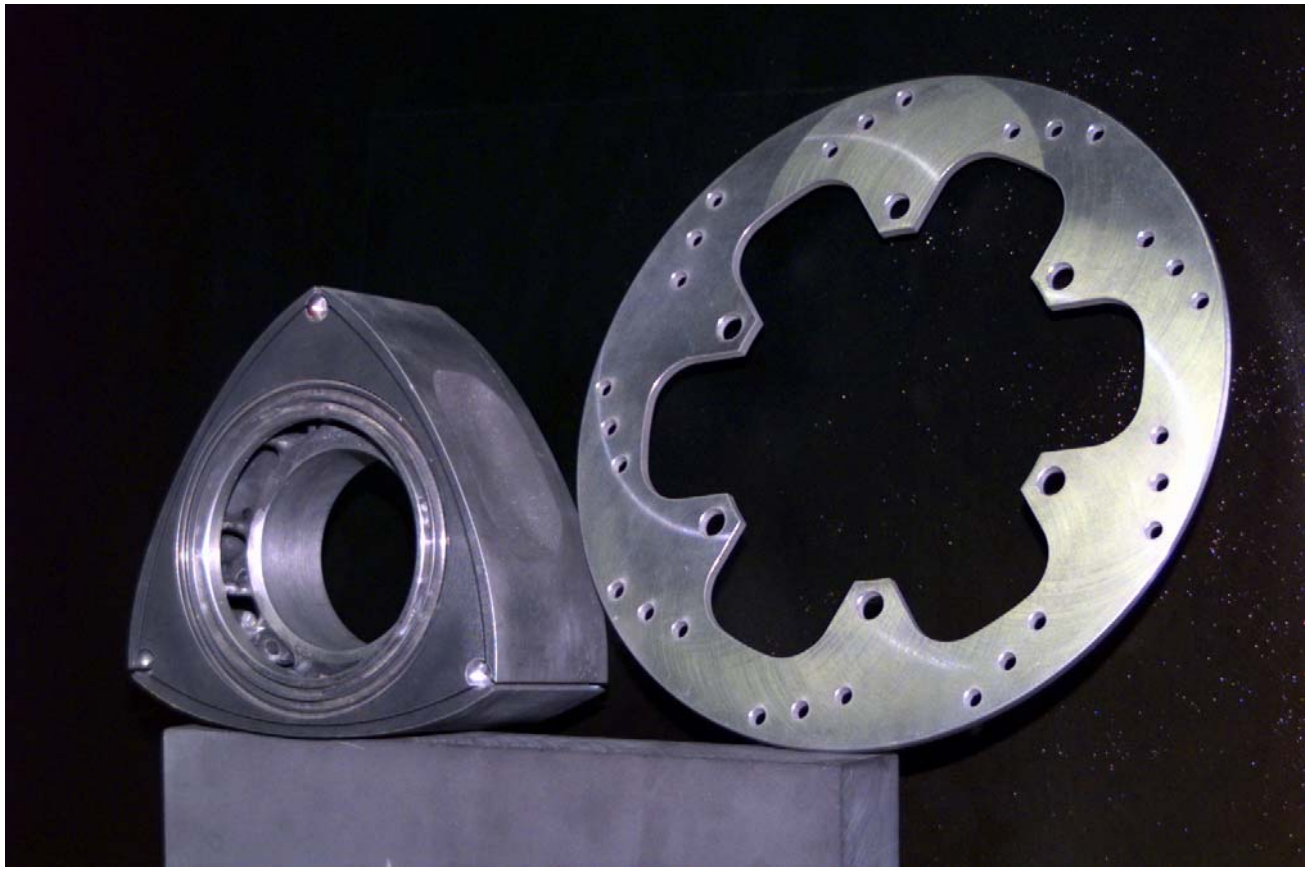
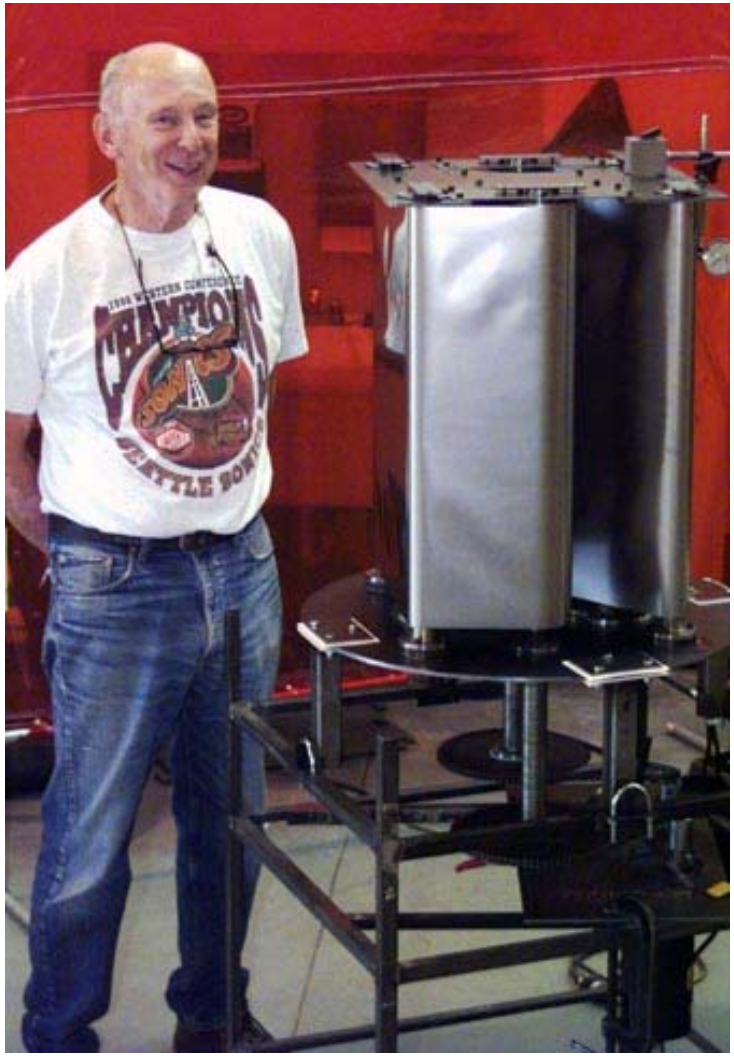
Low Cost Metal Matrix Composites



- **Lower CTE**
- **High Strength, Stiffness, Fracture**
- **Functional Gradient Properties in Castings**
- **High % Percentage Reinforcement**

Laminated TiGr Metal Composites



Don Grande 1929 ~ 2004

- **Design Tools/Data**
- **Dry Surface Preps on Metal Surfaces**
- **Chrome Cathodic arc ≈ 700Å**

- **Prototype Parts**
  - **C-17 Tear Straps**
  - **HSCT Fuselage Structure**
  - **Bell V-22 Nacelle Door**
  - **777-200 Fuselage Stringers**

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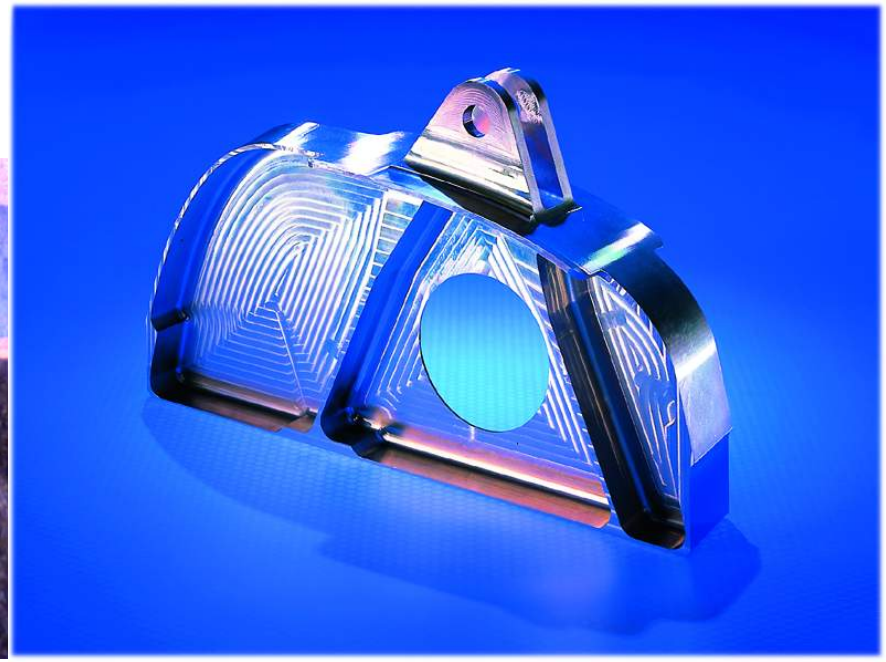
Metal & Composite Machining
Flight Hardware Joint Strike Fighter

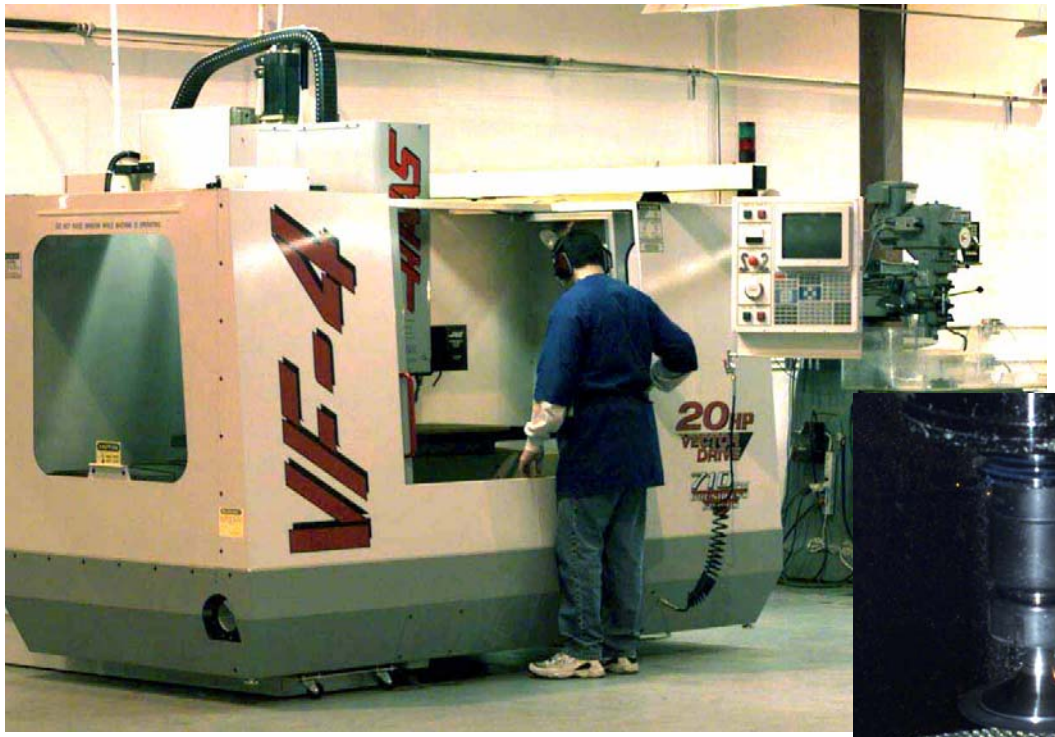
Aerospace Machining example:

Intec has produced several major components for the Boeing Joint Strike Fighter prototype forebody. These parts include the air inlet duct pivots (Bullnose), nosewheel landing gear retract arms, and several large, high tolerance aluminum grid avionics trays.



Metal & Composite Machining
Flight Hardware -737-757-767- Landing Gear Doors

Metal & Composite Machining
Precision Core Machining



Integrated Technologies, Inc.

UW-FAA Center of Excellence on Advanced Materials.

Fabrication

Engineering **Machining** **Testing**