Aircraft project 2007
Linköpings University

RAVEN
BizJet Medivac
Agenda

• Introduction
• Goals
• Requirements
• Results
  – Full scale
  – Demonstrator
Introduction

• Course given in fourth year
• 13 students and 4 different nationalities
• Two different courses collaborates together
  – Aircraft Design
  – Ergonomy Design
• Sponsored By Linklab and NFFP
• Budget of 20000€
Introduction

Autumn (1 periode)
- Flight Mechanics
- Aircraft Conceptual Design

Spring (2 periode)
- Aircraft Structural Design and System Integration
- Aircraft Project Course
Goals

• Design a BizJet/Medivac aircraft in full scale
• Design Manufacture Flight a “Dynamically scaled” aircraft based on the full scale study
• Design the interior solution for BizJet and Medivac application

• Why?
  – Simulate the “real” aircraft behavior with reduced risk
  – Extend the flight envelope
  – Understand difficulties with dynamic scaling
Requirements Full Scale

- Two roles: bizjet or medivac
- Quick change (30 min max.)
- Two pilots
- In medivac role:
  - 575 kg payload (max 700kg)
  - Range 1300 nm
  - Two Patients, one doctor and one nurse
  - Enable one stretcher to remain inside while the other is removed
- BizJet Role
  - 4 to 6 passenger
  - Offer space and high class interior
- Able to use runways 800m long (ISA+20)
- Sized around two Williams FJ33 engines
Requirements for Demonstrator

- Dynamic scaling
- Full instrumentation for flight testing
- Endurance minimum 20min
- Full Instrumentation
  - Alpha Beta vanes
  - Pitot Tube
  - IMU
  - Data logger based on FPGA with Linux
  - Potentiometers for all control surfaces
  - Engine monitoring
  - Telemetry with stall speed warning
Work Load

- 400 h/person
- 16 Weeks
- 25 h/week
Dead lines

- 16 February: Presentation of Redesign
- 23 March: Outer geometry locked
- 18 May: Flight test
Project management

Project Supervisor
Christopher Jouannet
Patrick Berry
David Lundström
Kristian Amadori

Project Manager
Christopher Jouannet

External Board
Knut Övrebö
Jan-Ove Palmberg
Sven Anzen

Full Scale Redesign

Configuration for Demonstrator

Structure
Flight Dynamics

System for Demo
CATIA

Ergonomy Design
Testing
Manufacturing
Tools

- Sizing Program in excel
- DATCOM
- Matlab
  - Aerodynamics (Tornado from KTH)
  - Flight Mechanics
- Catia V5
- Flight Gear
- OVL (aerodynamic)
- Xfoil (aero)
Project: Raven
General structure

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length = 12 m</td>
<td>MTOW 3900kg</td>
</tr>
<tr>
<td>Diameter = 1,7 m</td>
<td>OEW 2690kg</td>
</tr>
<tr>
<td>Sref 21,8m²</td>
<td>Span 14,4m</td>
</tr>
<tr>
<td>Mcruise 0,55 (40 000ft)</td>
<td>AR 10</td>
</tr>
</tbody>
</table>

- Weather radar location
- Back door solution
Main door and canopy

Canopy design:
• Follows the minimum visibility pattern
Wing: Main specifications

- Flight direction
- Ailerons
- Flaps
Spars and wing attachment

Front spar

Rear spar

"Kick spar"
Main landing gear
Nose landing gear
Back door solution

- Engine attachment
- Back door

- Width = 0.68 m
- Height = 1 m
Back door opening

1. Stretcher loading
2. Sliding track
3. Rotating track
Result – Fixed interior

- Empty plane

Dimensions:
- 1,55m height
- 5,5m width

Linköping University
INSTITUTE OF TECHNOLOGY
Result – Fixed interior
Result – Fixed interior
Result – Fixed interior

•
Result – Business Jet

- Business Jet
Result – Business Jet
Result – Business Jet
Result – Business Jet
Result - Medevac

• Stretchers

Allfa Europe
Result - Medevac
Result - Medevac
Result - Medevac
Dynamic Scaling

Froude-scaling accounts for gravitational-, and inertial effects:

Response according to scale

- Velocities
- Forces
- Angular rates, etc…
Inertia determination
Car top testing
Propulsion
Engine testing
**Sandwich technology:**

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd Layer of glass fiber</td>
<td></td>
</tr>
<tr>
<td>Sandwich material (foam or balza)</td>
<td></td>
</tr>
<tr>
<td>2nd layer of glass fiber</td>
<td></td>
</tr>
<tr>
<td>1st layer of glass fiber</td>
<td></td>
</tr>
<tr>
<td>External painting</td>
<td><strong>Epoxy resin to hold it together</strong></td>
</tr>
</tbody>
</table>
Mold Preparation
Wing manufacturing
Manufacturing
Manufacturing
Manufacturing
Manufacturing
Current Status

- Wing Finish Now...
- Systems installation and testing need to be completed
- First flight end of June
Conclusion