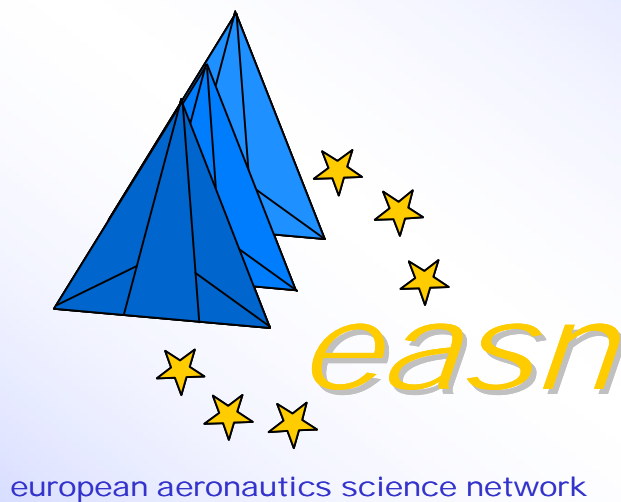


Theodoros Kermanidis; University of Patras, LTSM



Aerostructures

EASN Interest Groups

Interests Groups in Aerostructures (ACARE- ASTERA Taxonomy)

- Ageing Aircraft (P. Horst)
- Crashworthiness and structural Impact for Commercial a/c (R.Mines)
- Increased Exploitation of Metallic Airframe Materials(E.Hombergmeier)
- Surface Engg. (C. Rodopoulos)
- Damage Tolerance of Welded Aerostructures (A. Kermanidis)
- Increased exploitation of composites (G.Labeas)
- Recycling (of composites?) and Life-Cycle Management (N.N.)

IG: Ageing Aircraft

IG leader: Prof. Peter Horst, TU Braunschweig, IFL

Technology Area: Aerostructures

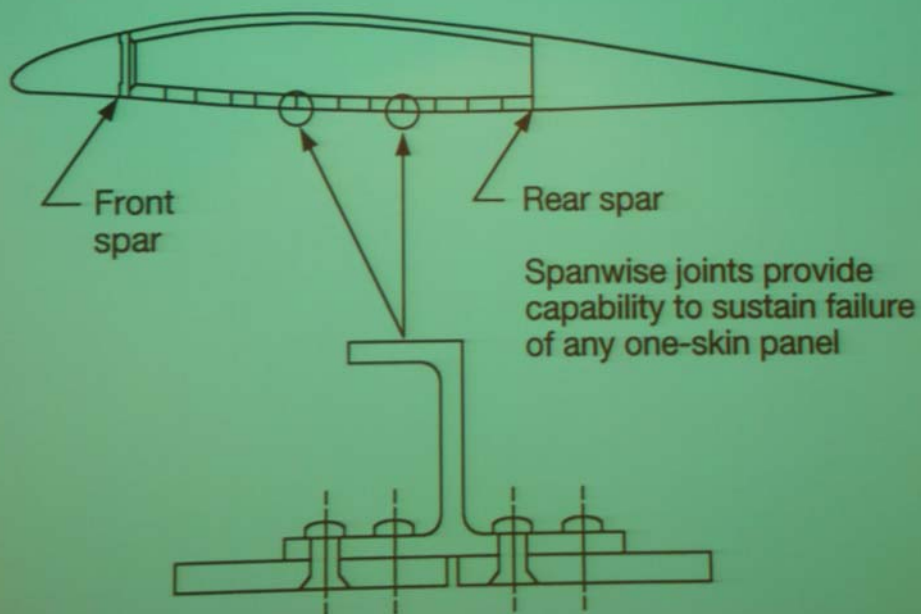
Objective:

Ageing aircraft is the technical term indicating that an aircraft is about to reach its original design goal. It is estimated that currently more than 15000 airplanes have already or are about to reach the ageing aircraft condition. At this condition, the light alloy structures used in commercial aircraft are susceptible to Widespread Fatigue Damage (WFD) and possibly other deteriorating effects, such as corrosion, fretting, etc. The widespread cracking, resulting from WFD, leads to the condition of Multiple Site Damage (MSD), which refers to the existence of interacting fatigue cracks at different sites of a structural component. Critical crack sizes are greatly reduced by the presence of MSD, decreasing the residual strength of the structure. The sudden cohesion of such interacting cracks may lead to catastrophic failure.

IG Members

| <i>Organization</i> | <i>Surname</i> | <i>First Name</i> | <i>Email</i> |
|-------------------------------------|-----------------------|--------------------------|------------------------------------|
| Airbus | Zink | Walter | walter.zink@airbus.com |
| ASMT | de Koning | Arij | asmtech@zonnet.nl |
| Brno University of Technology (BUT) | Klement | Josef | klement@fme.vutbr.cz |
| DLR | Biallas | Gerhard | gerhard.biallas@dlr.de |
| EADS - CCR France | Allehaux | Delphine | delphine.allehaux@eads.net |
| EADS - CRC Germany | Palm | Frank | frank.palm@eads.net |
| FOI | Wang | Gengsheng | wgs@foi.se |
| IDMEC | De Castro | Paulo | ptcastro@fe.up.pt |
| IFL | Horst | Peter | p.horst@tu-bs.de |
| Imperial College London | Aliabadi | Ferri | m.h.aliabadi@imperial.ac.uk |
| Israel Aircraft Industries (IAI) | Brot | Abraham | abrot@iai.co.il |
| NLR | Hoen-Velterop | Ludmila | velterop@nlr.nl |
| Sheffield Hallam University | Rodopoulos | Chris | c.rodopoulos@shu.ac.uk |
| University of Patras | Labeas | George | labeas@mech.upatras.gr |
| University of Patras | Kermanidis | Theodoros | kermanid@mech.upatras.gr |
| University of Pisa | Lazzeri | Luigi | aero.lazzeri@ing.unipi.it |
| ALCAN | Ehrström | Jean-Christophe | jean-christophe.ehrstrom@alcan.com |

Wing Fail Safety

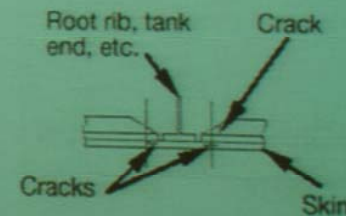
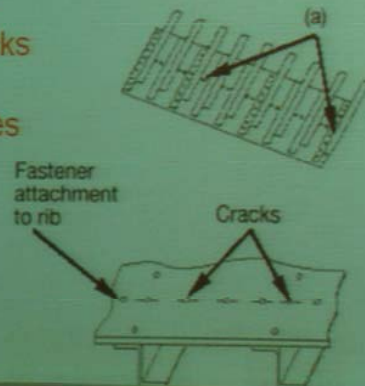


WFD Evaluation

Australian Government
Department of Defence
Defence Science and
Technology Organisation

- WFD is precluded by establishing
 - A Structural Modification Point (SMP) beyond which an aeroplane cannot be operated unless the relevant structural feature is modified or replaced
- Precautionary inspections, where viable, are introduced at
 - An Inspection Start Point (ISP)
- WFD comes in two types MSD and MED

MSD Example:
Chordwise cracks
link up at rib
attachment holes



MED Example:
Cracks in multiple components
at stiffener run-outs at root rib
or tank end rib

EASN IG-Aging aircraft

IG-Activities so far

Several Projects have been proposed under this title.

- DaToN
- ...
- BICPAN

EASN IGs

DaToN: Short History

1st proposal : was not successful

2nd proposal was successful under 6th FP
(approx. 2.8 M€)

The project just ended (Sept. 08)

Dissemination takes place
(e.g. by a special issue on the project in a scientific journal)

EASN IGs

DaToN:

| | |
|---------------------|-----------|
| IFL TU Braunschweig | Germany |
| Airbus Deutschland | Germany |
| EADS CCR | France |
| EADS CRC | Germany |
| IAI | Israel |
| ASMT | Netherl.s |
| FOI | Sweden |
| DLR | Germany |

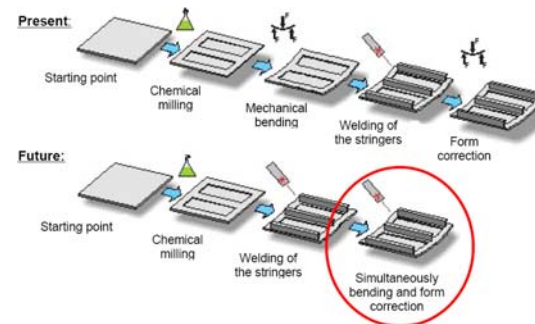
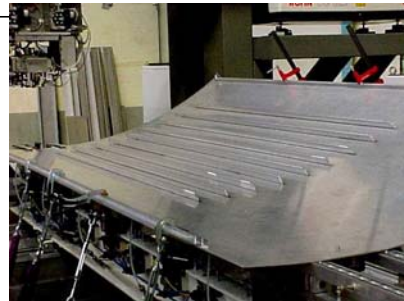
| | |
|------------------|------------|
| NLR | Netherl.s |
| IDMEC | Portugal |
| Pisa | Italy |
| Brno | Czech Rep. |
| Sheffield Hallam | UK |
| Patras | Greece |
| Imperial | UK |
| * ALCAN | France |



UNIVERSITY OF PATRAS
DEPARTMENT OF MECHANICAL AND AERONAUTICAL ENGINEERING
LABORATORY OF TECHNOLOGY & STRENGTH OF MATERIALS

Modern manufacturing techniques

The target of cost reduction and productivity increase leads industry to the production of **integral structures** by adopting new manufacturing techniques.



Modern
manufacturing
techniques

Residual Stresses

Problem definition

FE analysis

Effect of RS field
on SIFs

Prediction of crack
propagation angle

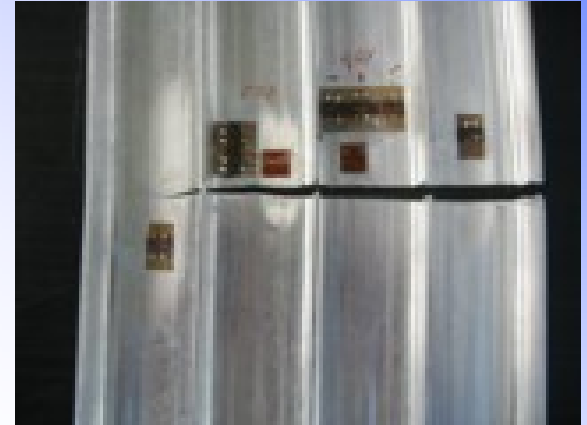
Conclusions

EASN IGs

DaToN:

New manufacturing techniques available :

- LBW
- FSW
- HSC / HPC



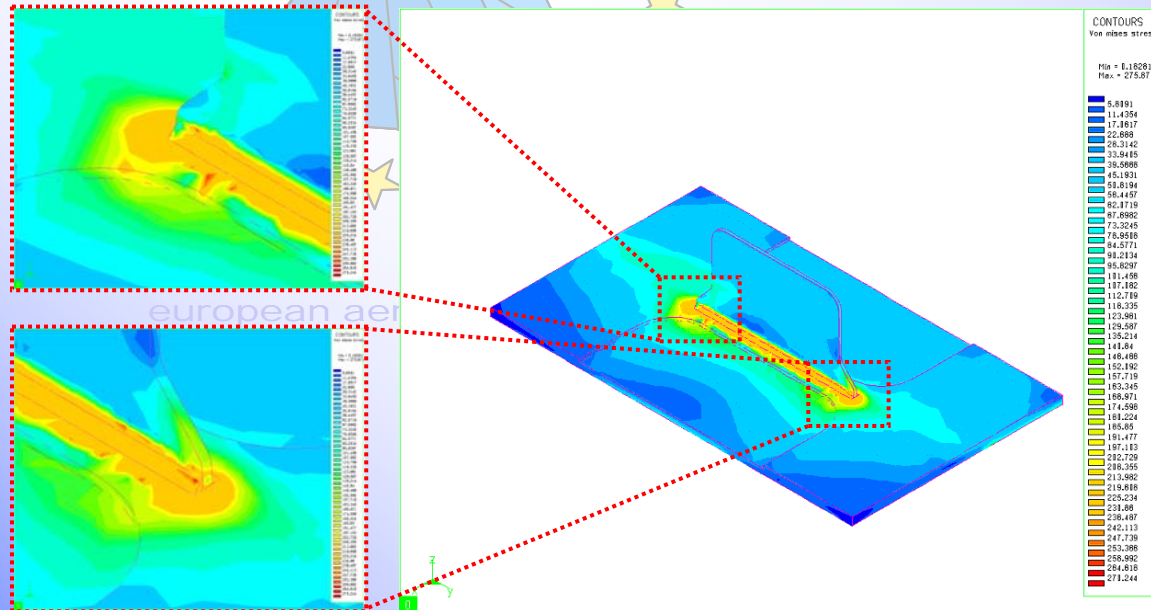
All resulting in a more or less „integrally stiffened structure“

Ability to manufacture is clearly proved.

In order to allow a reasonable (broad) application in aeronautics,
reliable assessment methods
are needed.

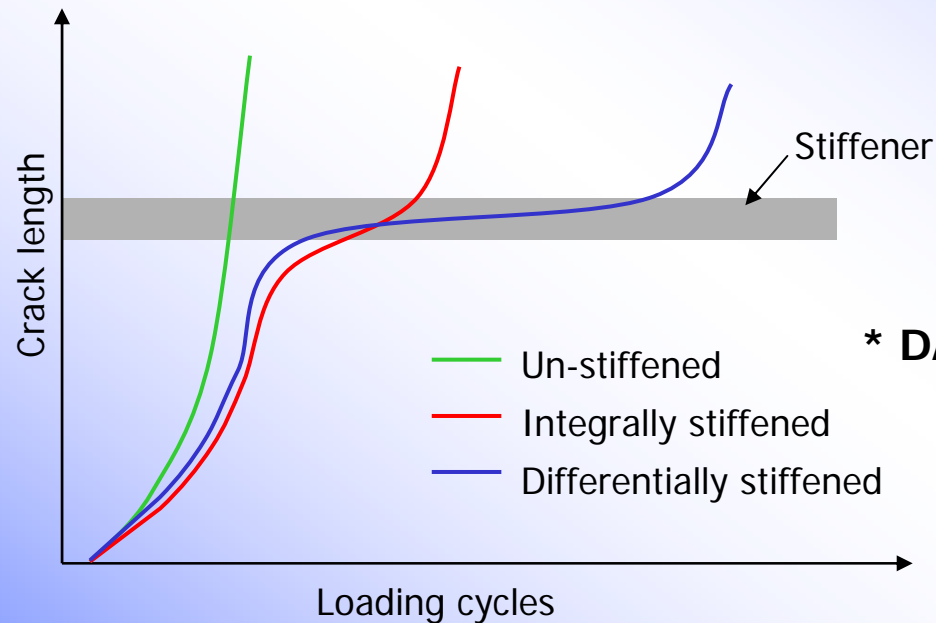
Residual Stresses in welded structures can be determined by:

- Experimental techniques (x-ray, neutron de-fraction etc.)
- Complex numerical simulation



Application of these techniques leads to:

- Development of residual stresses and deformations
- Different mechanical and damage tolerance behaviour compared with conventional differential structures



*** DATON project**

EASN IGs

Area of Interest: Aerostructures:

- Ageing Aircraft (P. Horst)
- Crashworthiness and structural Impact for Commercial a/c (R.Mines)
- Increased Exploitation of Metallic Airframe Materials(E.Hombergmeier)
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- **Recycling (of composites?) and Life-Cycle Management (N.N.)**

EASN IGs

Area of Interest: Aerostructures:

- **Recycling (of composites) and Life-Cycle Management (N.N.)**

proposed during Munich meeting

up to now interest by

- Villu Mikita (Eesti Lennuakadeemia)
- Andris Chate (Riga TU)
- ...
- Dr.-Ing. habil. Herrmann (TU Braunschweig)

Questions .. Proposals...?