



SAAB

Structural Component Testing of the Saab JAS 39 Gripen E/F

Presentation FT2019

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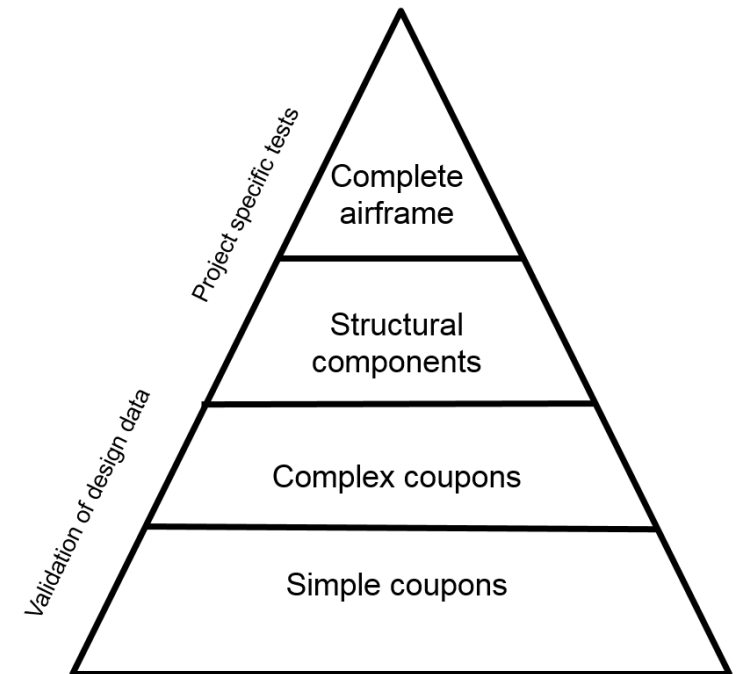
Structural Component Testing of the Saab JAS 39 Gripen E/F

→ Test verification programme for Gripen E airframe:

- Components Tests
- Full Scale Tests
- Bird Strike Tests

Pyramid of tests

- **Simple coupons**, materials basic testing
- **Complex coupons**, simplified sample with multiple parts
- **Structural Components**, important components with complete surroundings
- **Complete Airframe Tests**



Test development and verification programme

1. Control surface pivot
Generic
New material
Mixed mode loading

2. Elevon lug attachments
Generic
New material
Bearing & fretting

3. Canopy sill to stringer 01 joint at $X_{85}=6330$
New safety-of-flight item
(New material)

4. Stringer 01 joint behind $X_{85}=11170$
New design of primary load path
New safety-of-flight item
(New material)

5. Stringer 01 joint behind $X_{85}=8390$
New design of primary load path
New safety-of-flight item

6. Wing-to-fuselage joint at $Y_{85}=2000$ incl. bulkhead flanges
New design of primary load path
New safety-of-flight item
(New material)

7. Canard wing with pivot
Not included in 5.8.1/5.8.2
Service life & Damage tolerance
(New material)

8. Inner elevon
Not included in 5.8.1/5.8.2
Service life & Damage tolerance
(New material)

9. Rudder
Not included in 5.8.1/5.8.2
Service life & Damage tolerance

Component Testing of the Saab JAS 39 Gripen E/F

→ Why is component testing done?

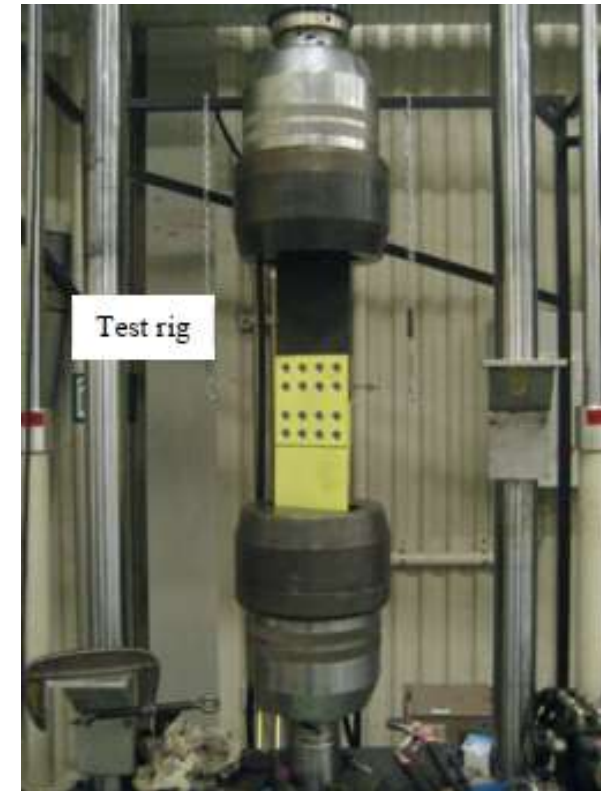
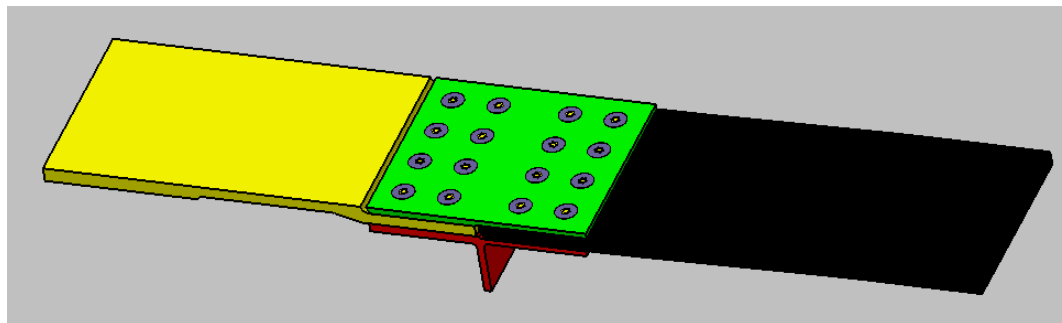
- Where a new design needs to be tested at an early stage of a project
- Where one needs continuous inspection during the test period, which can be difficult in a complete airframe test
- Where, for example, wants to do a test in temperature and environment

→ Component testing minimizes the project risk.

Component Testing of the Saab JAS 39 Gripen E/F

→ Simplified wing joint development tests

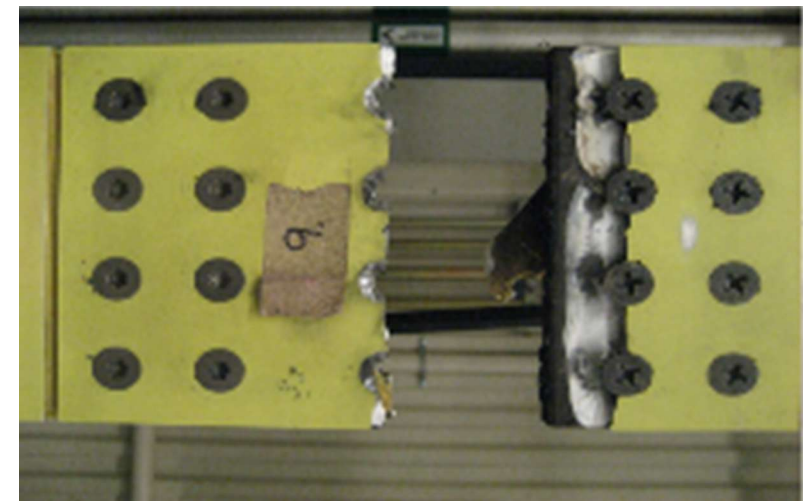
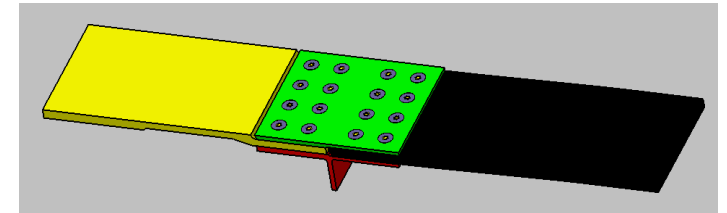
- Static
- Fatigue
- Damage Tolerance
- Several joint designs
- Two materials (AA2050 and AA7050)



Component Testing of the Saab JAS 39 Gripen E/F

→ Simplified wing joint development tests, results

- Two materials (AA2050 and AA7050)
- Two geometries
- Detailed FE-analyses of stresses and strains
- Results
 - Static test to failure (>220 % Limit Load)
 - Fatigue test to failure (withstand >4 Design Life)
 - Damage tolerance test to failure (withstand >3 Design Life)
 - This means that the requirements were met
- Failure in metallic parts



Wing to fuselage joint testing

→ The aim of the tests is

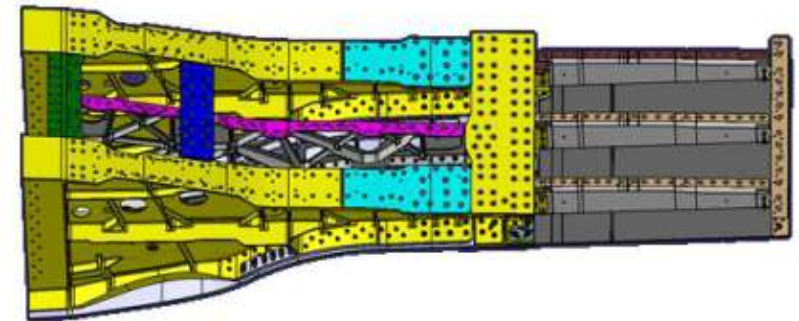
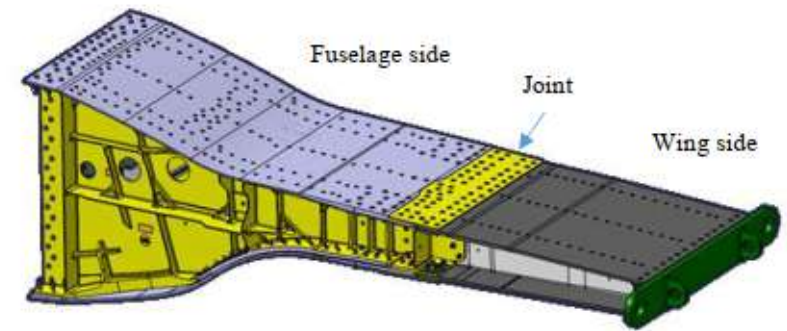
- To verify the structural integrity regarding both static strength and damage tolerance capability of the wing-fuselage joint

→ Background:

- New design principle
- Continuous joint with screws
- New materials
- Upgraded criticality

→ Testing:

- One specimen for static loading
- One specimen for damage tolerance testing with artificial defects



Wing to fuselage joint testing, results

→ Static test:

- Test has been completed without any deviations from expected results
- At the end of the test, artificial defects were introduced both in the metallic and the composite parts
- This means that the requirements were met

→ Damage tolerance test:

- Artificial defects are introduced in the metallic parts
- The test has just started

Specimen 1 in test rig.



Wing to fuselage joint testing, results

→ Static test, after testing to failure



Canopy sill to stringer testing

→ The aim of the tests is:

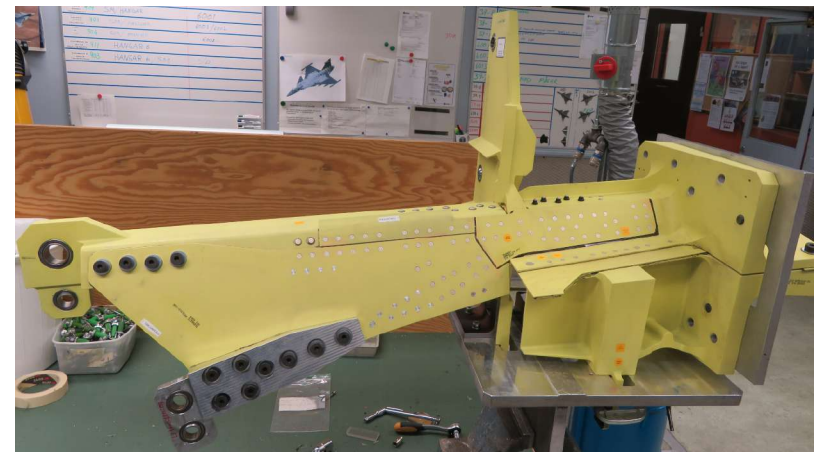
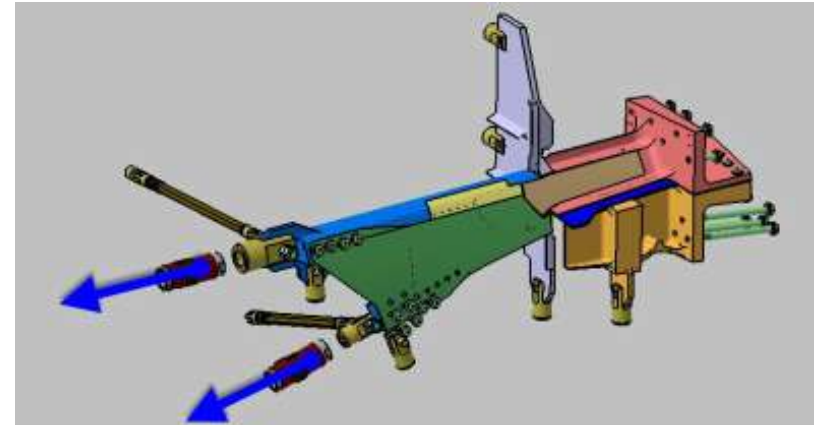
- To verify the rail joint at the frame between the Forward Fuselage and Gun Section against fatigue and damage tolerance

→ Background:

- New design principle
- New materials
- Upgraded criticality

→ Testing:

- Specimen 1: Fatigue testing
- Specimen 2 and 3: Damage tolerance testing



Canopy sill to stringer testing, results

- Fatigue test: (Specimen 1)
 - Test has been completed without any deviations from expected results
 - After ordinary testing, the load was increased with 20% DSL
- Damage tolerance test: (Specimen 2 and 3)
 - Totally artificial 18 defects are introduced, mainly at fastener holes
 - The test has just started for specimen 2

Specimen 1 in test rig.



Stringer joint behind 8390 testing

→ Background:

- New design
- Upgraded criticality

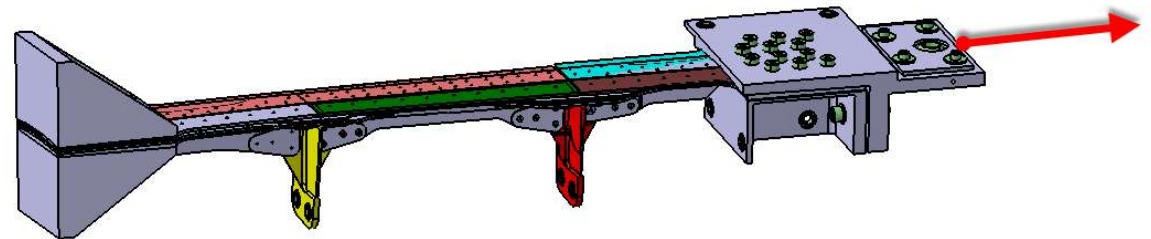
→ Testing:

- Specimen 1: Fatigue testing
- Specimen 2 and 3: Damage tolerance testing

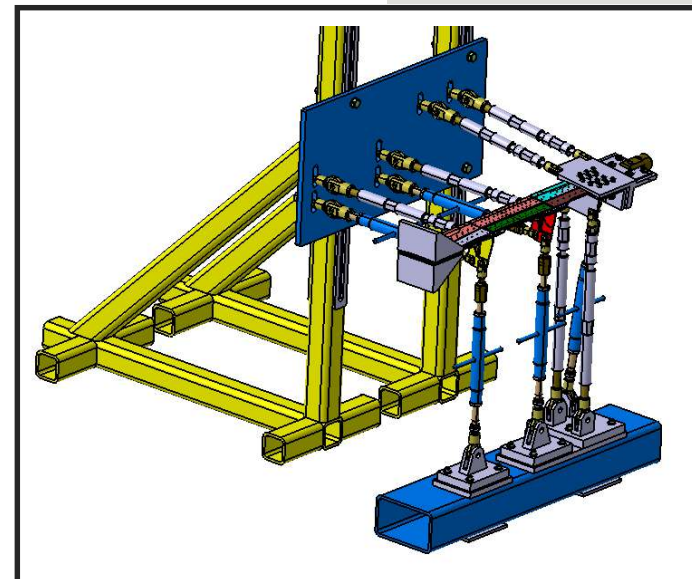
→ Status:

- Test start specimen 1 shortly

Test specimen.



Specimen in test rig.



Stringer joint behind 11770 testing

→ Background:

- New design principle
- New materials
- Upgraded criticality

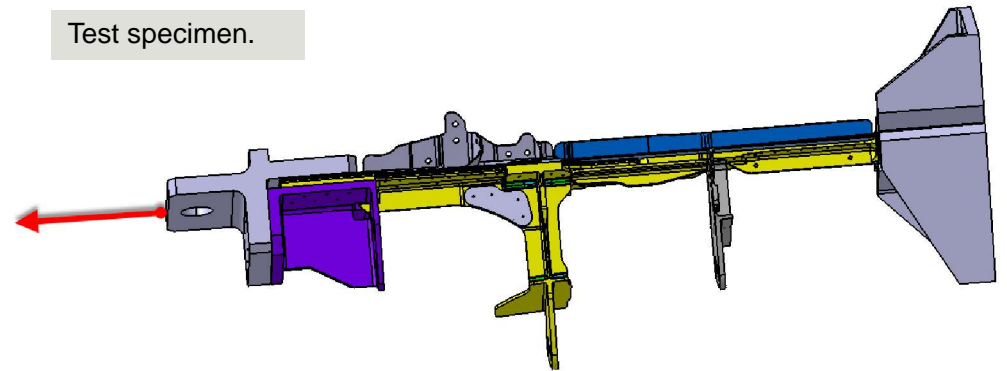
→ Testing:

- Specimen 1: Fatigue testing
- Specimen 2 and 3: Damage tolerance testing

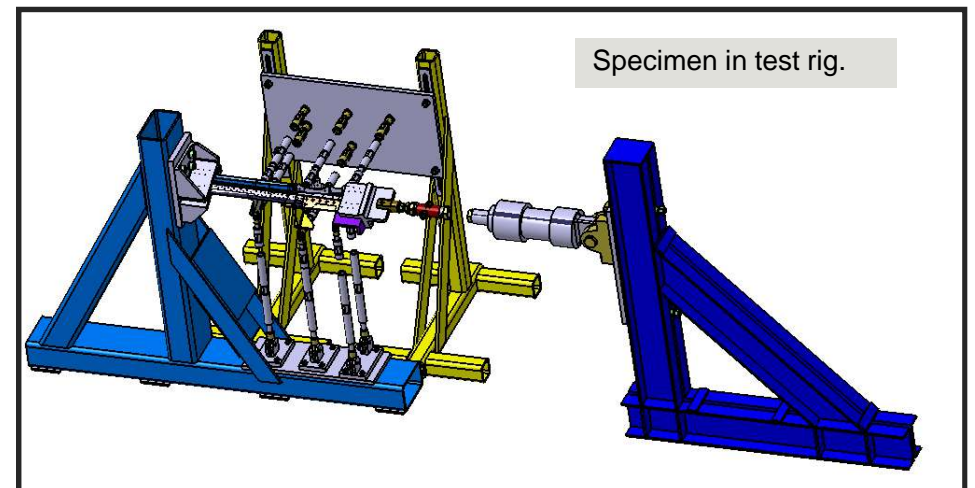
→ Status:

- Production of specimens start shortly

Test specimen.



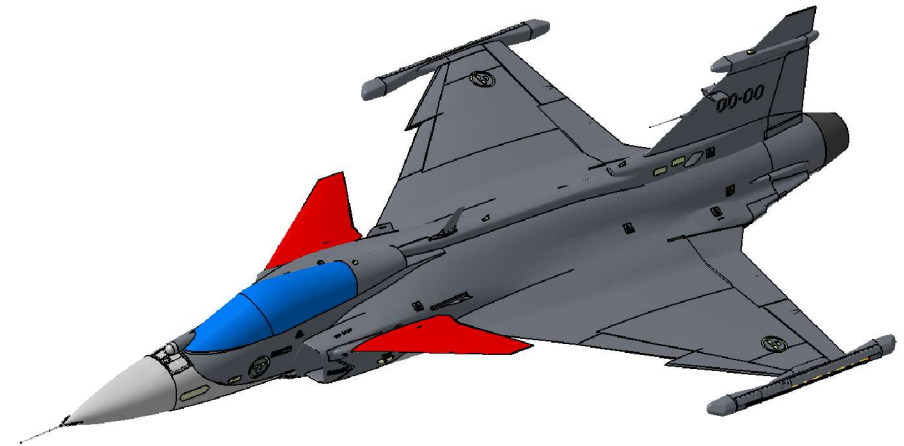
Specimen in test rig.



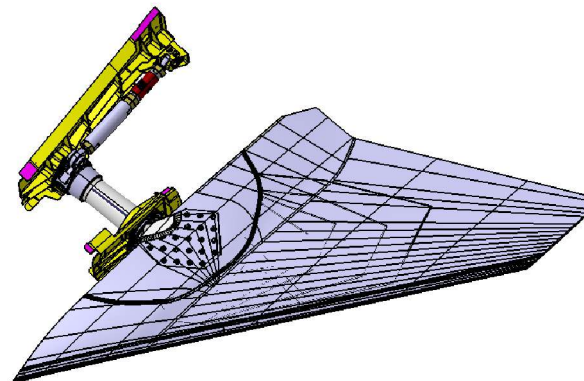
Canard wing with pivot testing

→ Description

- New materials
- New load spectra
- One specimen (from ordinary production)
- Fatigue and Damage Tolerance Test
 - Without artificial defects
 - With artificial defects



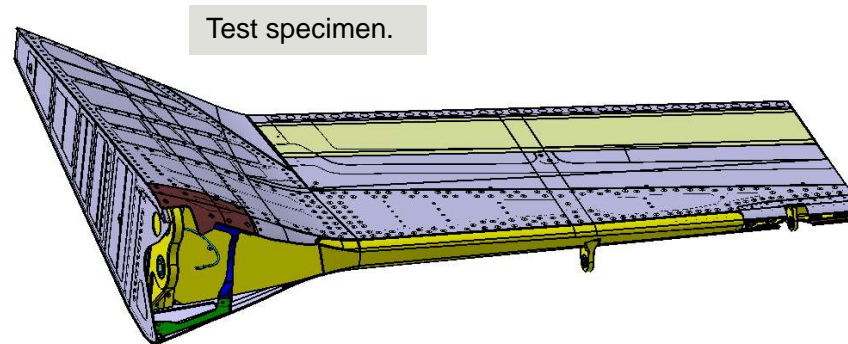
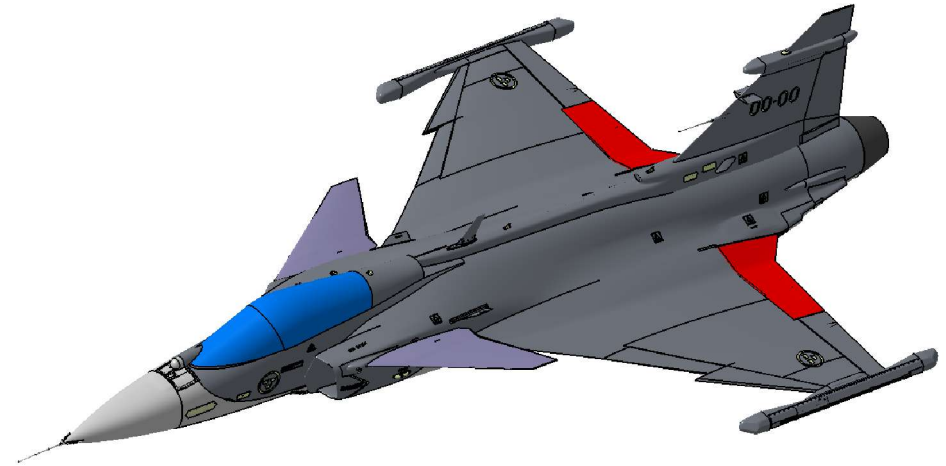
Test specimen.



Inner elevon testing

→ Description

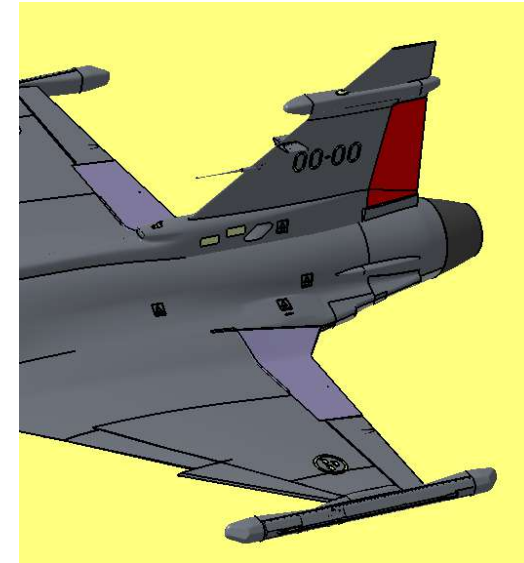
- New materials
- New load spectra
- One specimen
- Fatigue and Damage Tolerance Test
 - Without artificial defects
 - With artificial defects



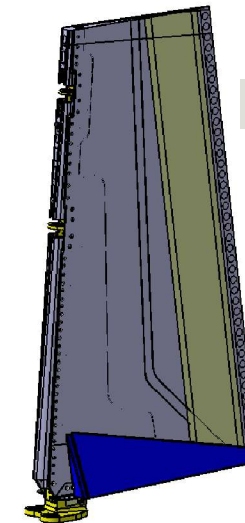
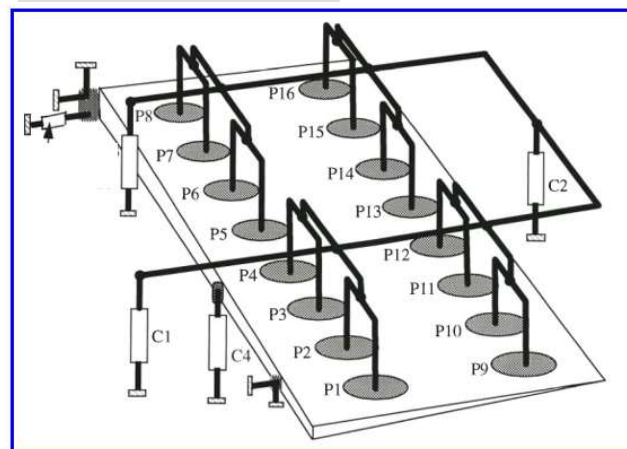
Rudder Testing

→ Description

- New load spectra
- One specimen
- Fatigue and Damage Tolerance Test
 - Without artificial defects
 - With artificial defects



Test rig, schematically



Test specimen.

Component Testing of the Saab JAS 39 Gripen E/F

→ The end

