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Trends in Defence Aeronautics Research

Examples from history and future

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OPEN | NOT EXPORT CONTROLLED | NOT CLASSIFIED Per-Olof Marklund | - | Issue 1

A 400-year legacy of defence and security







Defence Aeronautics Challenges

- Systems
 - Complex
 - Multi-disciplinary
 - Expert operated and maintained
- Large and heterogeneous development organizations
- Unusual acquirer/supplier relationship
- Long product life cycles
- *Brown field* (incremental upgrades) vs. *green field* (clean sheet) development capability







What matters Pace of change



COST BAR PAR

Evolving technology trends

- Autonomy
- Information Technology & Cyber security
- Communication
- Quantum technologies
- Green technologies
- Human-performance enhancement
- Materials and manufacturing
- ...etc
- ... in a closed system

So traditional aeronautical disciplines will always be needed!





Communication, Digitalization

Goal?





Parts of our important history

- 1947 the Swedish government sent 5 scholars to the US to learn how to design computers
 - Göran Kjellberg, b 1920
 - Erik Stemme b 1921
 - Carl-Erik Fröberg b 1918
 - Gösta Neovius b 1921
 - Nils Arne Lindberger b 1923
- 1955 the first Swedish made computer BESK (Binär Elektronisk SekvensKalkylator) was introduced



Från vänster Ingeborg Hilding, gift med en matematiker vid Princeton, Anne-Marie Neovius, gift med Gösta Neovius, Carl-Erik Fröberg, Gösta Neovius och Göran Kjellberg. Foto: Edy Velander.



Digitalization – Aircraft Design

- Introduced in mid 1950
- Load distribution J35 Draken







SARA – "Saab Automatic Calculation Apparatus"

Innovation track record 1937-

- 1st Ejection Seat
- 1st A/C modified from propeller to jet engine
- 1st Swept Wing Jet in Europe
- 1st production A/C with afterburner
- 2 world speed records
- 1st Saab Supersonic A/C
- 1st Saab System A/C ex Radar
- 1st Double Delta Wing
- 1st Canard configuration in production
- 1st A/C w Central Computer
- 1st Tactical Data Link bw A/C
- 1st Digital FCS
- 1st Auto Gun Aiming
- 1st HUD in production
- 1st virtual target training aid
- 1st metal bonded wing panels in Mach 2 A/C
- Unprecedented capability- size ratio
- First Nato fighter of 4th generation
- First fully autonomous flight in Europe
- First fighter to fire Meteor
-

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J21	(prod.1944-47)
J21	
Tunnan	(1st flight 1948)
Tunnan	
Tunnan	
Lansen	(1st flight 1952)
Lansen	
Draken	(1st flight 1955)
Viggen	(1st flight 1967)
Viggen	
Gripen	
Gripen	
Sharc	
Gripen	
Gripen	
Gripen	





















Automation in Systems Development and V&V





Materials and Manufacturing



• "Could we 3D-print an entire aircraft"?





Photo: Divergent

SAABS FIRST FLYING CFRP COMPONENT, 1971 TRIM TAB, SAAB 105 RUDDER





Composite design used at Saab 2023

Monolithic structures

Sandwich

Assembly of monolithic and/or sandwich structures

Co-bonded structures

Co-cured structures









Saab Trials 3D-printed Part on Gripen for Battlefield Damage Repairs

Saab has successfully conducted the trial which marked the first time an exterior 3Dprinted part has been flown on a Gripen, rather than internal 3D-printed components. The purpose of the trial was to test how additive manufacturing could be used in battlefield damage repair.





Thank You!

Questions?

