Gripen update and Saab preparations for HX

Linköping, February 7th 2019
Welcome to Linköping!

Aeronautics and Gripen

Jonas Hjelm
Head of Aeronautics
In 1937 We Took Off

Parts of our history go back to the 17th century through the famous scientist Alfred Nobel.

In 1937, Saab was founded to protect Sweden’s borders and its people.

Born smart – as a small country, we were forced to arm ourselves with good and cost-effective equipment.

On our journey we created Sweden’s computer, missile and space industries.
How we are organised

CEO

Group Functions
- Finance
- Strategy
- Human Resources
- Legal Affairs
- Communication
- Governmental Affairs, Procurement, Quality and Environment, ICT

Market Areas
- North America
  - Washington, USA
- Latin America
  - Brasilia, Brazil
- Europe, London, UK
- Middle East & Africa
  - Abu Dhabi, UAE
- Asia Pacific
  - Singapore

Business Areas
- Aeronautics
- Dynamics
- Industrial Products and Services
- Kockums
- Support and Services
- Surveillance
Saab in Linköping

**Aeronautics**
- Gripen, Advanced Pilot Training Systems, Unmanned Aerial Systems

**Dynamics**
- Missiles, torpedoes, Remotely Operated Vehicle and Autonomous Underwater Vehicle

**Surveillance**
- Civil security, TransponderTech and airborne early warning systems (EriEye, Global Eye)

**Support and Services**
- Gripen maintenance, Flight School SK60, maintenance of Saab 340/2000 and its spares and modifications of Erieye etc

**Industrial Products and Services**
- Aerostructures

**Combitech**
- High-tech consultancy

**Corporate functions**
Aeronautics

Product areas

- Gripen
- Advanced pilot training systems

Locations:
Sweden, Brazil

Headed by:
Jonas Hjelm

Share of sales 2017

23%

Order backlog, MSEK 50,154
Sales, MSEK 7,267
Operating income*, MSEK 478
No. of employees (FTE) 3,073
Saab and Boeing signed an agreement in 2013 to offer a new, advanced and cost-efficient trainer aircraft in the competition to replace the US Air Force’s T-38 aircrew training system.

The Boeing-Saab team delivered the winning proposal and the acquisition includes 350 aircraft.
Gripen E-series
In production

Serial aircraft for Sweden and Brazil in production
Our global footprint

Gripen Prospects
Gripen E-series

Designed to counter and defeat today’s and tomorrow’s most advanced threats in a very complex environment.

• True multi-role
• Designed for the purpose
• Most recent technology
• Future-proof design
• Maximizing operational effect for the money invested
“MY OFFICE DEVELOPMENT”
The **rapidly evolving** battlespace

- Rapid technological development
- High-tempo operations
- Long range weapons and radars
- Low observable targets
- Advanced electronic warfare
- More data to analyse
- Rapid obsolescence
The rapidly evolving battlespace

For the pilot, this means:

• No threat avoidance
• Deal with low-signature threats
• Human machine collaboration
• Full spectrum control
  • More information
  • Higher pace…
The **rapidly evolving** battlespace

The future of air power is defined by [technology](#) and how you use it.
Gripen E

Embrace technological development and turn it into operational effect.
GRIPEN E

- External Sensors
- Improved Communication
- Superior HMI and Decision Support
- AESA Radar
- IRST
- Electronic Warfare MAW & MFS
- New Avionics Architecture
- More weapon stations
- Increased Thrust
- Increased Range
- Airframe upgrades
- General Systems upgrade
- External Sensors

NOT EXPORT CONTROLLED | NOT CLASSIFIED
Gripen E – one step ahead

Operational effect is enabled by

- Ensuring a quick decision cycle
- Breaking the opponents decision cycle
Gripen E – one step ahead

Observe – Situational Awareness

- Advanced Sensors
- Data Collection
- Sensor fusion
- Shared resources
- Human Machine Interface
Gripen E – one step ahead

Orient – Situational Awareness

- Quick answers to the pilot’s questions
- Transparent Data Fusion
- Cross-platform awareness
Gripen E – one step ahead

Decide – Advanced Decision Support

- Answer the pilot’s questions
- On board simulation
- Cross-sensor awareness
- Human Machine Collaboration
- Transparent automation
Gripen E – one step ahead

**Act – High Level Control**

- Assign the aircraft complex tasks
- Balanced workload between the aircraft and the pilot
- Possibility to quickly move from high to low level control
GRIPEN E HMI
Gripen E – one step ahead

Adapt fast. Stay relevant.

- Smart avionics architecture
- New threats require new tactics
- Tailored applications and H/W changes
- Quick integration with minimum testing
- New functions updated during a mission.
Gripen E – one step ahead

Critical functions
Tactical functions
In short

Three Challenges
Evolution/Revolution
Configurable Avionics Platform
"Estimated software development cost increased by a factor of almost 300 over a 32 year period"
<table>
<thead>
<tr>
<th>NOT EXPORT CONTROLLED</th>
<th>NOT CLASSIFIED</th>
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**COMPLEXITY, NEW ECOSYSTEMS**

<table>
<thead>
<tr>
<th>2005</th>
<th>2016</th>
</tr>
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*Example: Tech Stack needed to push a webpage*
Moving at the pace of change

“COMPLEXITY OF EMBEDDED SYSTEMS GROW WITH APPROX 10X EVERY 7TH YEAR”

Prof. dr. ir. Jan Bosch, Chalmers
PACE OF CHANGE

- Complexity
- Pace
- Safety

Diagram showing the relationship between time and capability, with traditional systems and computer power represented on the graph.
DIGITALIZATION – TO INTEGRATED
DIGITALIZATION – INTEGRATED MODULAR AVIONICS
DIGITALIZATION – INTEGRATED MODULAR AVIONICS
DIGITALIZATION – INTEGRATED MODULAR AVIONICS
INDEPENDENT LAYERS
Software independent of hardware
INDEPENDENT LAYERS

Hardware independent of software
INDEPENDENT LAYERS

Code, tools, automatic tests
INDEPENDENT LAYERS

Code once

Mix criticality

Assured to strictest standard

Reconfigurable

Agile development
INDEPENDENT LAYERS

- Requires a lot of initial effort
- Easy to add/delete(modify)
- Allows for third party or partner involvement
- Easy to upgrade computers
Adapt fast. Stay relevant.

- Is the system upgradable, adaptable and reconfigurable?
- How hard is it to add more customer value?
- How fast can more computer power be added?
Finnish Journalist Visit, February 7 2019

Electronic Warfare on Gripen

Inga Bergström, M.Sc. E.E.
Sales Director, Product Unit Fighter EW, Surveillance
This is Electronic warfare - EW

- The Electromagnetic (EM) spectrum covers all energy radiated by means of EM waves and include:
  - Radio communications
  - Radar transmissions
  - Laser/ Infrared radiation

- EW is the combat for the control over the EM spectrum

- The goal is to gain superiority against enemy sensors
Electronic Warfare is a force multiplier
Achieve the unexpected
Signal and threat environment

Stealth fighter

5G telecom

Long range surface-to-air

AWACS

Short range surface-to-air

Air-to-air IR missile
Fighter aircraft protection

Avoid Detection
Avoid Acquisition
Avoid Lock-on
Avoid being Hit

Detect Target
Locate Target (Acquisition)
Track Target
Launch
Survival in the air

- Detect Target (Surveillance)
- Locate Target (Acquisition)
- Command & Control
- SPJ
- Missile Launch
- Track Target

Probability vs. Time

Avoid Detection
Avoid Acquisition
Avoid Lock-on
Avoid being Hit

| NOT EXPORT CONTROLLED | NOT CLASSIFIED |
Fighter EW requirements – passive sensors

- Radar and Missile approach warning for self protection
- Electronic Support Measure for tactical support

See the unseen. Before being seen.
Fighter EW requirements - Countermeasures

- Electronic countermeasures
- Countermeasure dispensing

Defeat any threat. Anywhere.
Advanced pylon integrated CMDS*

- Stealth capabilities alone cannot protect an aircraft
- Radar- and IR-countermeasures still an attractive end-game self-protection solution
- New range of pylon-integrated "invisible" countermeasure dispenser systems

*Counter Measure Dispenser Systems
<table>
<thead>
<tr>
<th>Year</th>
<th>Systems</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1960</td>
<td>RWR &amp; CMDS</td>
<td>Radar Warning Receiver and Countermeasure Dispenser Systems</td>
</tr>
<tr>
<td>1980</td>
<td>RWR &amp; CMDS</td>
<td>Radar Warning Receiver and Countermeasure Dispenser Systems</td>
</tr>
<tr>
<td>2000</td>
<td>SIGINT</td>
<td>Signals Intelligence</td>
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</tbody>
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**Saab EW Experience – a selection**

- **Jammer Pod**
- **RWR & CMDS**
- **CMDS**
- **RWR & CMDS**
- **RWR & CMDS**
- **SIGINT**
- **ESM/ELINT**
- **RWR/ESM, ECM & CMDS**

**Equipment and Systems**

- **J32E Lansen**
- **BOZ-EC**
- **Gripen A/B**
- **IDAS, integrated self protection system**
- **EPS, Land SIGINT**
- **UME/SME**
- **Naval SIGINT**
- **HES-21, Airborne ESM/ELINT**
- **Gripen E/F**

**Abbreviations**

- **RWR**: Radar Warning Receiver
- **CMDS**: Countermeasure Dispenser Systems
- **SIGINT**: Signals Intelligence
- **ESM**: Electronic Support Measure
- **ELINT**: Electronic Intelligence
- **ECM**: Electronic Countermeasure

**Time Periods**

- 1960
- 1980
- 2000
- 2020
Cutting edge technology

Low signature dispenser installation

Cognitive Processing & Identification

Digital Receiver and Exciter

Antenna Technology based on Gallium Nitride (GaN)
EW installation

MAWSU, rear right

BOP-G – Chaff/flare Dispenser (3 pcs)

RPS – Receiver and Power Supply unit (2 pcs)

QRT – Quadrant Receiver and Transmitter (4 pcs)

MAWSU, up

MAWSU, fwd right

TFA – Transmitter Forward/Aft (2 pcs)

NGIR – Next Gen IR MAW processor

PPU – Primary Power Unit (2 pcs)

EWCU – Electronic Warfare Central Unit

ELECTROMECHANICAL DISPENSERS

PYROTECHNICAL DISPENSERS
Jamming capabilities

- Self-protection jamming
- Escort jamming
- Stand-off jamming
Electronic Attack Jammer Pod

High Power & efficient GaN AESA's
Complement to Gripen on-board system
To summarize

• EW Solutions on Gripen utilize the latest technology developments to cope with the evolving threat scenarios
• Passive sensors provides excellent situational awareness and tactical support
• EW providing self protection and enables offensive operations
• Silent behavior and smart countermeasure techniques outrivals airframe shaping
Thank you for listening!

Inga Bergström
Gripen for Finland - a perfect match

- Long-term commitment for Finland
- Gripen is designed for the task
- Latest available and future-proofed technology – on-board a proven and mature Gripen system
- Security of Supply in close cooperation with local industry
- Unbeaten cost efficiency – maximum operational effect for the budget