GRIPEN

COST AND TIME EFFECTIVE WEAPON INTEGRATION

AEROSPACE TECHNOLOGY CONGRESS 2016

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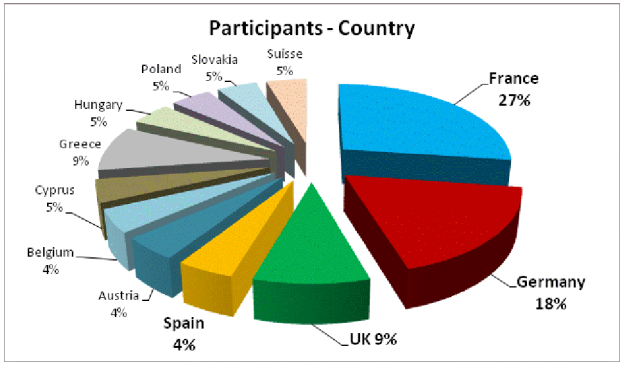
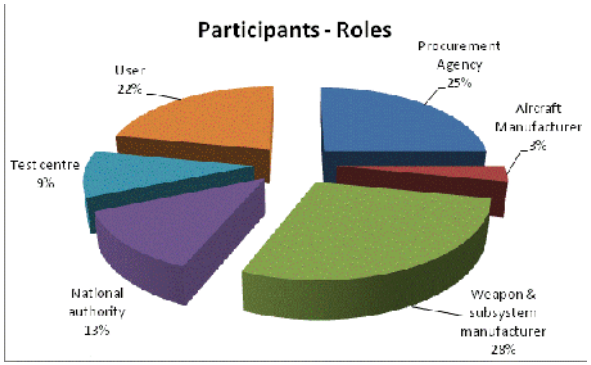
AGENDA

- Weapon Integration Issues
- Cost Drivers
- Customer Needs
- Integration examples on Gripen
- What is the Secret?
- Conclusions

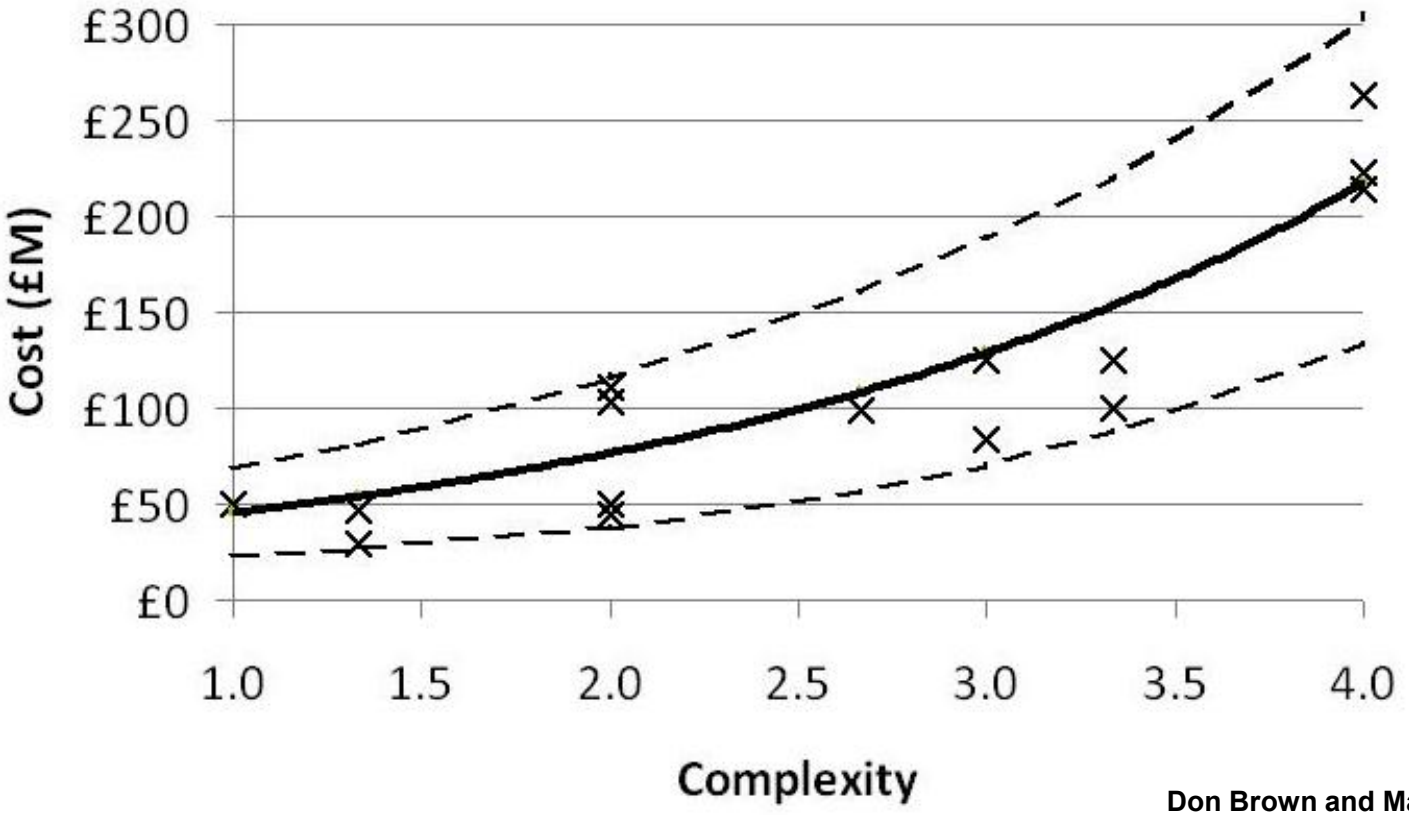
WEAPON INTEGRATION ISSUES
EDA WORKSHOP, 2013





- **Complex integration drives costs**
  - 15-50 M€ for simple integrations
  - Up to 200 M€ for complex integrations (4th generation a/c)
- **Identified cost drivers**
  - Unrealistic requirements
  - Lack of standards
  - Lack of Common methodology
  - Low confidence in qualification results between actors

INTEGRATION - COST VS COMPLEXITY



Don Brown and Matt McNally; *"Weapons Integration Cost Modelling presentation to SCAF"*

COST DRIVERS - SAABS INTERPRETATION

- Defining the operational requirements
- System integration levels
- Defining the critical parameters
- Weapon/sensor maturity
- Multi-phased integration
- Agreement on essential operational envelope
- Interoperability with other units/GSE

SMALL FIGHTERS – REALITY CHECK

CUSTOMER NEEDS & EXPECTATIONS

- Changing threats and operational tasks
  - New tactics require modified capabilities
  - Revised requirements from allies, ground forces and C4I
  - Defences and penetration needs require new approach profiles
  - Data-link and BDA requirements
- Level of Integration
  - Weapon HMI compatibility with aircraft logic
  - HOTAS philosophy
  - Dynamic envelopes
  - Data-links
  - Recording and playback to crew
  - Testing and Health monitoring
- Maintenance & Logistics

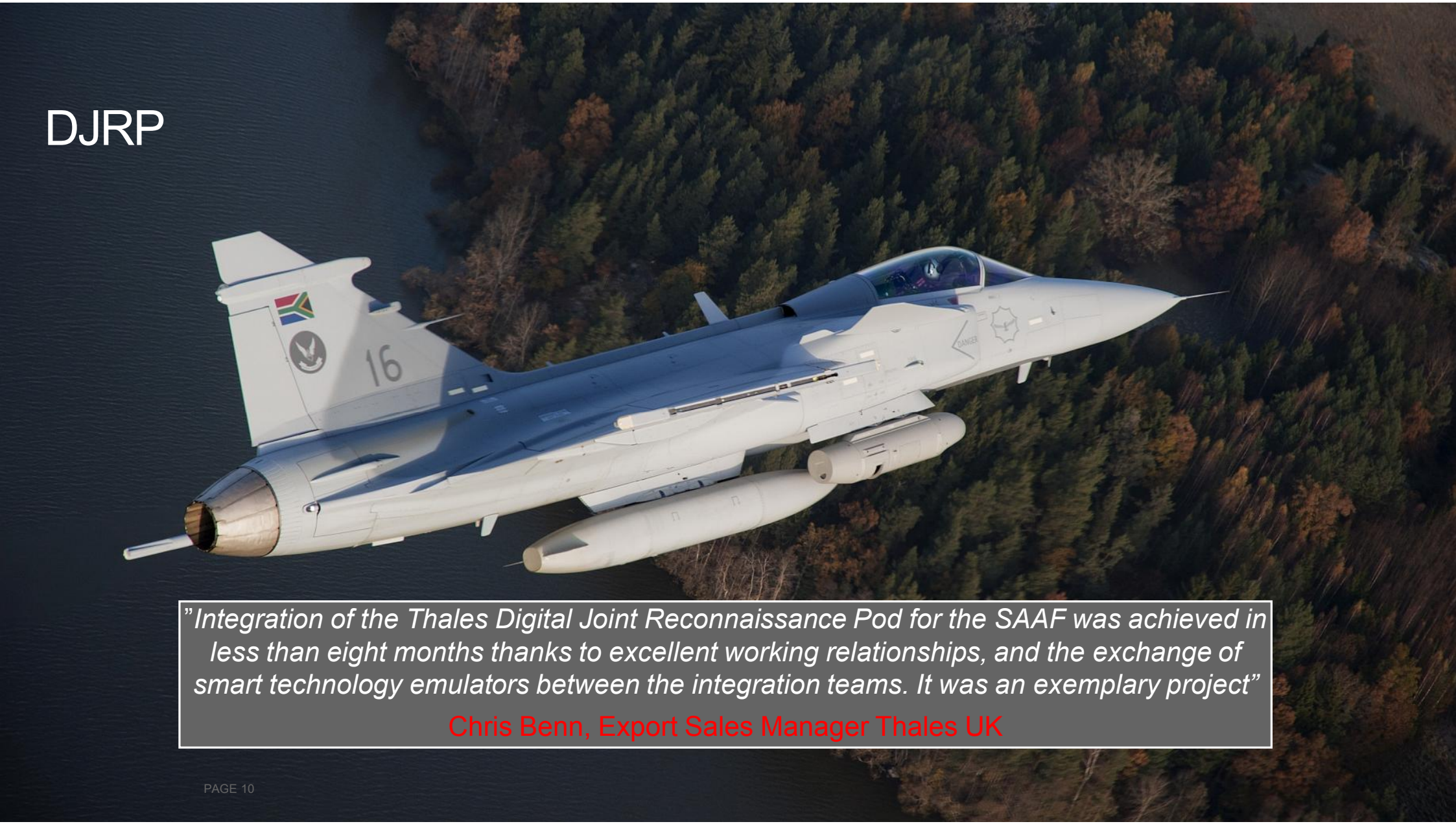
REACH EARLY AGREEMENT!

- **Definition Phases**
  - Realistic interpretation of requirements
  - Definition of envelope and function
  - Avoid “Full envelope” and “All”
- **Involve pilots, logistics and integration engineers**
- **Vendor involvement**
  - Early agreements on limitations and options
  - Platform/weapon interaction risks
- **Limitations**
  - Clear distinction between Weapon and Platform limitations
- **Limit scope of Test and Verification and Means of Compliance**
  - Define test objects (dummies, inert, instrumented)
  - Realistic schedule!
  - “What if” planning

SAAB LESSONS LEARNED

- Ask for what you really need!
  - Limited envelope
  - The extra 10% will cost a lot more
- Phased introduction
  - Lower risk
  - Learn and update
  - Operational evaluation phase before final integration
- Keep aircraft and HMI interface logic
  - Reduce error risk
  - Limited training
- Simulate extensively in operational scenarios to evaluate usability

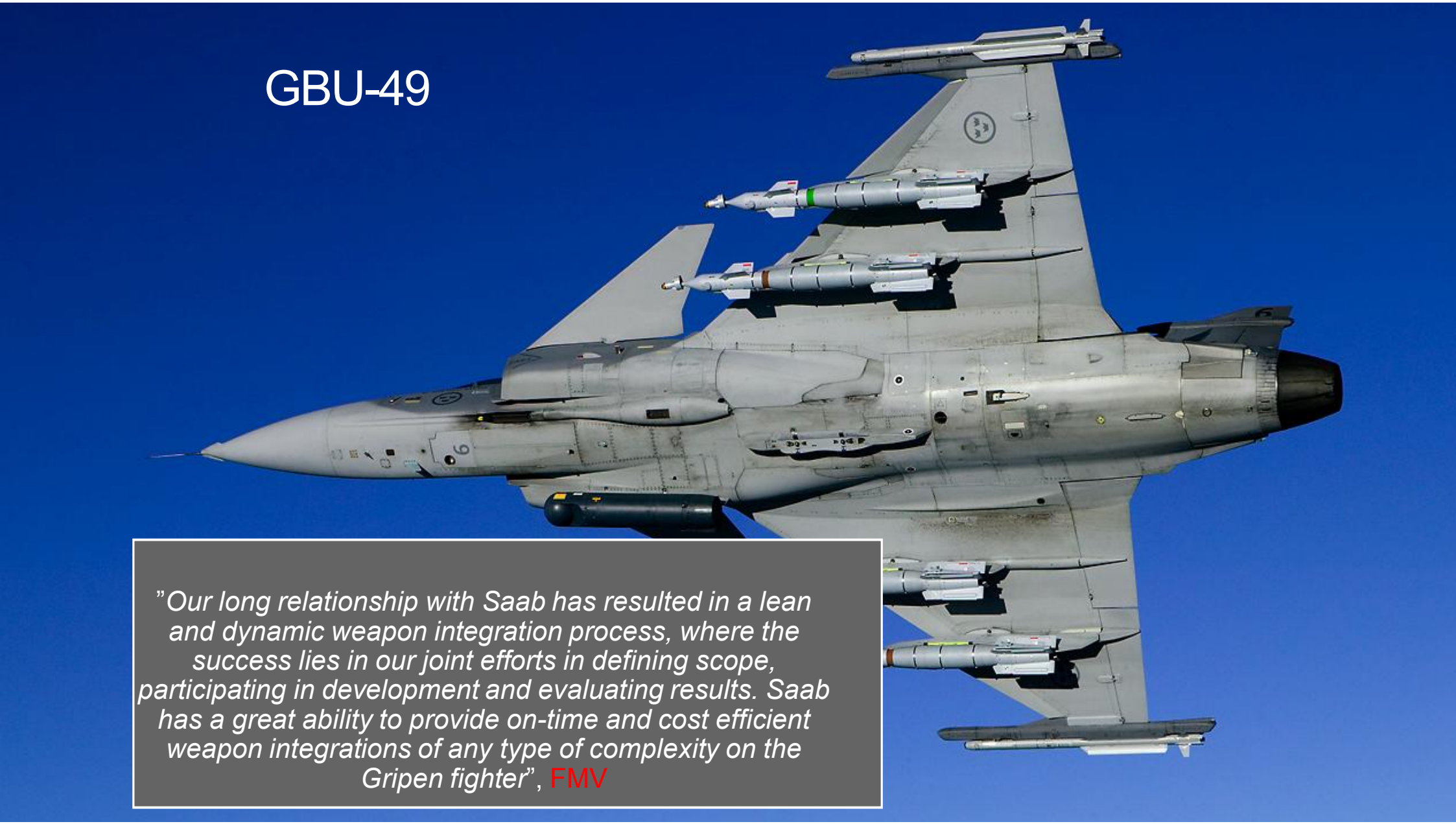
DJRP



”Integration of the Thales Digital Joint Reconnaissance Pod for the SAAF was achieved in less than eight months thanks to excellent working relationships, and the exchange of smart technology emulators between the integration teams. It was an exemplary project”

Chris Benn, Export Sales Manager Thales UK

GBU-49



”Our long relationship with Saab has resulted in a lean and dynamic weapon integration process, where the success lies in our joint efforts in defining scope, participating in development and evaluating results. Saab has a great ability to provide on-time and cost efficient weapon integrations of any type of complexity on the Gripen fighter”, FMV

IRIS-T

” It was a great experience to work with Saab during the IRIS-T integration, because it was a lean, well structured and well managed program using a standardized integration scheme to the maximum extend possible, starting even in parallel to the missile development”

Albert Zuzej, Head of Business Unit Air Force Systems, Diehl BGT Defence

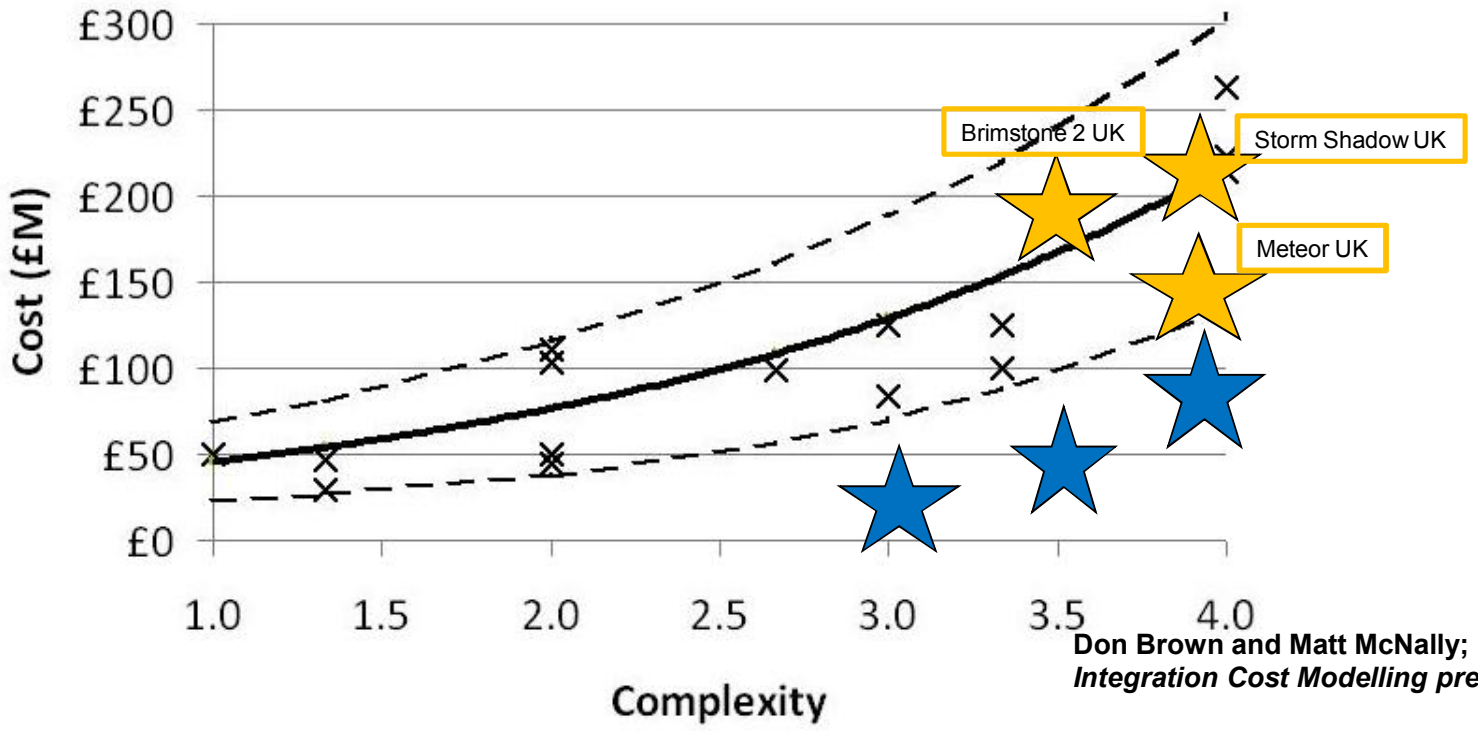
METEOR

“The Saab Gripen has been used extensively through the development of MBDA’s Meteor Beyond Visual Range Air-to-Air Missile. Gripen has been used for firing trials both in the UK and Sweden and we have been delighted with the close working relationship we have created with Saab through this important pan European programme. Saab and MBDA are now working together to complete the full integration of Meteor onto Gripen for the Flygvapnet.”

MBDA UK Ltd.

COMPARISON

Gripen Weapon Integration



Report
by the Comptroller
and Auditor General

Ministry of Defence

Major Projects Report 2015
and the Equipment Plan
2015 to 2025

Don Brown and Matt McNally; "*Weapons Integration Cost Modelling presentation to SCAF*"

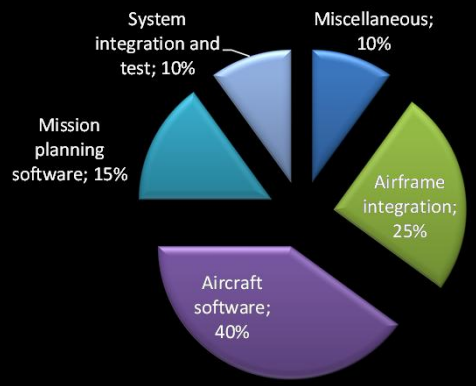
GDP AND MILITARY SPENDING

	2012 (M$)	Military spending 2012 (% of GDP from SIPRI)	Military spending 2012 (in M$)	Fighters (developed and introduced between 1980 and 2013)
USA	15 684 750	4.7 %	737 183	F18/F22/F35
Germany	3 400 579	1.4 %	47 608	
France	2 608 699	2.3 %	60 000	Rafale
Sweden	526 192	1.2 %	6 314	Gripen (A/B, C/D, E)

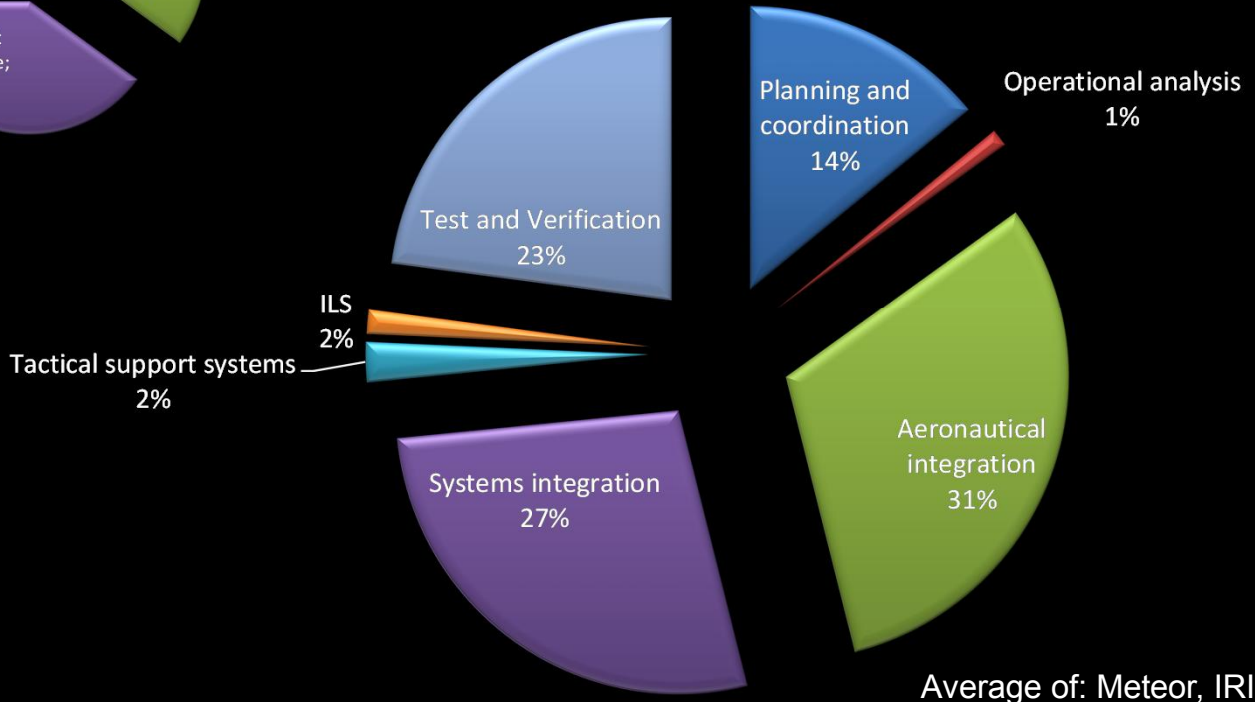
Sweden´s total military spending is far below other fighter-building nations:
- 1% of US spending
- 4 % of Eurofighter countries (Italy, Germany, Spain and UK) spending
- 10% of France´s spending

- **GDB (Gross Domestic Product) data from IMF**
- **Military spending from SIPRI (Stockholm International Peace Research Institute)**

Reference Keith Rigby



Average Saab Weapon Integration

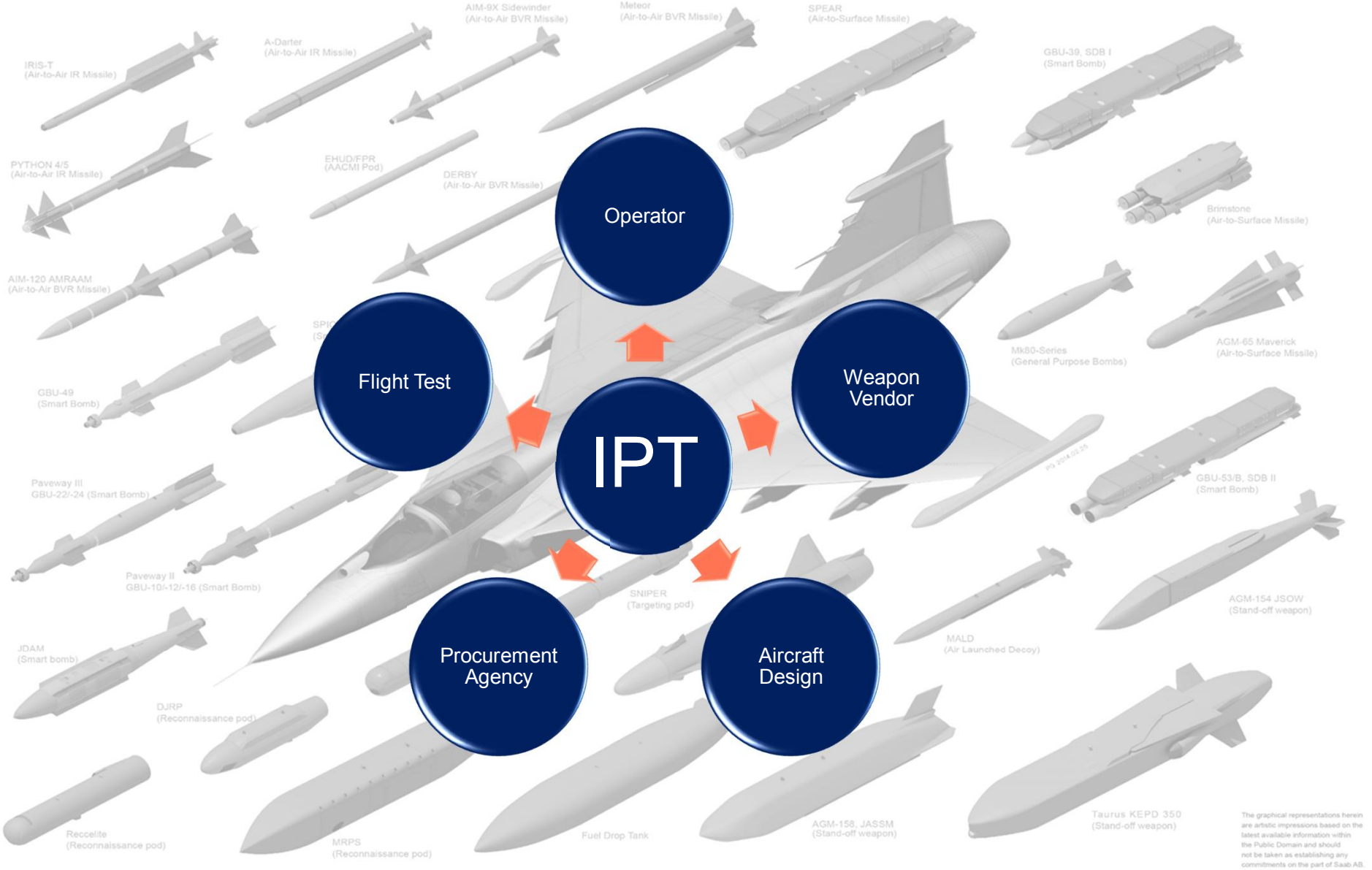


Average of: Meteor, IRIS-T, A-Darter, AGM-65, SDB, DJRP, GBU-49 integrated on Gripen C/D

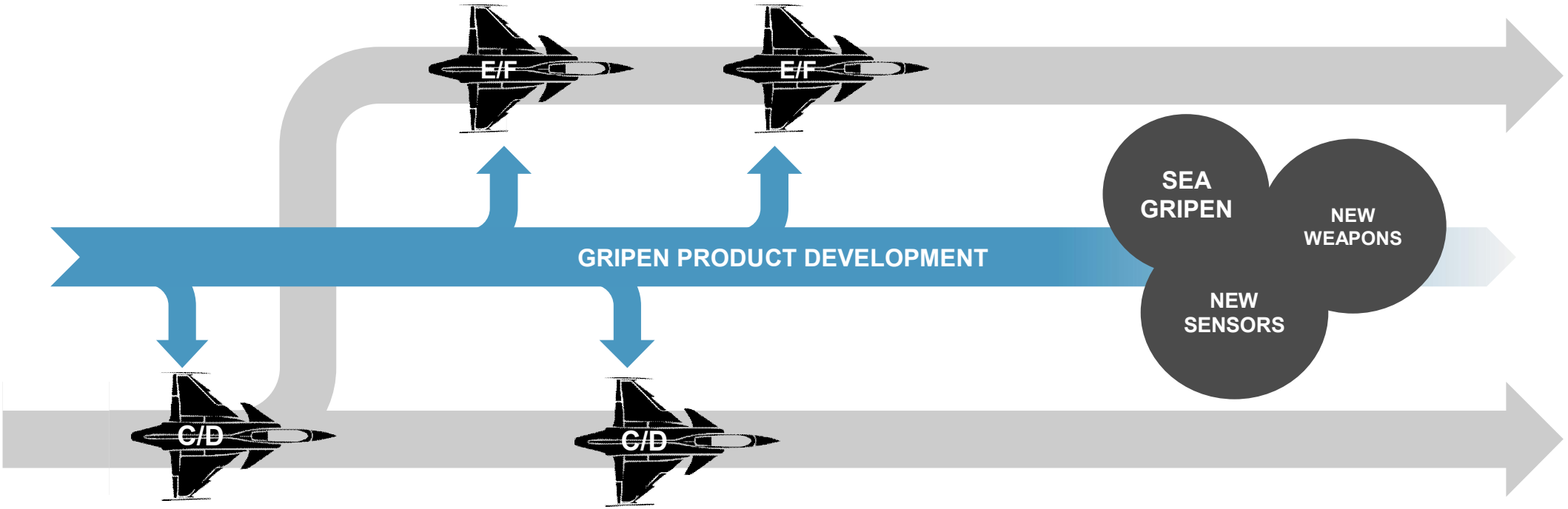
WHAT IS THE SECRET?

The platform:

- Very short development loops – new releases every 2-3 years
- Planned growth with spare capacity
- Saab has full responsibility and control of functionality and software in the core avionics system and the total weapon system
- A long tradition of model based design (starting already with J35 Draken and JA37 Viggen)



MODULARITY IN DESIGN



WHAT IS THE SECRET?

The Culture:

- A lean and flat organization
- Empowerment of co-workers
- Communication!
- Closeness (also geographically) between all functions
- Our experts make the technical decisions – not the managers!
- Errors and problems are early identified – no blame gaming!
- Competence driven culture rather than hierarchy driven

CONCLUSIONS

Saab has the ability to integrate:

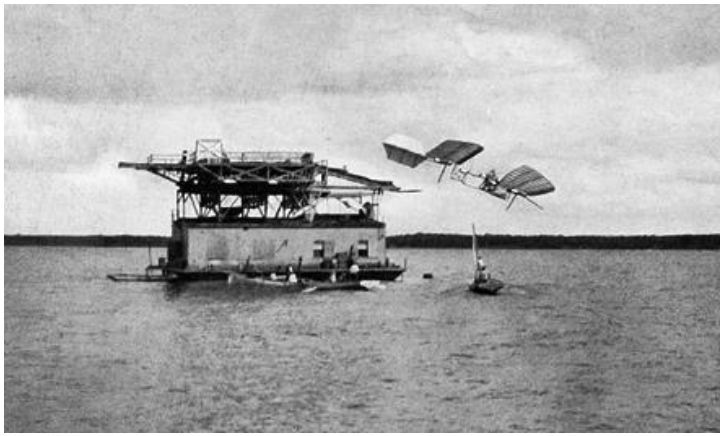
- *complex weapons*
- *on an advanced fighter*
- *to satisfied customers*
- *at a highly competitive price*

SAVE NO EXPENSES?

Wrights Brothers' first flight at Kill Devil Hills, NC

~4 years of development
Total spending $1 000
Funded by own money

Model flew successfully in 1903



Samuel Langley first flight in Potomac river

~16 years of development
Total spending $70 000
Funded by Smithsonian institute

The model never flew


Thank you for your attention