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Agile In Military Hardware

How the SAAB Gripen became the world's most cost effective military aircraft

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JJ Sutherland and Joe Justice

1976: F-16 Fighting Falcon

3 People

Cheaper

Collocation

No Scrum

40 Years Old
Nearly 3000 Still in Service in 28 Countries

Joe

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2016: F-35 Lightning II

8,000 People

Source: Government Publishing Office

Total Project Cost: $1.5 Trillion
Unit Cost: $148 - $337 Million

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2017 Saab JAS 39 E/F

Total Project Cost:
$14 Billion

Unit Cost:
$69 Million

First Production Run:
April 2017

Source: Manufacturer Website

Owning the Sky with Agile

Building a Jet Fighter Faster, Cheaper, Better with Scrum

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Abstract

Advanced military systems are some of the most expensive and most complex research, design, and manufacturing challenges in the world. The sheer cost of military procurement worldwide is measured in the trillions of dollars, and for decades costs risen seemingly indefinitely. As a result, many companies are seeking new ways of working that will control costs while delivering the highest quality. Saab Defense has adopted an Agile process to address the issue in both hardware and software teams to produce a new multi-role strike fighter, the JAS 39E Saab Gripen.

1. Introduction

While predecessors to Test Driven Development and related Agile practices such as dedicated, co-located, cross functional teams

with flexible priorities have been used in fighter jet design as early as 1960 [2], modern Agile practices such as Scrum roles and release burn down charts in complex systems may be pioneered by Saab Aeronautics.

3. Agile at Saab

Saab introduced Agile [3] practices approximately ten years ago during updates of the previous Gripen versions. First, small independent teams of software developers

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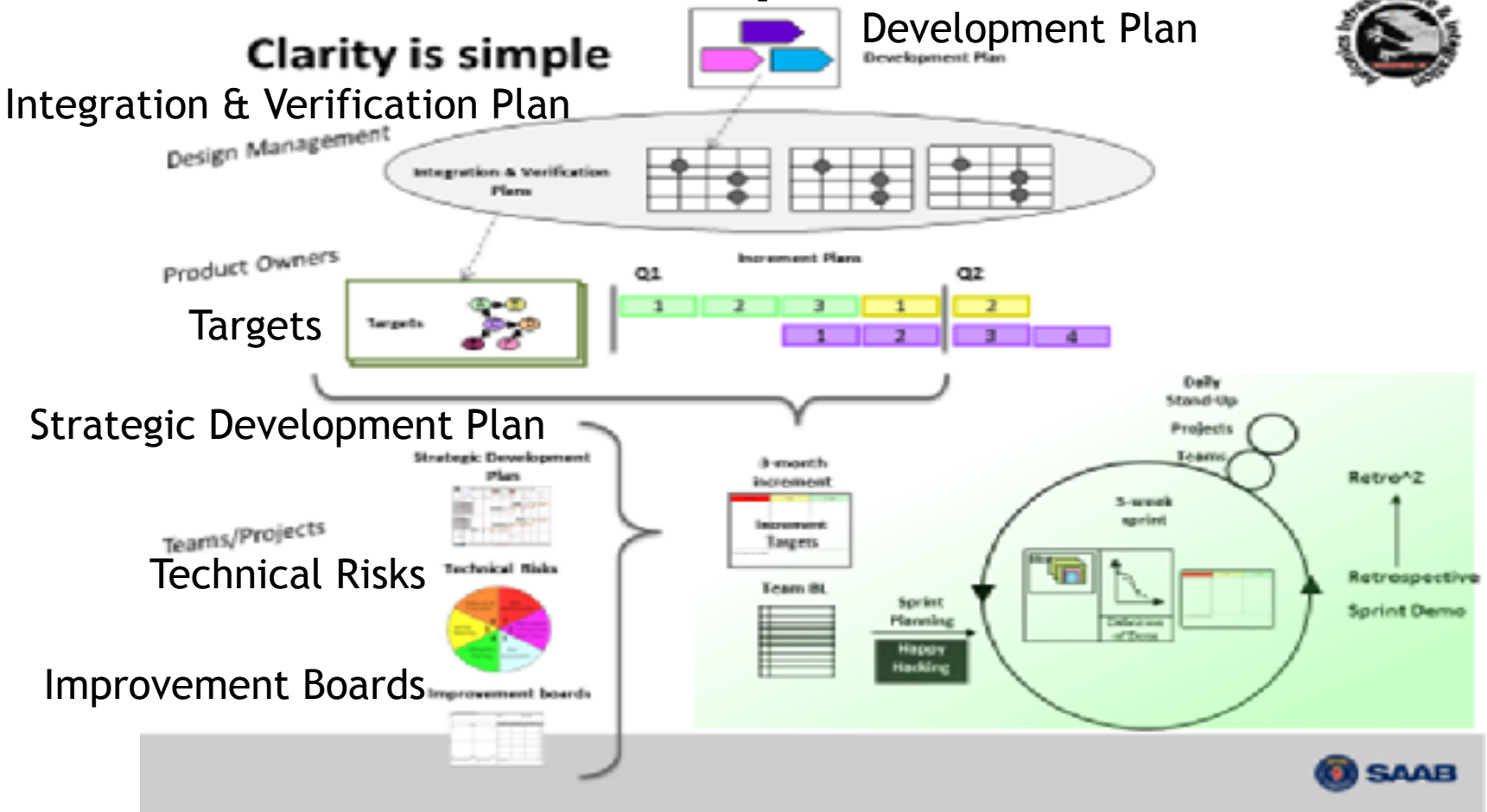
Saab Gripen Process



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SAAB Aeronautics

4096 People in 1 Hour!

- 8:30 Executive Action Team
- 8:15 Scrum of Scrum of Scrum of Scrums
- 8:00 Scrum of Scrum of Scrums
- 7:45 Scrum of Scrums
- 7:30 Daily Scrum
- Scaled Retrospectives

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Object Oriented Architecture

System Group built of Module Teams and Functional Teams

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Practices are not Prescriptive

- Teams have varying levels of maturity
- All have visual boards and daily Stand-Up meeting
- All teams have 3 week sprints, starting and ending on the same day.
- All teams have multi-level planning before sprint start.
- Teams have authority to optimize other aspects of the process to their own local context.
- e.g. Many teams add technical practices from XP and flow maximizers from Kanban

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Hardware Is All Software Anyway

Anyone in the company at any time has access to complete current 3d model and software. Everyone has the flight sim running the current CAD and code on their desktop.

Can test new part or code in simulation, fly the plane around on their desktop. Simulate high speed collision with a bird. Simulate more powerful fuel pump. Try different bolt sizes. Whatever.

The complete commitment to scaled simulation is inspiring.

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Collocation

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Scrum Room

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Culture

- Teams do the detailed planning
- Teams set the sprint targets (aligning the overall time plan)
- Teams celebrate their victories

- **Complete commitment at the team level.**
- **Planes are cool. Only Google is rated more desirable work choice by graduating engineers.**
- **“May we please work even just 4 hours on Saturday?” Some teams opt for overtime.**
- **Swedish engineering culture: Don’t ask manager to get something for you from another department, go there yourself right now and get it.**

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How SAAB Launches a New Scrum Team

- Majority of team members have been delivering every three weeks using Scrum at SAAB for years.
- Makes team boot-up almost automatic.

Three week beat/ sprint cycle:
- Teams-level: Synchronizing needs and demands of
- But continuous deliveries

Quarterly beat/ increment cycle:
- Sub-project-level: Synchronizing needs and demands
- Increment conference

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Management

- Manage cost by looking at speed and flow of teams, time costs money.
- Highest priority is to remove impediments
- Decompose contract into systems with goals on their Scrum Boards, have daily Scrum senior management meetings.
- Product Owners decompose system goals into backlogs of targets (goals).
- Backlogs with burn downs create the schedule of increments with targets (goals).
- All of Saab Aeronautics on the same 3 week sprint, same start and end day. “It is a Heartbeat. Everyone knows what day of the Sprint we are on.”
- All Systems, Goals, and Backlogs on Physical Scrum Boards visible to all staff.

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Regulatory Compliance

- Certifying officials on site regularly throughout iterative development.
- Certification documents developed iteratively.
- Over time, trust has been earned between certifying officials and development teams.
- Final certification almost instant, and a formality.

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Problems

Time

Cost

Quality

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Agile Issues

Ready Backlog

Prioritized Backlog

Clean Backlog

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Other Companies

- Other SAAB groups are using Scrum.
- Scrum is becoming the new normal for hardware companies in Sweden.

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ENGINEERING ON THE FAST TRACK

RAYTHEON'S AGILE ENGINEERING CREATES NEXT-GEN RADAR

Raytheon engineers use Agile techniques to collaborate on a variety of complex systems, including the Air and Missile Defense Radar.

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The engineers call it "The Radar House."

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November 17, 2014

Raytheon's accelerated milestone powered by Agile development

TEWKSBURY, Mass., Nov. 17, 2014 /PRNewswire/ -- Raytheon Company's (NYSE: RTN) first major software build for the new **Air and Missile Defense Radar** successfully tracked a simulated Anti-Air Warfare (AAW) target. The milestone verified the infrastructure and functionality of the AMDR software build, which was demonstrated less than eight months after contract award – an achievement made possible by the company's agile software development

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Raytheon touts its Agile software development process

Testing validates Raytheon's software build for Navy Air Missile Defense Radar system, the company says.

By Richard Tomkins | Nov. 17, 2014 at 1:52 PM

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Artist's conception of the new Air and Missile Defense Radar array atop a ship. Raytheon

TEWKSBURY, Mass., Nov. 17 (UPI) --
Raytheon says its method of developing

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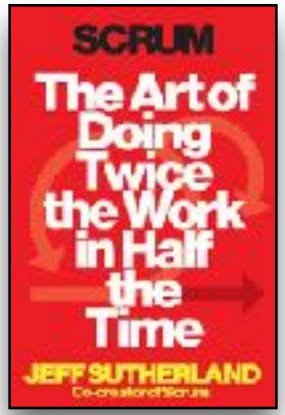
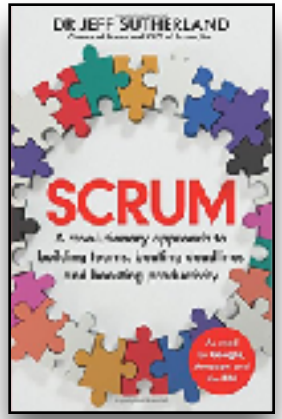
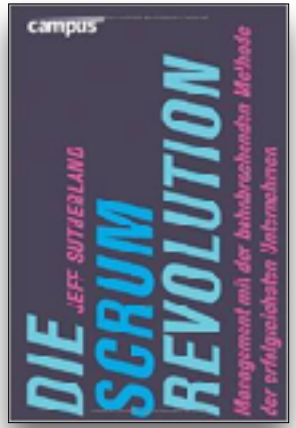
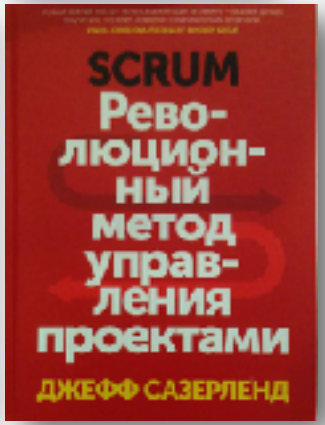
“Scrum is a Productivity Super Weapon. It is Shockingly Efficient.”

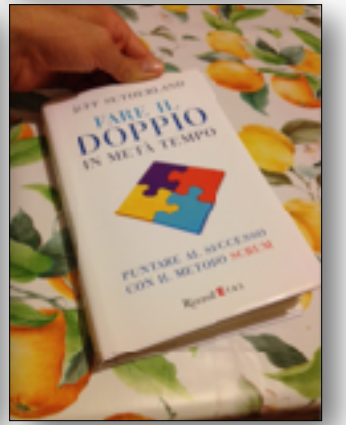
Rick Horgan, Sr. Editor, Crown Business











Download the SAAB Aeronautics white paper, listen to the interview on ScrumInc.com

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