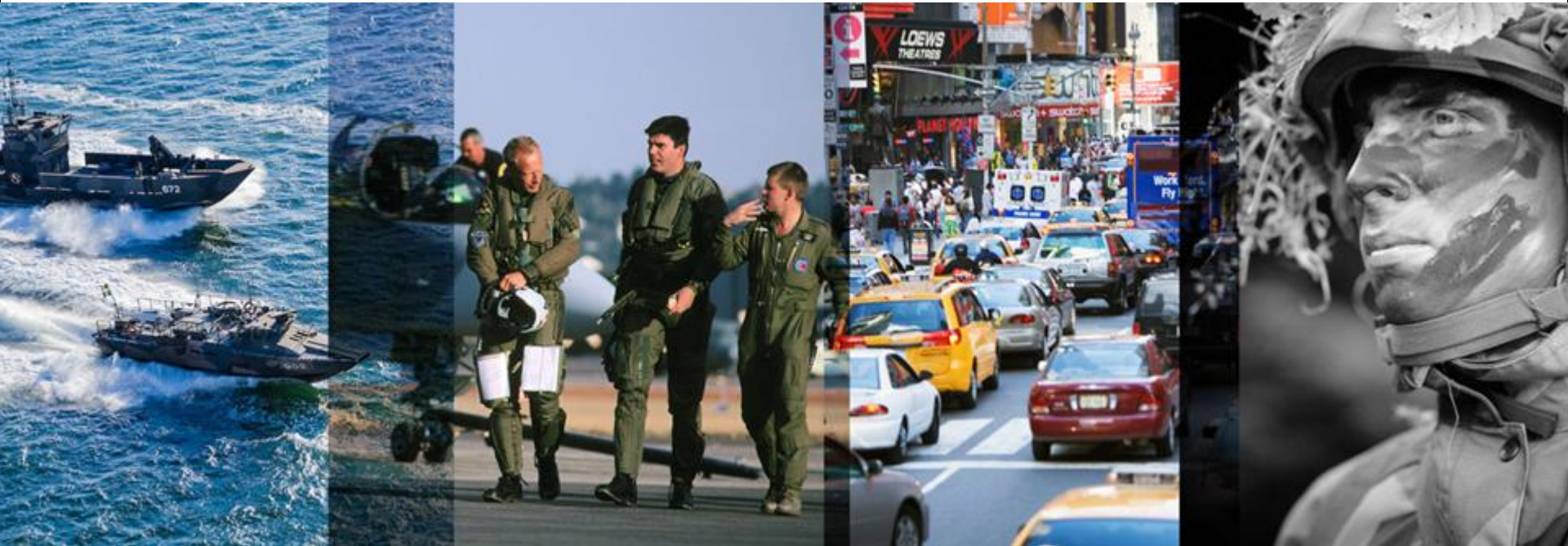




**SAAB**

# Koncept framtida stridsflyg – generisk målbild för FoT Flygteknik



**Jan Tano**

**Saab AB Aeronautics**

**2010-10-19**

# Bakgrund

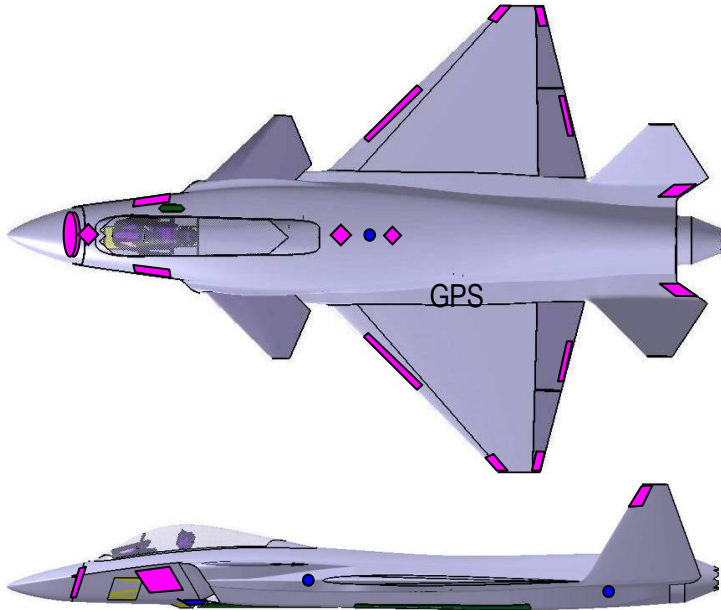
**Svensk flygindustris deltagande i nationell och internationell utveckling inom:**

- **högpresterande flygsystem med bred uppdragsprofil**
- **teknologi för systemen**
- **metoder för design och analys**



# SYFTE

Studien ska bidra till ett gemensamt objekt för:



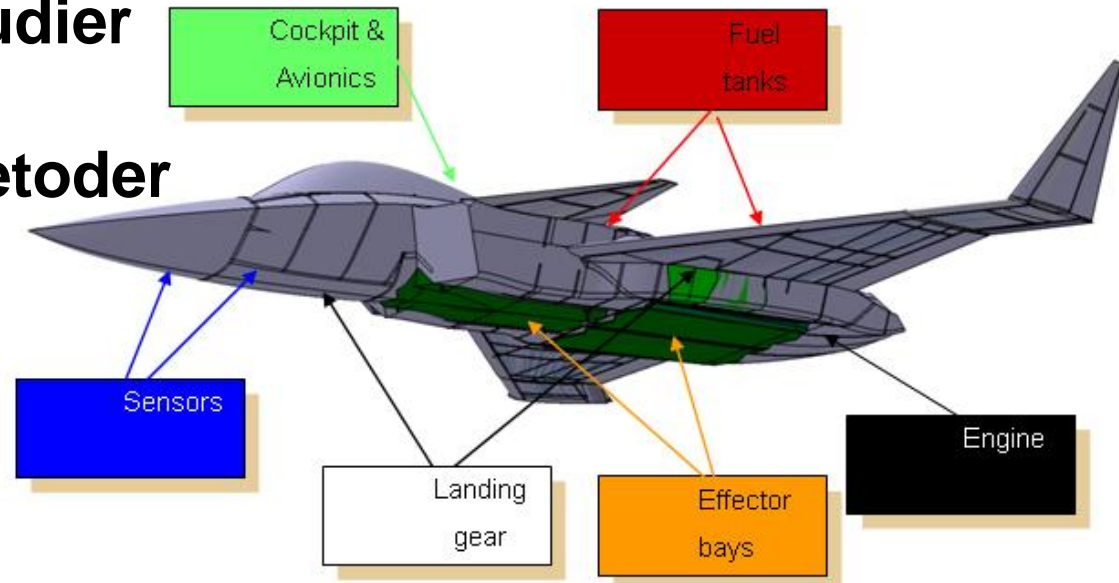
- övriga teknikstudier
- svensk referens
- teknikbärare i konceptanalyser av framtida flygsystem
- strukturerad metod- och verktygsutveckling
- möjliggöra proaktivt deltagande i samarbetsstudier:
  - ETAP – European Technology Acquisition Program
  - FCAS – Future Combat Air System
  - FAPS – Future Air Power System

# Mål är att få:

- en relevant, balanserad och förankrad målbild

- långsiktiga teknikstudier

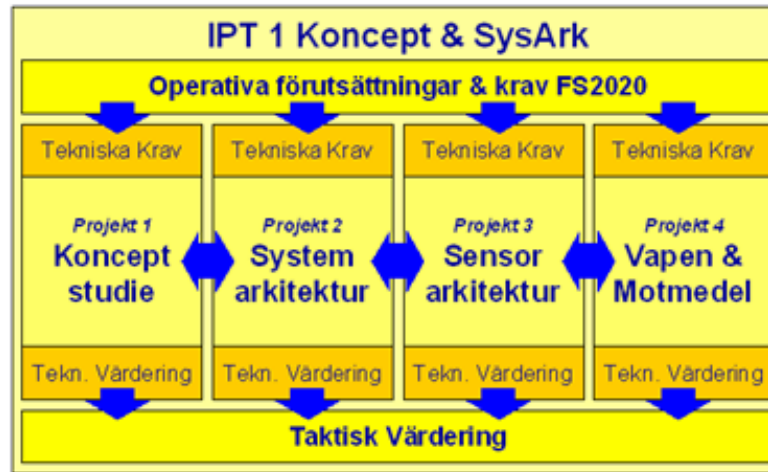
- vidareutvecklade metoder och verktyg



- stöd för att balansera teknik och förmågor

- stöd att göra avvägda bedömningar av nytta och konsekvens för ny teknik

# IPT 1 Konceptstudie



Krav & Objekt

Teknik & Möjligheter



Projekt 1 - Konceptstudie FS2020  
beskriver och sammanhåller helt objekt FS2020

## FS2020

- ▶ Saab Aerosystems
- ▶ FOI
- ▶ Volvo Aero
- ▶ Saab Bofors Dynamics
- ▶ Saab Microwave Systems
- ▶ LiU

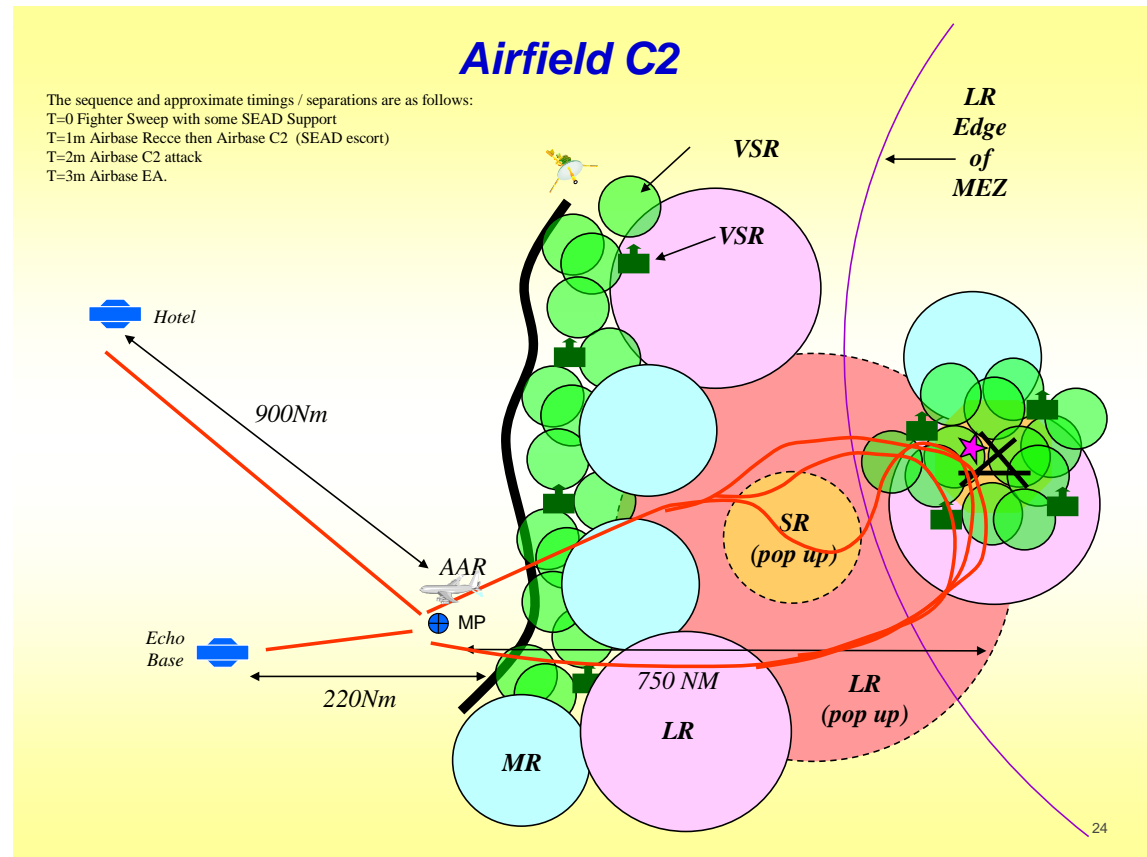
## FS2025

- ▶ Saab Aeronautics
- ▶ FOI
- ▶ Saab Dynamics
- ▶ Saab EDS
- ▶ Volvo Aero

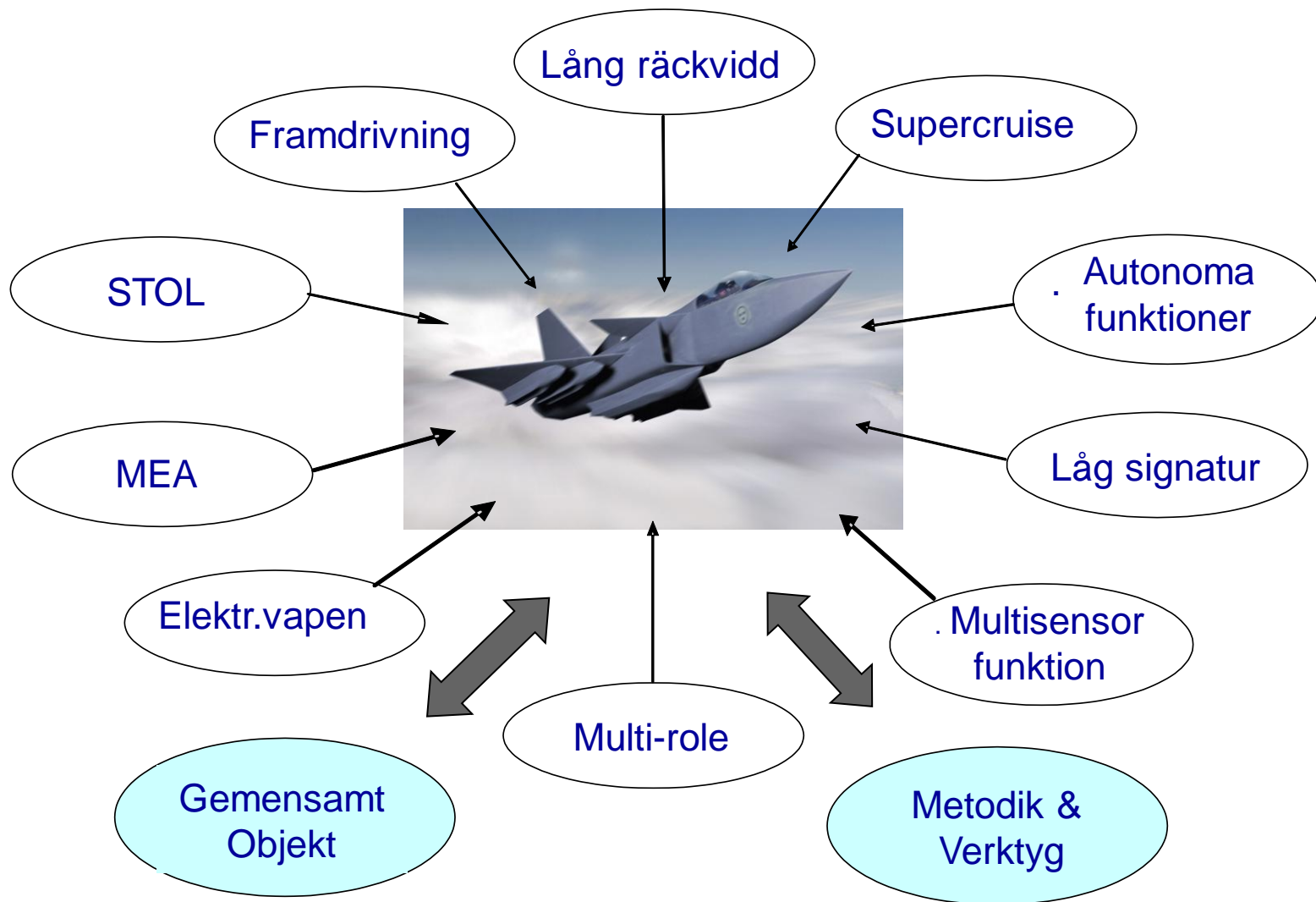
# Förutsättningar

## CONOPS (Concepts of Operations) ger krav på:

- Operativa uppdrag
- Kampanjer
- Logistik
- Livscykel perspektiv



# Viktiga drivande egenskaper



# Krav CPS Farkost

Air Segment		Components Characteristics
<b>Platform</b>		
<i>Requirements</i> see CONOPS & mission profile	Fueling Range unrefueled <i>Loiter time</i> Speed max Altitude max <i>STR</i> <i>STR</i> <i>T-O &amp; landing distance</i> Limit load  Design rules	AAR 2 x 750 nm + *(220nm) 2.1 h / 3.4 h M>1.2 (mil) M=1.8 (AB) 16 km 5g / M09 / 6km 3.5g / M13 / 9km 1.8km [-3g:+9g] @ 60% fuel with A/A payload (design limit load factor, 1.5) 10% Empty Weight (growth margin)
<b>Survivability</b>		
<i>Requirements</i> SAM/Fighter threat	Protection  UHF/L/S/-band C-band X/Ku-band IR	LO Front / Side / Rear xx / yy / zz dBsm xx / yy / zz dBsm xx / yy / zz dBsm xx / yy / zz W/Sr



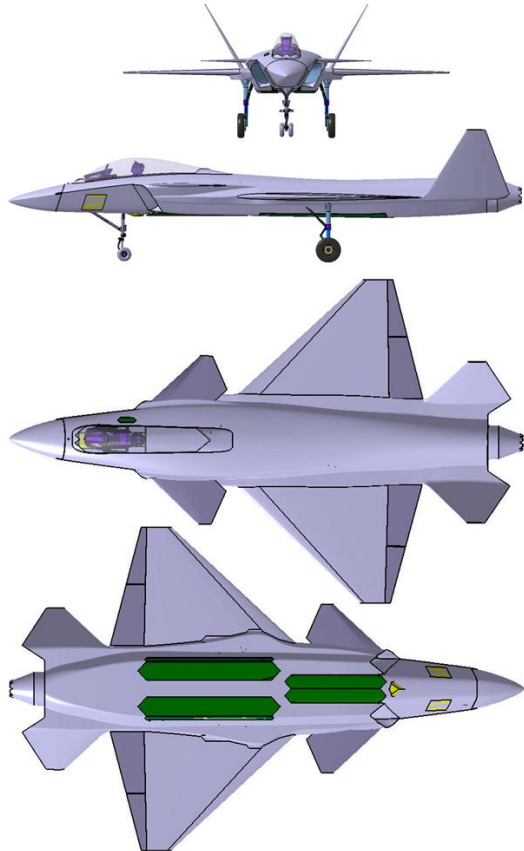
# Krav CPS Nyttosystem

<b>Sensor</b>		
<i>Requirements A/S</i> PID target at night / broken clouds @ < 450m / Visibility <10km / Humidity 50-75% Imaging: Resolution 0.2m; area: 2x2km	Type / Resolution / (Mounting/FoV) / Mass / Dimensions / Consumption	Alt. 1 EO/IR +AESAs(SAR-function)
<b>Electronic Warfare</b>		
<b>ESM</b>		
<i>Requirements</i>  Self protection ?	Capability  Type / (Mounting/FoV) / Mass / Dimensions / Consumption	Multispectral self protection suite Chaffs & flares, Launched decoys, DIRCM, ECM, LW,MWS, RWR,
<b>Communications</b>		
<i>Requirements</i> Air coordination orders	Capability Type / Bandwidth / Range / Mass /Consumption	(VHF/UHF Radio)

# Teknikhypoteser

Title: <b>Missile Approach Warning System, MAWS</b>	
<b>IPT:</b>	IPT 1 – Konceptstudie FS2020 (sensorarkitektur)
<b>Issue:</b>	1
<b>Date:</b>	2007-04-11
<b>Requirement</b>	<Reference to the operational requirement at which the technology is aimed, if any> Self defense performance required due to the threat level in mission description XX. The system shall have LO actions taken for the apertures. The main threat direction is surface to air (SAM/MANPADS).
<b>Purpose:</b>	<Description of the purpose and benefit of the new technology, and if possible, a comparison (in qualitative or quantitative terms) with current, existing alternatives. This also includes technology not readily identified through operational requirements> The system can be considered as a missile approach warning system (MAWS) due to the fact that it operates in the thermal infrared region of the spectra. The MAWS operate in two thermal wavelength bands to lower the false alarm rate. Present missile warning system is often ultraviolet systems and operates only in the boost phase of the missile, thermal system operates in both boost and in the approach phase of the missile. MWS is used for self-protection purpose, towards RF, infrared and beam rider threat missiles, the missile warning system shall have a low false alarm rate and a range performance better than 6km. The system shall not require more than two apertures to achieve full coverage (except of own a/c masking). Angular accuracy for threat direction 1 degree. Alarm generation in less than 1 second
<b>Description:</b>	<General description of the new technology in terms of functionality, performance, physical properties, consequences or influence on other systems, or similar. This should include sufficient information to allow for evaluation of the inserted technology at FS2020 level> The detectors operate in two thermal infrared bands this to lower the false alarm rate. The technology gives integration advantages due to the number of detectors needed to be integrated in the airframe to get "full coverage", 4pi steradian. The system has performance/provision to align to a DIRCM system.
<b>Maturity:</b>	<Current TRL for the technology and an assessment of availability timeframe and required R&D to develop the technology> Present, TRL level is estimated to TRL 5. Estimated TRL level 2009 is TRL8, TRL 9 2020. Development item, first item intended for A400M.
<b>Integration/Interface</b>	
<b>IO Interface:</b>	MIL-STD-1553B and RS-422
<b>Size, l x w x h (m³):</b>	Sensor unit (estimated 2020): <b>11 x 9 x 9 cm</b> Signal Processing Unit (estimated 2020): <b>20 x 16 x 10 cm</b>
<b>HW requirement:</b>	Two detector elements, one signal processing unit, one electronic warfare central unit
<b>Weight (kg):</b>	Sensor unit (estimated 2020): <b>2 kg</b> Signal Processing Unit (estimated 2020): <b>5 kg</b>
<b>SW requirement:</b>	Interface to countermeasure system, threat libraries, technique libraries
<b>Power required (kW):</b>	Sensor unit (estimated 2020): <b>50 W</b> Signal Processing Unit (estimated 2020): <b>200W</b>
<b>Considerations:</b>	2pi steradian for each detector, FoV, Full sphere coverage require two detectors.
<b>Cooling required (kW):</b>	Sensor unit (estimated): ? Signal Processing Unit (estimated 2020): ?
<b>Other:</b>	The system will have a half sphere apertures, drag issues.
<b>Contact:</b>	Stefan Ringberg, Saab Aerosystems tel: 013-18 50 56 mail: stefan.ringberg@saab.se
<b>Source:</b>	<Reference to R&D or activities supporting this technology hypothesis> Future developments in FPA technologies focus on large format, high density arrays. Array size continue to grow, while pixel size decrease. Multispectral FPAs could collect simultaneous images from two or more bands to give better target identification and clutter rejection. More advanced FPA technologies include strained layer superlattices. Significant development work is required for this technology.

# Resultat fas 1



## Geometri

Längd	m	17
Spännvidd	m	10.5
Aerodyn. medelkorda	m	5.4
Vingyta	m <sup>2</sup>	47

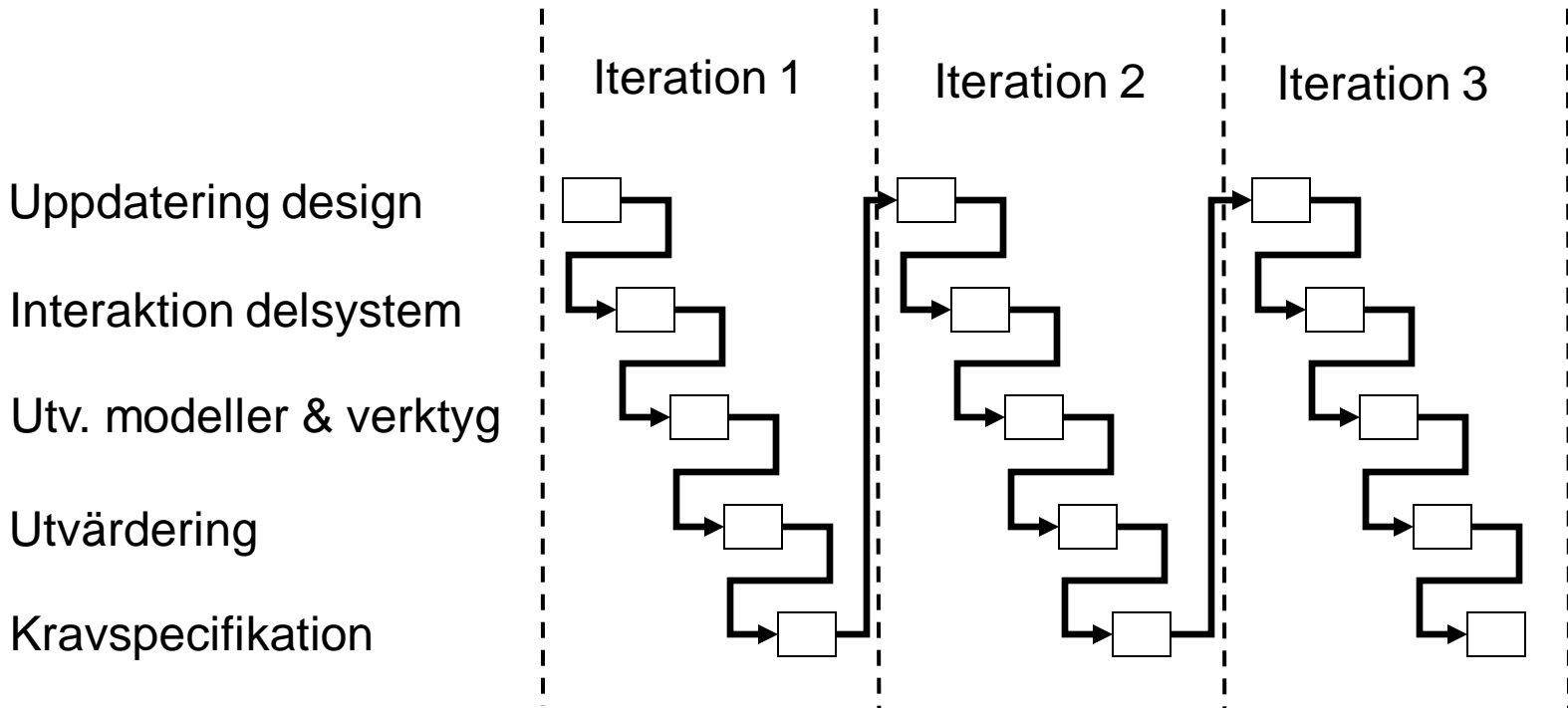
## FS2020

Max dragkraft (ebk)	kN	170
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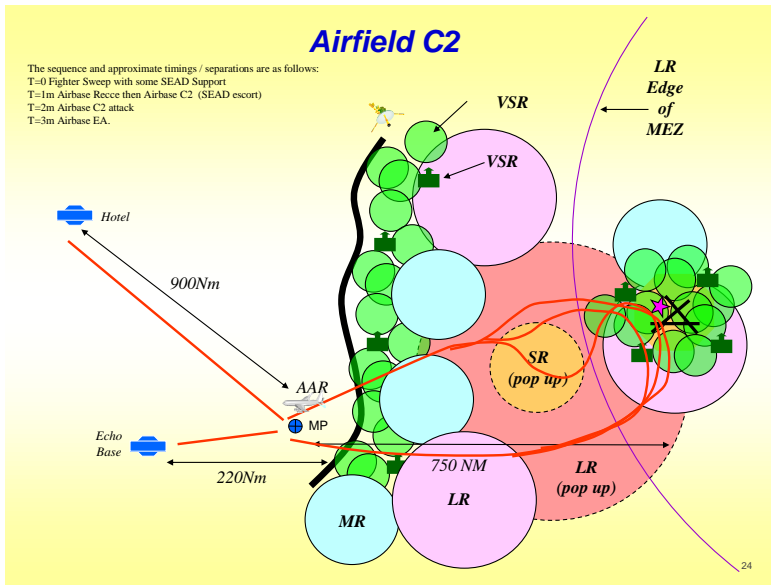
## Vikter

Tjänstetomvikt	kg	10 000
Internt bränsle	kg	6 200
Designvikt	kg	15 400
Max startvikt	kg	23 000

# Fas 2 Integration och anpassning

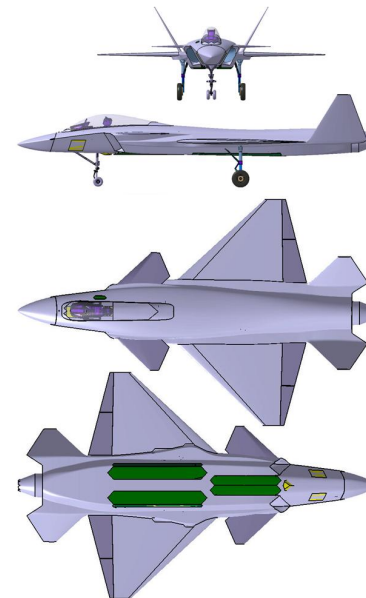


# Ingång till Konceptstudie FS2025



**Operativa förutsättningarna ska återanvändas.**

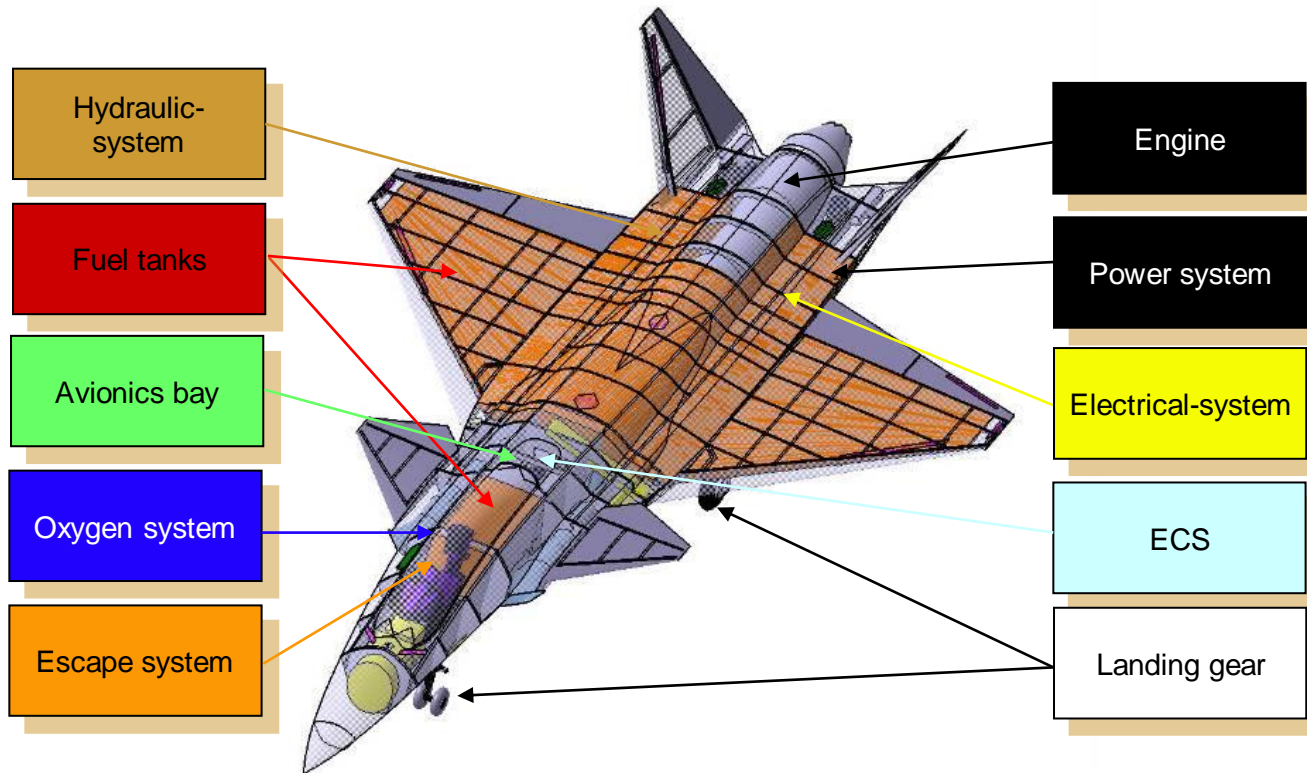
**Systemdesignen ska återanvändas så långt som möjligt.**



# Uppdaterade teknikhypoteser

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# Integrations analys



- Geometri
- Förläggning

- Gränssnitt
- Tekniska budgetar

- Kostnad
- Risk

# Iterativt uppdatering

The Missile Approach Warning System, MAWS			
Rev	Doc ID	Issue	Date
001	IP1-1 - konceptstudie F3020 (del av A4020)	1	2007-06-11

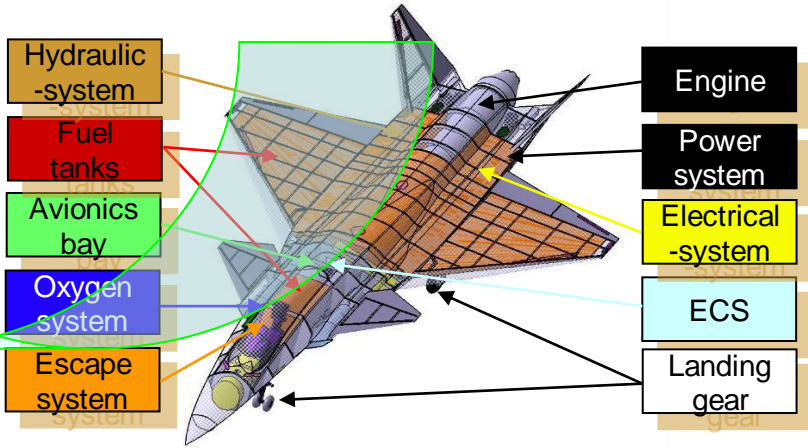
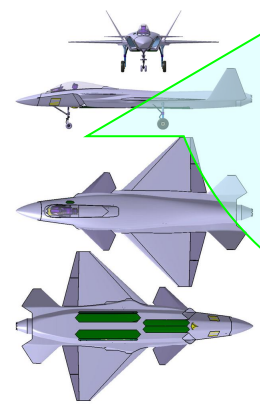
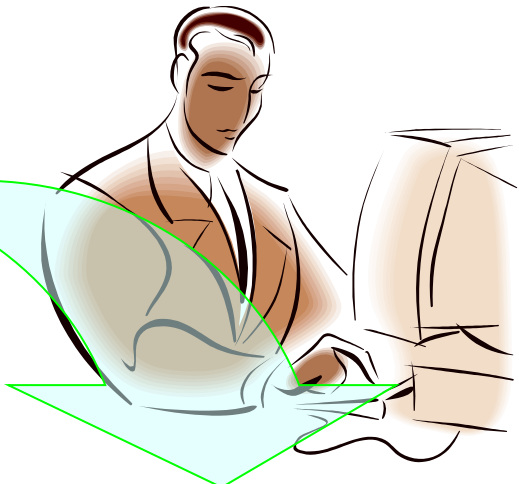
**Revisionshistorik** - Tabell med 20 rader som visar revisioner från Rev 001 till Rev 200. Varje rad innehåller Doc ID, Issue och Date.

**Revisionsändringar** - Tabell som listar ändringar för varje revision.

**Systembeskrivning** - Text som beskriver systemets funktioner, till exempel: "The system can be considered as a missile approach warning system (MAWS) due to the fact that it operates in the thermal infrared region of the spectra."

**Systemkrav** - Tabell som listar tekniska krav och specifikationer för systemkomponenterna.

Komponent	Specifikation	Estimerat värde
RO sensor	MIL-STD-1553B and RS-422	11 x 9 cm
RO processor	Two detector elements, one signal processing unit, one electronic warfare central unit	20 x 16 x 10 cm
RO weight		6 kg
RO power		60 W
RO coverage	Interface to countermeasure system, threat libraries, discharge libraries	200W
RO data rate	200 bps	
RO data format	Full sphere coverage require two detectors	





# Sammanfattning

## ➤ Nytt

- Gemensamt objekt med högnivåkrav för teknikstudier
- Underlag till nationella och internationella studier samt långsiktig produktveckling samt
- Vidareutveckling av metodik och verktyg för konceptstudier

## ➤ Kopplingar

- Stark koppling till övriga projekt i FoT Flygteknik
- Stark koppling till övriga ETAP studier
- Stark koppling till internationella framtidsstudier

## ➤ Fortsättning

- Projektet fortsätter i FoT Flygteknik 2010-2012 Konceptstudie FS2025 med fokus på integration och värdering



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