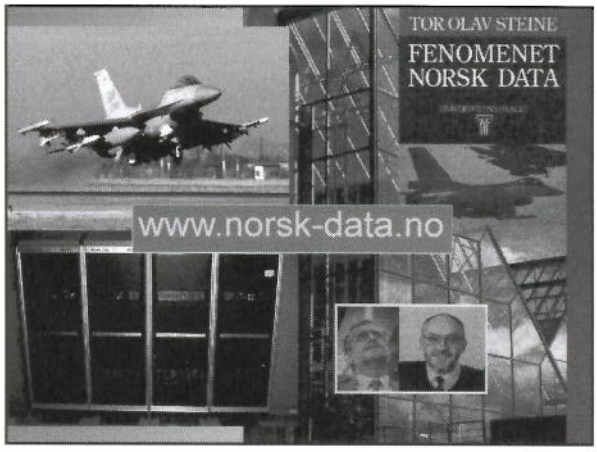
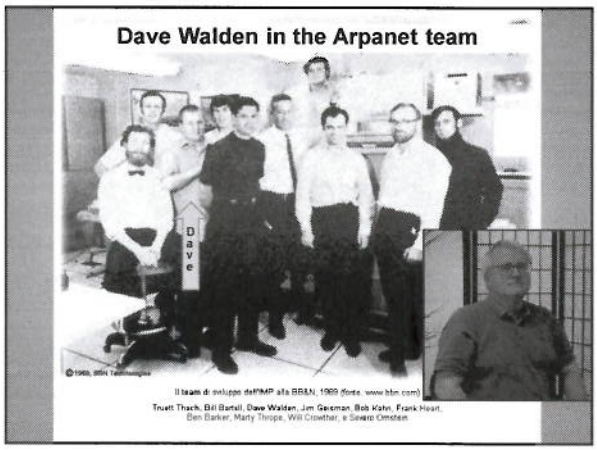
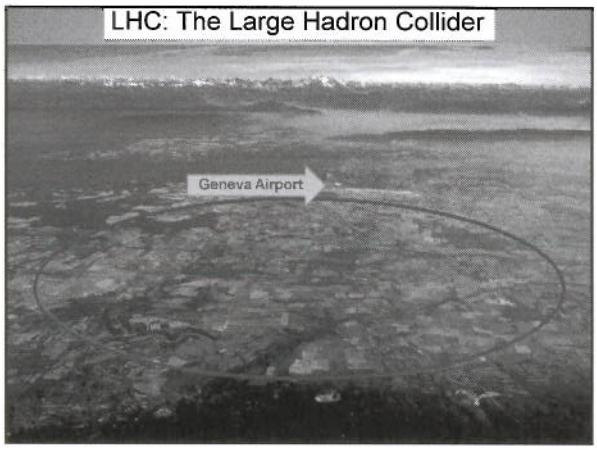
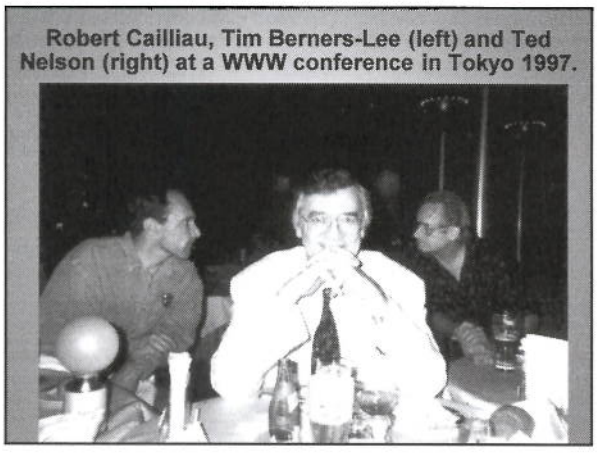
The Cassidian/EADS - Alfatroll AS

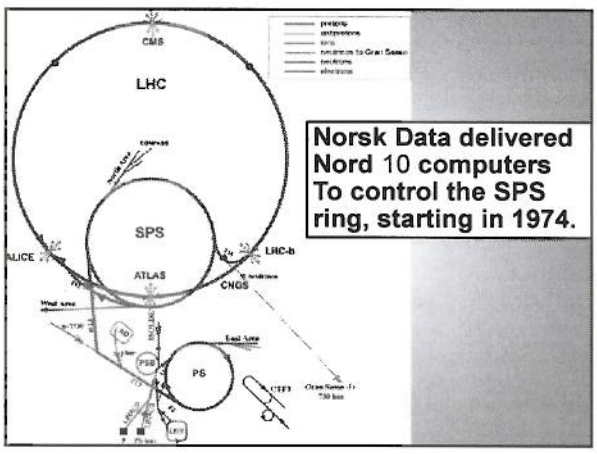
- General level of ambition
- The project phases
- The partners

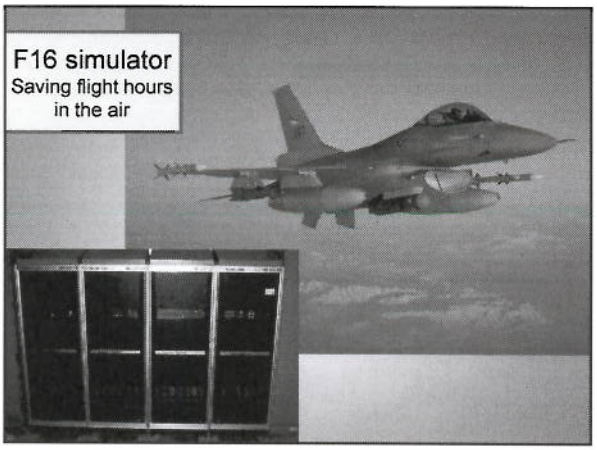


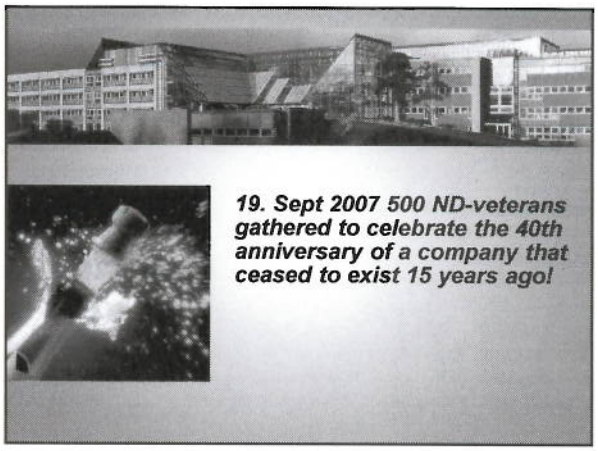


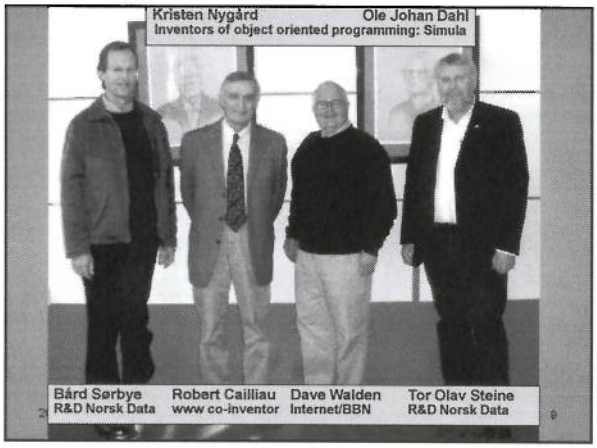




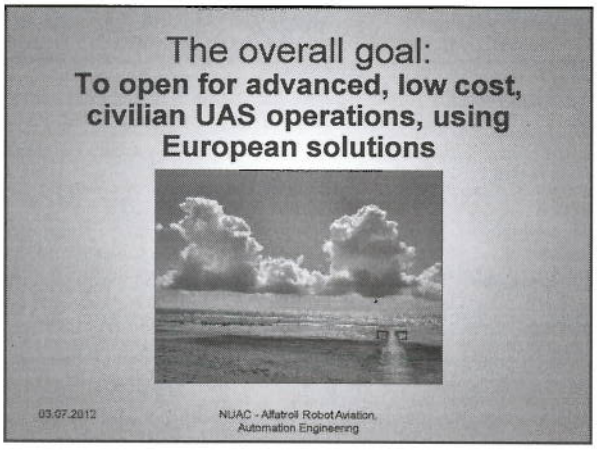


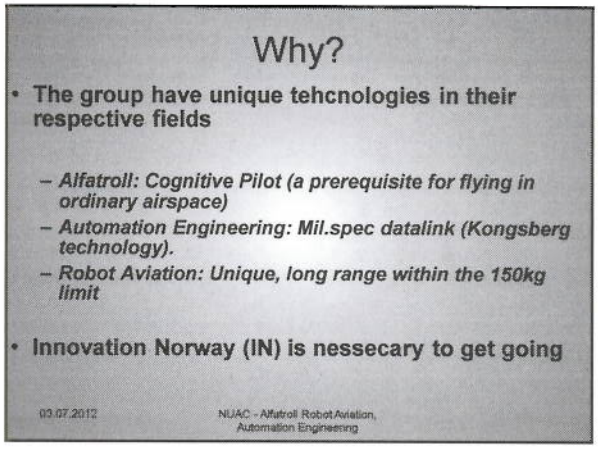

F16 simulator
Saving flight hours
in the air


19. Sept 2007 500 ND-veterans gathered to celebrate the 40th anniversary of a company that ceased to exist 15 years ago!


Kristen Nygård
Ole Johan Dahl
Inventors of object oriented programming: Simula
Bård Sørbye
R&D Norsk Data
Robert Cailliau
www co-inventor
Dave Walden
Internet/BBN
Tor Olav Steine
R&D Norsk Data


..resulting in Internet, WWW, and object oriented programming – in short: state of the art computing
ND may not have invented the gunpowder ... but we heard the explosion!!


The overall goal:
To open for advanced, low cost, civilian UAS operations, using European solutions
03.07.2012
NUAC - Alfatroll Robot Aviation, Automation Engineering


Why?
• The group have unique tehcnologies in their respective fields
– Alfatroll: Cognitive Pilot (a prerequisite for flying in ordinary airspace)
– Automation Engineering: Mil.spec datalink (Kongsberg technology).
– Robot Aviation: Unique, long range within the 150kg limit
• Innovation Norway (IN) is nessecary to get going
03.07.2012
NUAC - Alfatroll Robot Aviation, Automation Engineering

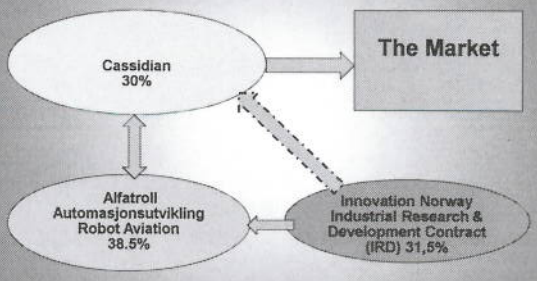
UAS System Areas

Physical System
power consumption
accuracy, durability,
sensors

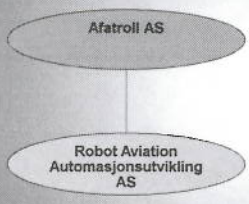
Control Software
RTOS, Logic/KBS
Properties, reliability

Hardware platform
Embedded Computer, scaleability,
latency, capacity

IFU Prosjekt – standard

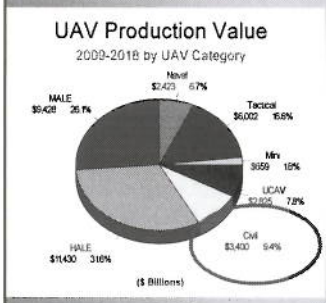


IFU Project – Scenario



- AT IFU partner to Cassidian
- RA, AU supplier to AT
- All other activities as planned

UAS – is there a market?



Source: Teal Group

UAS – most rapid growth within aerospace.

Expected revenue >50 billion USD the next 10 years, mostly defence.

The civilian market ca 10% of total during 2009-18

Detect & Avoid is an essential enabler for full development of this market!

UAS – where are the enablers?

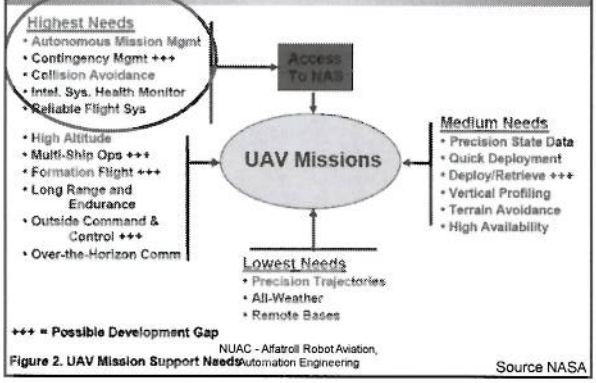
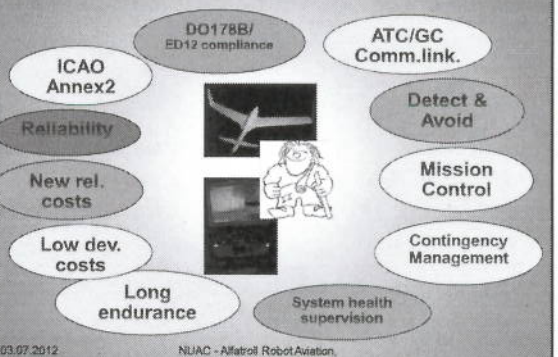


Figure 2. UAV Mission Support Needs

Source NASA

UAS onboard requirements



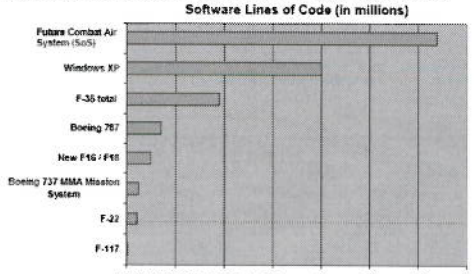
Software cost problem no 1!!!

Unmanned Systems Software Architectures

Large variety of requirements with respect to autonomy

- Replacement of pilots capabilities
- Improved mission systems to support various operations
- Demanding mission management and guidance systems to enable autonomous operation

Software Lines of Code (in millions)



→ *High Number of Software Lines of Code required*

What do the experts say?

"Affordability will be treated as a key performance parameter (KPP) equal to,if not more important than, schedule and technical performance" (p. v).

"DoD must continue to pursue technologies and policies that introduce a higher degree of autonomy to reduce the manpower burden and reliance on full-time high-speed communications links while also reducing decision loop cycle time.

The introduction of increased unmanned system autonomy must be mindful of affordability, operational utilities, technological developments, policy, public opinion, and their associated constraints» (p. vi).

"In 2010, the USAF released the results of a year-long study highlighting the need for increased autonomy in modern weapon systems, especially given the rapid introduction of UAS.

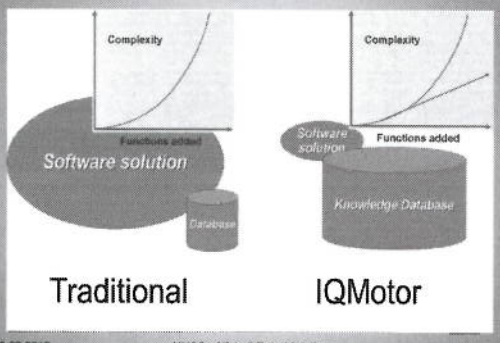
This study, "Technology Horizons," identified the need for greater system autonomy as the "*single greatest theme*" for future USAF S&T investments." (p. 43)

"... the ability to understand and control future costs from a program's inception is critical to achieving affordability requirements."

--Under Secretary of Defense Memorandum for Acquisition

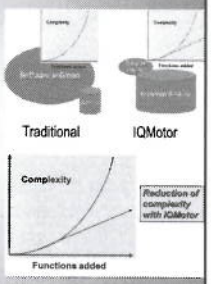
Professionals, Better Buying Power, September 2010 (p.46)

We claim we can help reduce that



What is so unique here?

- **Unique Technology:**
  - Compact software solution – independent of the amount of decisions required.
  - Decision engine, based upon stored knowledge
  - Smart data organization yields fast and precise response, almost unaffected by the amount of knowledge added.
- **Lowered development costs:**
  - Changes and additions are applied on a layered basis.
  - No changes in software necessary when now knowledge is added.
  - Certification of initial version and new releases is less expencive.
- **Step-by-step progression:**
  - Allows verification of knowledge platforms to be built upon
  - New functions are added on top of already existing knowledge.
- **Low level of complexity**
  - The software and the knowledge are totally separated.
  - New knowledge can be added without affecting the software.
- **Fits both SMALL and LARGE autonomous systems**
  - Systems developed by traditional methods may require heavy computer systems.



Norwegian airspace Norwegian CAA

These are positive aspects for the project!

UAS Norway/Ansur BLOS Week 1-9 September 2012 at Gala

European Aerospace Company wants to use our technology...

- **Border Surveillance**
- **Inspection and supervision of..**
  - **Oil and gas lines**
  - **Oil and gas terminals**
- **European Aerospace Comp. Would like to integrate UAS technology from:**
  - **Robot Aviation**
  - **Alfatroll**
  - **Automation Engineeringg**
- **..and sell in large quantities**
- **(#500 was mentioned)**

Alfatroll's contribution:
Reduced development cost and complexity

- **Knowledge based reasoning engine**
- **Reduced complexity solution**
- **Faster development at lower cost**
- **Less expensive version costs**

More than an Autopilot

Cognitive pilot (on board)

High level decisions
- *Gives the autopilot orders*
- *Makes decisions based upon the information avilable.*

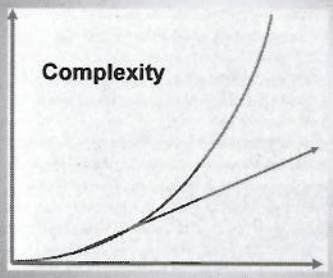
API

Autopilot (on board)

Only low level decisions
- *Follows order*
- *Bone marrow driven reflexes*

...while maintaining simplicity!

Is exponential growth in complexity necessary?



Reduction of complexity with IQMotor

Automasjonsutvikling AS
www.automasjonsutvikling.no

- Long experience with the MOD projects
- Speciality: DataLink w/ multiple data streams & priority management
- Also makes, UAV fully equipped
- Cameras, FLIRS.

Telemetric links

Performance
- UHF 220Mhz to 400Mhz 1W SR-600.
  - Frequency Band: 220Mhz to 400Mhz
  - Power Output: 100Mw to 1W (optionally 5W) ground controlled
  - Indoor/Urban Range: up 1km
  - NP Line-of-sight Range: 10km
  - Spread Spectrum Type: FHSS (Frequency Hopping Spread Spectrum)
  - Encryption: 256-bit AES
  - Operating Temperature: -40 to 85° C (industrial)
  - Bit rate: up to 2.2Mbit/s (on air, aprox. 1Mbit/s payload)
- 72Mhz Safety Radio,
  - Frequency Band: 72.550Mhz
  - Power Output: 1W
  - Indoor/Urban Range: up to 500m
  - Outdoor Line-of-sight Range:1 Km
  - Spread Spectrum Type: FM, dual tone
  - Addressing: 20Khz deviation pr. channel.
  - Encryption: proprietary PCM
  - Operating Temperature: -40 to 85° C (industrial)
- 5Ghz Analog Video,
  - Analog video down link: Rover III compatible downlink, readable from all Rover units in area.

Certifications:
- UHF mil. Spec., Safety commercial.

Robot Aviation's contribution...

- **UAV optimized for the 150 kg limit**
- **UAV built according to JAR22 (...)**
- **Long range, long endurance platform**
- **Rich know-how**

3 View drawing

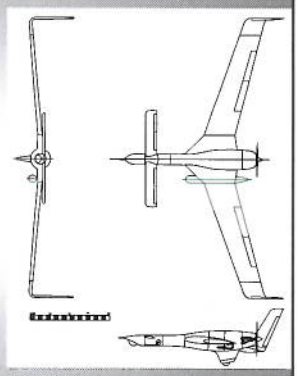
Specifications:

Wing span: 7.00 m
Length: 4.15 m
Max width: 0.55 m

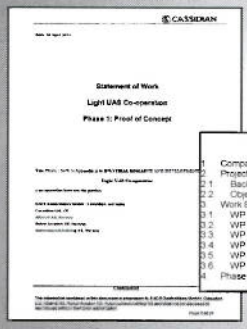
Cruise speed: 120 km/h
Stall speed: 55 km/h
Endurance: 25 hours

Engine: 220 ccm
Payload: 50 kg

Rescue: Ballistic Recovery System



Prosjektet for Cassidian


CASSIDIAN

Statement of Work

Light UAS Co-operation

Phase 1: Proof of Concept

Table of Contents

- ...er beskrevet over 20-30 sider i et Statement of Work (SOW), som omhandler:

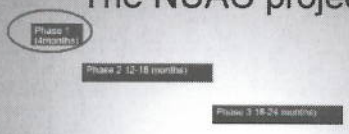
The NUAC project a staged approach

Phase 1 (4months) IFU

Phase 2 12-18 months) IFU and consulting?

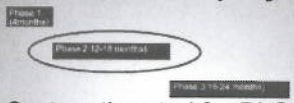
Phase 3 18-24 months) Consulting

The NUAC project



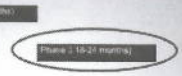
- Goal: Proof of concept!
  - all systems work (separately) as promised!
- Use cases and SOW (Statement Of Work) to mirror this goal!

The NUAC project



- Goal: System thrusted for BLOS operation
  - All systems work combined as promised!
  - Long range operation under full control demonstrated
  - Correct reactions to interfering traffic and emergencies
- Use cases and SOW to mirror this goal

The NUAC project



- **Goal: System certified/prepared for certification for BLOS operation**
  - All systems reworked to comply with required standards
  - Long range operation under full control tested according to standard requirements
- Use cases and SOW to mirror this goal

The Business Concept

- **IFU Project for the development phase**
- **The project phase for repeated sales**
- **The product phase for volume sales**

IFU totaløkonomi FASE 1-3

	2012		2013		2014		2015			
Project	*Hours*	*Total*	*Hours*	*Total*	*Hours*	*Total*	*Hours*	*Total*	*Hours*	*Total*
Cassidian/EADS Phase 1	2 874	2 694 604							2 874	2 694 604
Cassidian/EADS Phase 2	8 066	7 562 517	8 066	7 562 517					16 132	15 125 034
Cassidian/EADS Phase 3 (est)			7 223	6 772 175	7 223	6 772 175	7 223	6 772 175	21 669	20 316 525
Totalt Hours/project costs	10 940	10 257 121	15 289	14 334 692	7 223	6 772 175	7 223	6 772 175	40 675	38 136 163
Manyears	7,3		10,2		4,8		4,8		27,1	

Prosjektsalg

	2 012	2 013	2 014	2 015
Prosjektsalg:		**2 100**	**3 500**	**7 400**
IFU prosjekt inntekter:	**5 043**	**5 896**	**2 778**	**4 000**
Totalt prosjektsalg	**5 043**	**7 996**	**6 278**	**11 400**

IFU Prosjekt – utfordringen

NUAC: Alfatroll Robot Aviation, Automasjonsutvikling

- Prosjektet og partneren er OK
- Bedriftene i konsortiet er "for svake – dårlig overlevelsesevne"
- NUAC bedriftene trenger mer kapital/trygghet

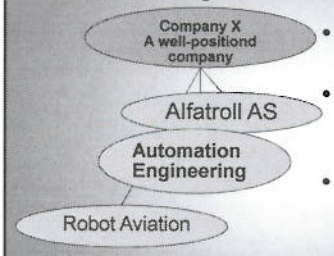
IFU Prosjekt – Mulig Løsning..

Venture Capital injection

NUAC: Alfatroll Robot Aviation, Automasjonsutvikling

- Ulempe: Man er "for billige" i tidlig fase => stor utvanning
- VC sikter mot "going business"
- Fordel: Aksepteres av Innovation Norway

IFU Prosjekt – Mulig Løsning



- Company X as main contact IN/Cassidian
- Alfatroll, RA og AU Suppliers to Company X
- All other activities as planned

What are we talkin about here??

Probably the most exiting aerospace project in Norway since Norsk Data sold computers to the Singer Link F-15 simulator