ÅAC Microtec

– Nano/microsatellites and subsystems –

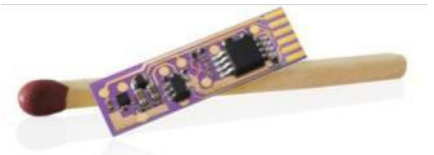
11 November 2011. SNSB, Solna

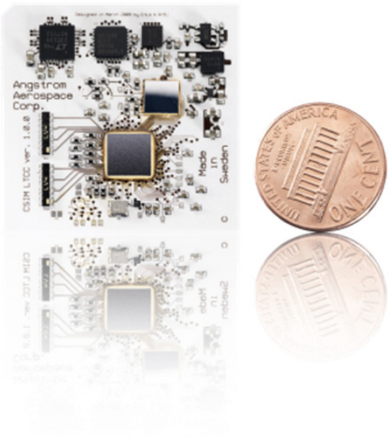
ÅAC Microtec AB
Dag Hammarskjölds väg 54B,
Uppsala Science Park
SE-751 83 Uppsala, Sweden
E: info@aacmicrotec.com
P: +46 18 560130

fredrik.bruhn@aacmicrotec.com

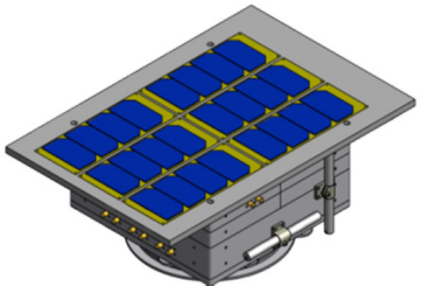
About ÅAC Microtec AB…

- ✓ Formerly named Ångström Aerospace Corporation
- ✓ Two business units
  - **Space and Defense**
  - **Miniaturized and Robust Industrial Electronics**
- ✓ Academic spin-off company from Uppsala University, The Ångström Laboratory
- ✓ Privately owned
- ✓ Semiconductor production class (100) clean rooms
- ✓ Turn over ~ €3.5M Euro





- ✓ CEO, Mats Magnell (f.m. Scania, Mydata, ABB)
- ✓ V.P. Space & Defense, Dr. Fredrik Bruhn
- ✓ Corporate Board
  - ChairmanSven Löfqvist (f.m. CEO Micronic Laser Systems)
  - Stefan Hanna (Deputy Mayor Uppsala, f.m. Ericsson, IBM, Industrimatematik)
  - Olof Stjernberg (board member C2SAT, f.m. CEO Wasakredit)
  - Johan Bäcke, RP Ventures



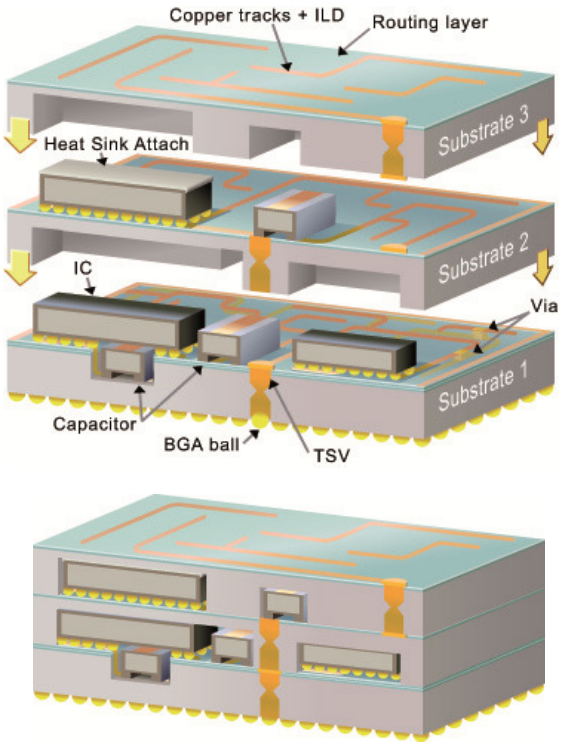
ÅAC world wide locations

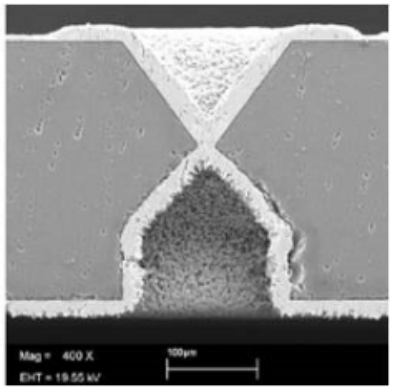
AAC Microtec North America Inc.
NASA Ames Research Center
Building 19 Room 2024
Moffett Field, CA 94035, USA

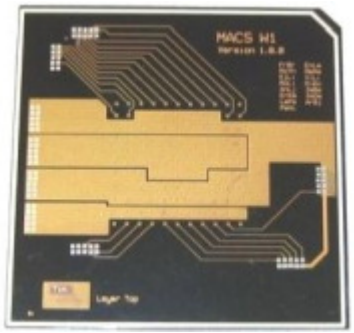
ÅAC Microtec AB
Dag Hammarskjölds väg 54 B
751 83 Uppsala, Sweden

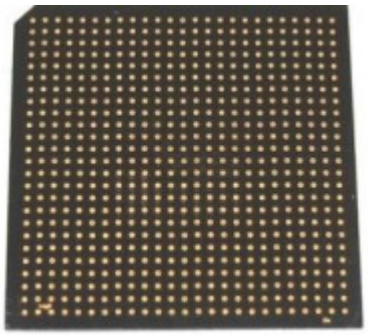
Advanced Packaging Si-interposer Technology Featuring XiVIA™

- ✓ Ruggedized for space temperature range.
- ✓ Licensed to Silex Microsystems and used in hermetic Met-Cap™ packaging for medtech.
- ✓ Under qualification with ESA as ”harmonized” packaging technology for 3D integrated electronics

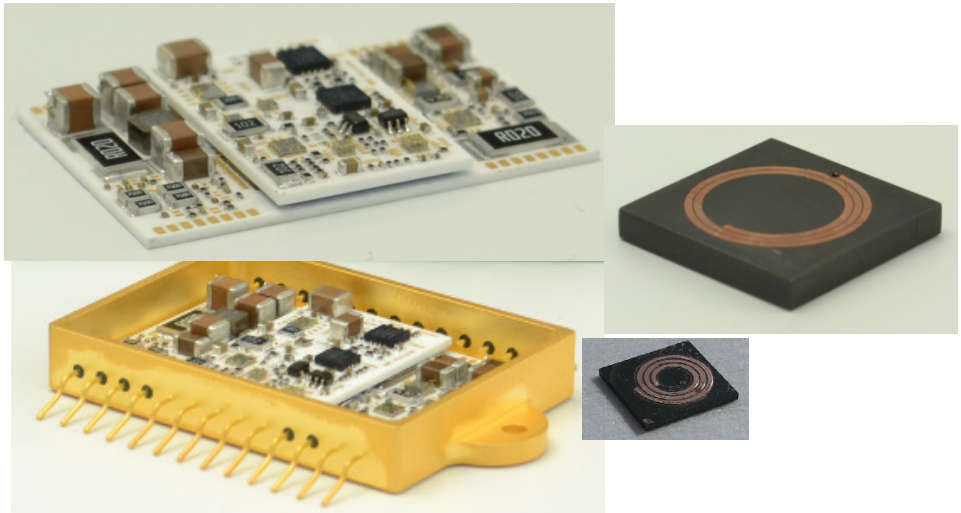


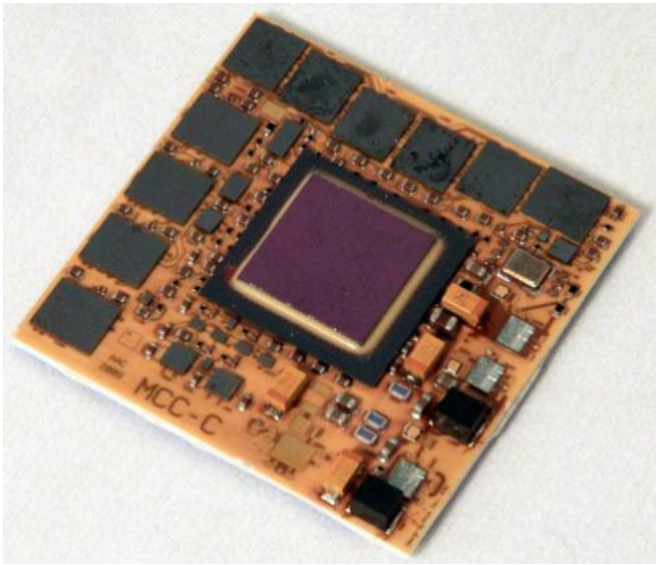


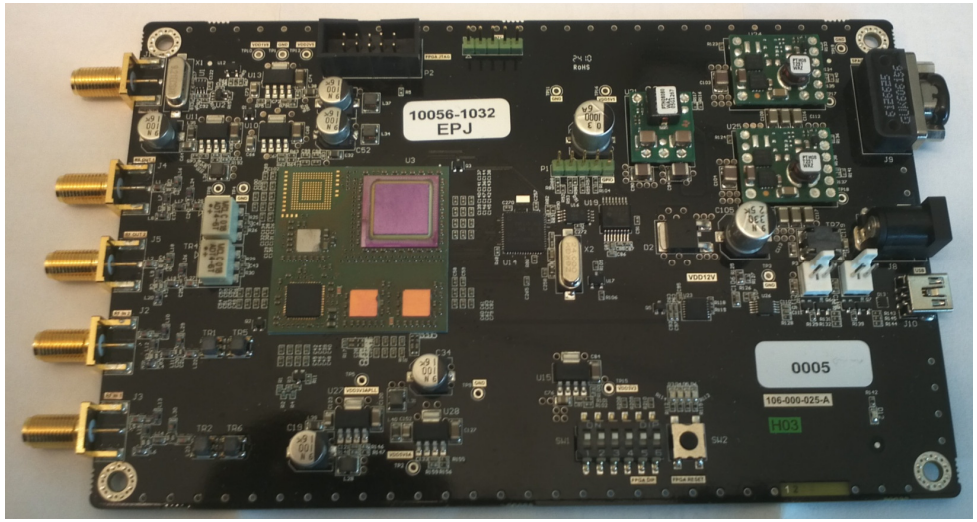


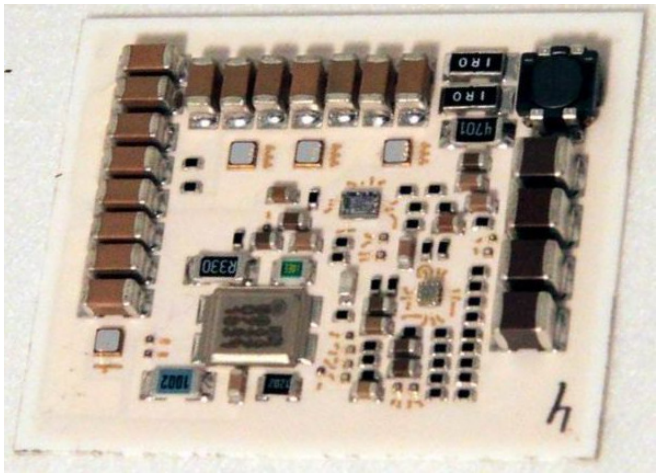


Example miniaturized avionics and power subsystems







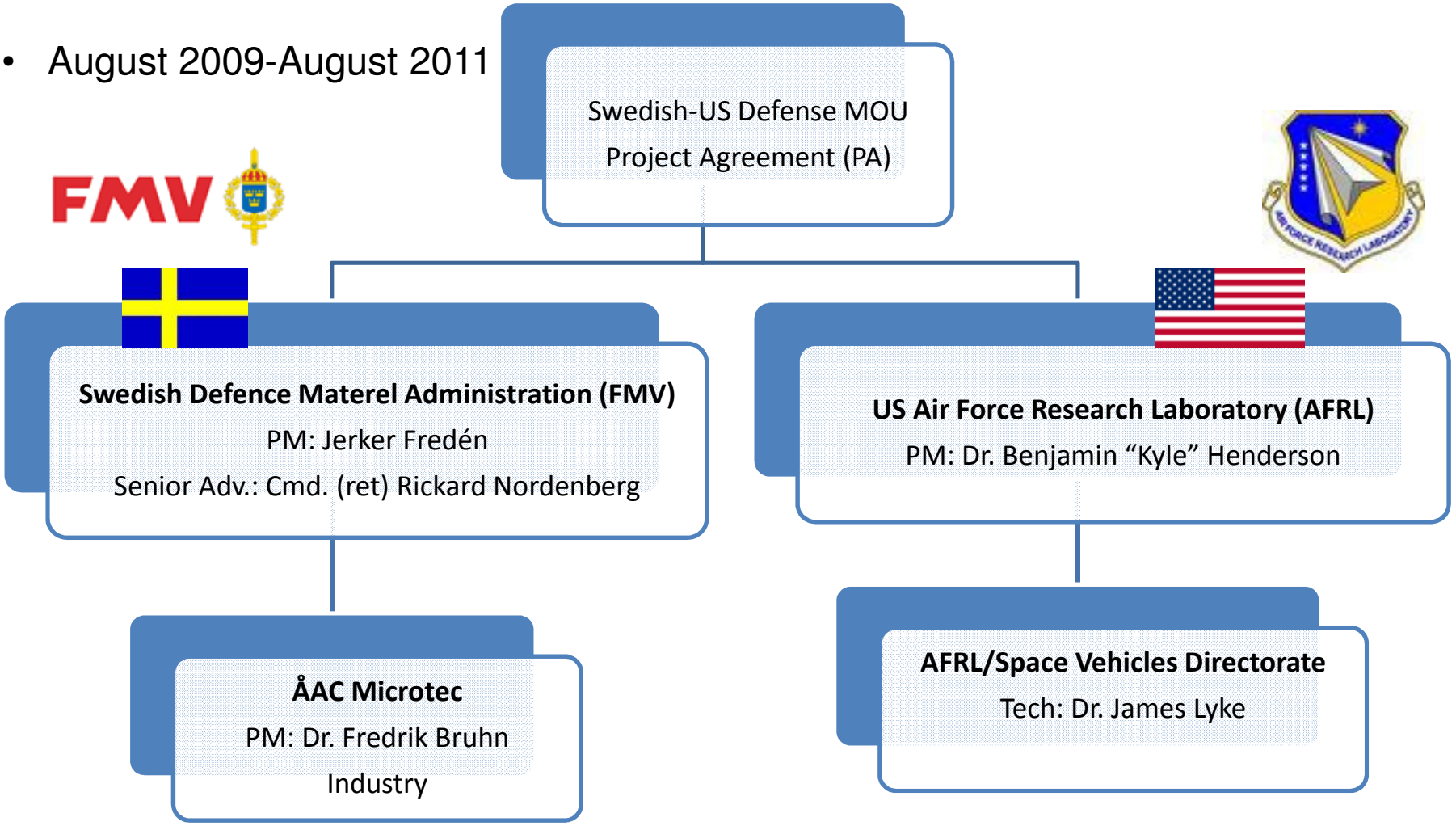


Lowering cost in space business

US Air Force Research Laboratory,
PnPSat-1 AIT

US-Sweden bi-lateral agreement on miniaturized aerospace systems and plug-and-play

- August 2009-August 2011



** Bi-lateral Project Agreement (PA-TRDP-US-SW-AF-09-002)*

Rapid Integration Architecture in short

✓ Self organizing networks according to Space Plug-and-Play Avionics

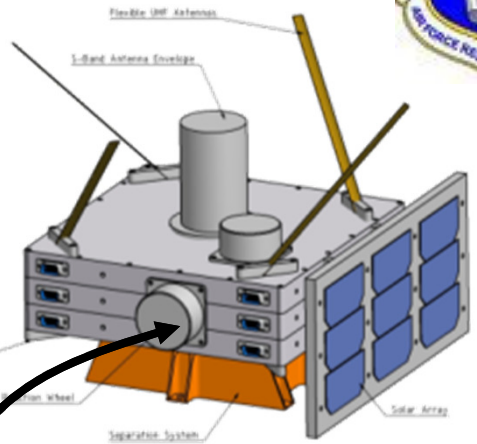
Personal Computer platform

driver

Driver loaded by Operating system based on matching unique device ID

plug-and-play Component with Unique ID

USB interface chip



Driver stored locally in subsystem and sent to On-board Computer for parsing

RIA enabled component

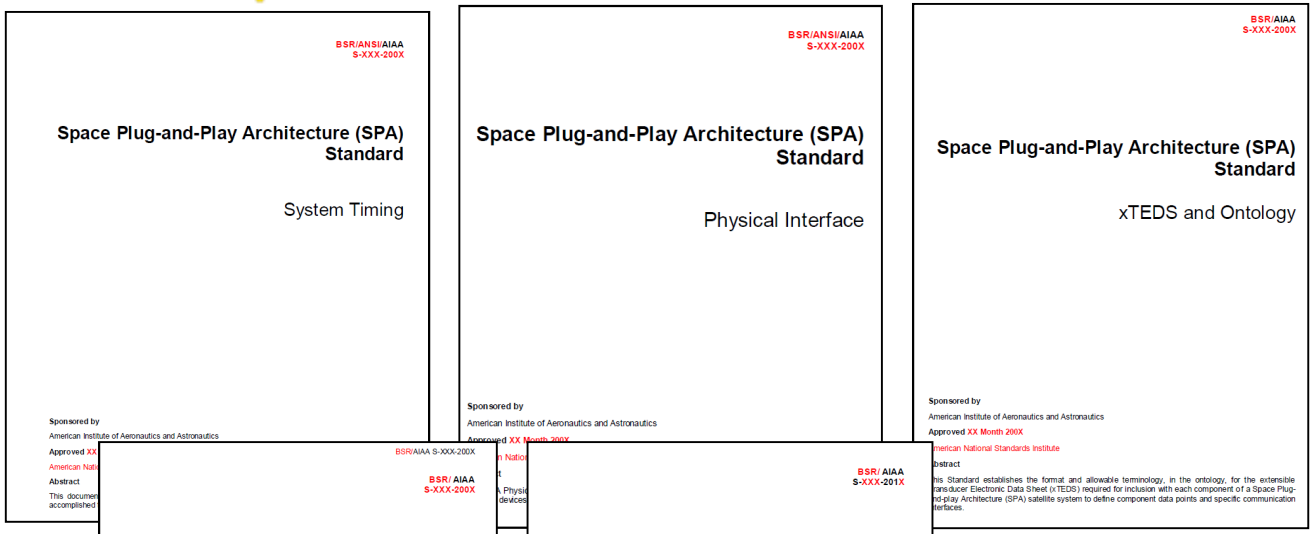
electronic Datasheet / Driver

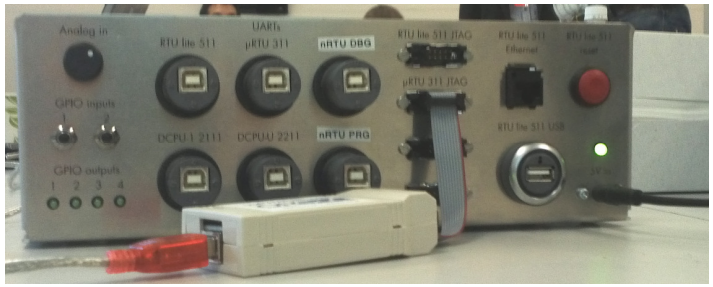
Subsystem / Function

RIA Component with Distributed datasheet / driver (XTEDS)

Remote Terminal Unit (RTU) or Appliqué Sensor Interface Module (ASIM)

Space Plug-and-Play Avionics

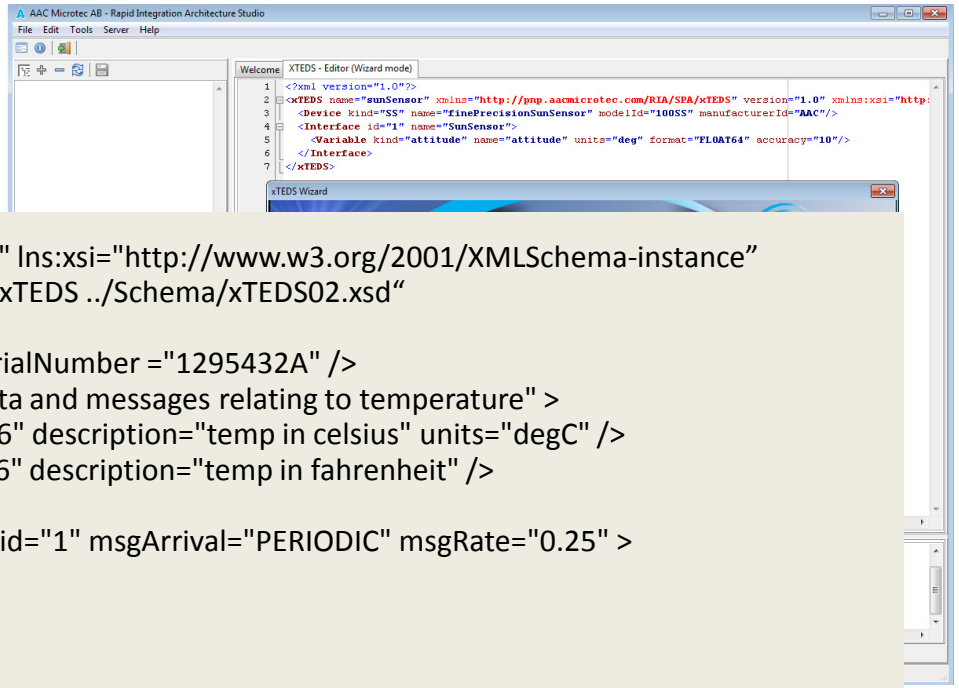




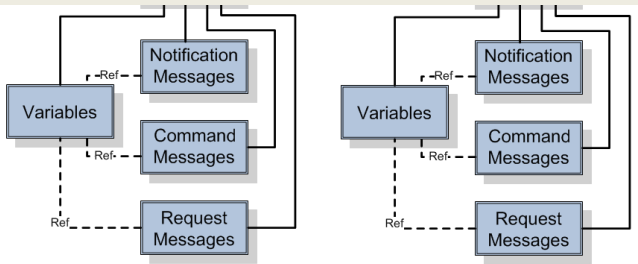
ÅAC Rapid Integration Architecture development kit front-panel

Write your RIA drivers in no time!

- Generate drivers from standardized Common Data Dictionary



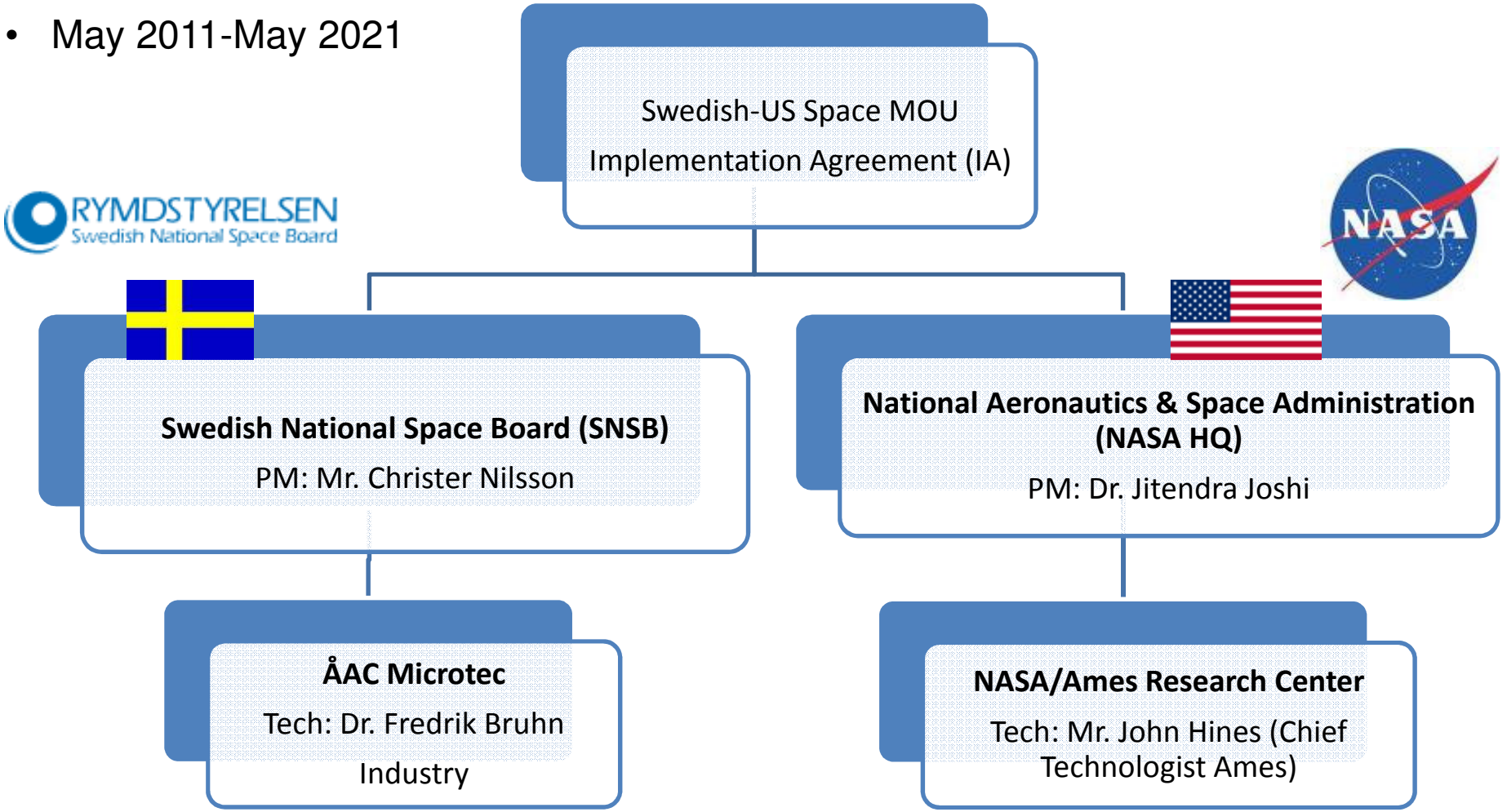

```
<?xml version="1.0" encoding="utf-8" ?>
<xTEDSxmlns="http://www.interfacecontrol.com/SPA/xTEDS" lns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.interfacecontrol.com/SPA/xTEDS ../Schema/xTEDS02.xsd"
 name="TemperatureSensor" version="1.0">
<Device name="TemperatureSensor" kind="TempSensor" serialNumber ="1295432A" />
<Interface name="TemperatureData" id="1" description="Data and messages relating to temperature" >
<Variable name="TempC" kind="temperature" format="INT16" description="temp in celsius" units="degC" />
<Variable name="TempF" kind="temperature" format="INT16" description="temp in fahrenheit" />
<Notification>
<DataMsg name="TemperatureC" description="celsius data" id="1" msgArrival="PERIODIC" msgRate="0.25" >
<VariableRef name="TempC" />
</DataMsg>
</Notification>
<Command>
<CommandMsg name="Reset" description="Re-initializes the temp sensor" id="2" />
</Command>
</Interface>
</xTEDS>
```



You are not alone!

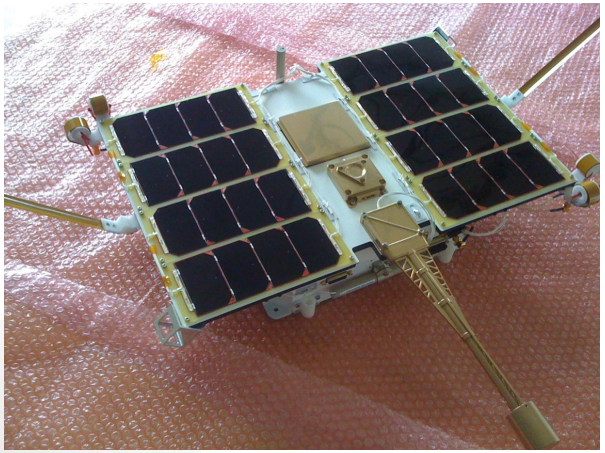
Planned US-Sweden bi-lateral agreement on evaluation and cooperation

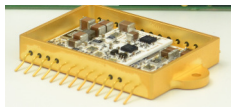
- May 2011-May 2021



QuadSat-PnP in-flight qualification setup

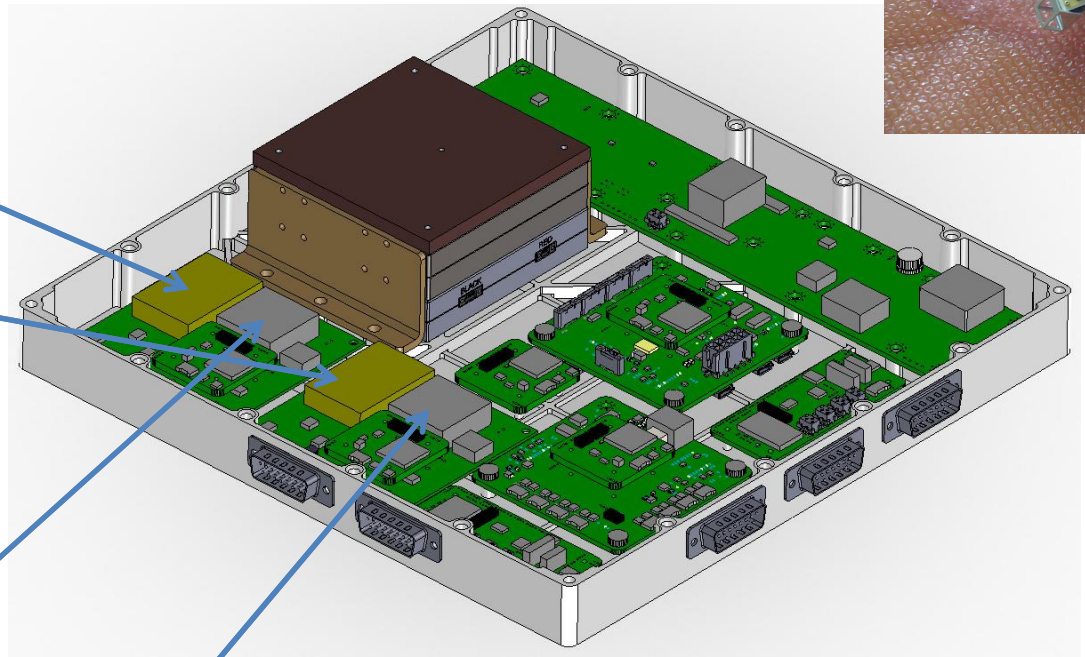
- 2 µPOL with 2 µCoil



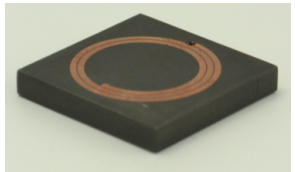


µPOL 1

µPOL 2



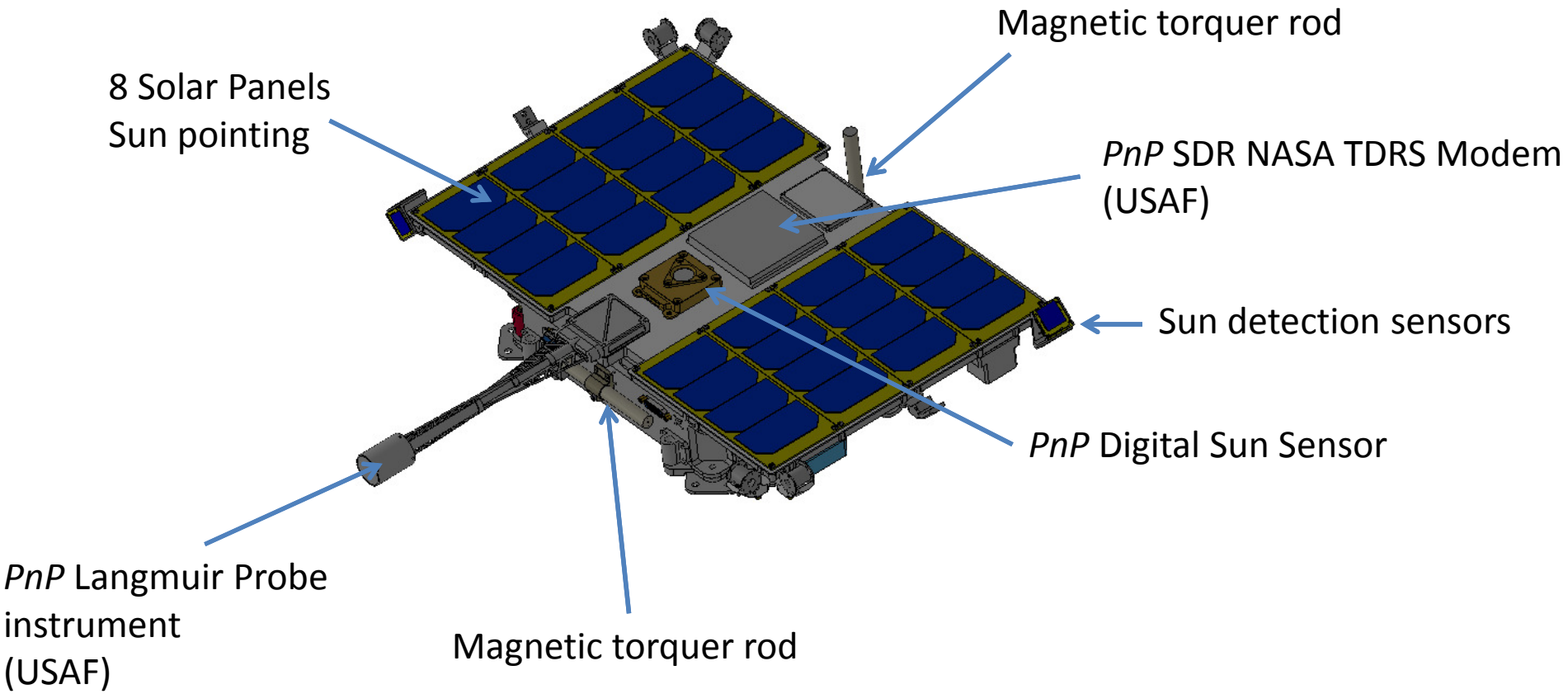
µCoil 1



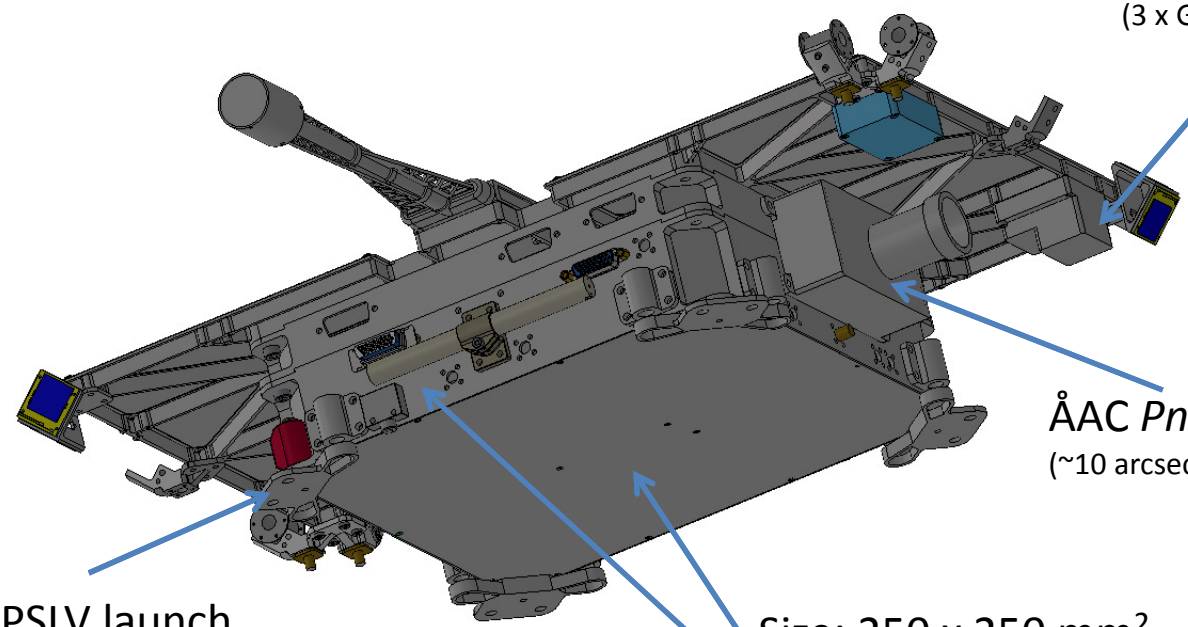
µCoil 2

Breaking boundaries, QuadSat-PnP

- 10 kg nanosatellite with active attitude control



Breaking boundaries, QuadSat-PnP



ÅAC *PnP* 9-DOF INS
(3 x Gyro, 3 x Accel, 3 x MGN)

ÅAC *PnP* StarTracker
(~10 arcsec)

4 x PSLV launch
vehicle interface

Size: 250 x 250 mm²
Height: 80 mm

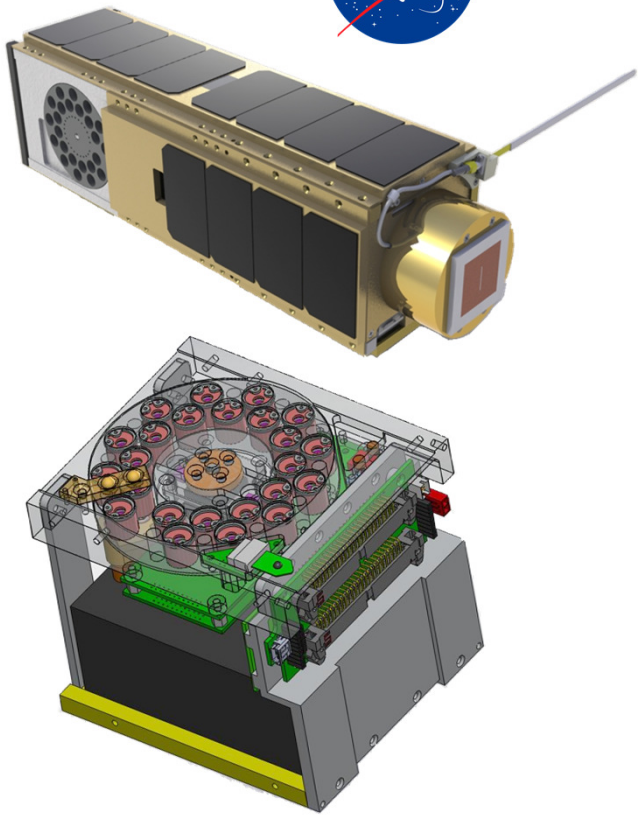
ÅAC 2014/15 nanosatellite performance target

- SPAready, Plug-and-play
- 6U (30 x 20 x 10) cm^3 , < 25 kg
- Radhard (> 40 kRAD, SEU free)
- ÅAC 32-bit Next Generation CPU on 45/90 nm ASIC CPU technology
- 200-400 Mbps SC backbone
- >50 Mbps telemetry (LEO)
- > 70 W (120 W) Orbit Average Power (OAP)
- > 100 GB non-volatile memory
- Chip Scale Atomic Clocks (10^{-12}, 125 mW)
- 10 arcseconds, 8 Hz lost in space star tracker
- Platform is < 25% of volume, ~ 10% of power
- 20 GFlops
- 3 axis stabilized, MTQ, RW

6U CubeSat form factor

NASA ARC
chief technologist,
John Hines
Center director,
Pete Worden

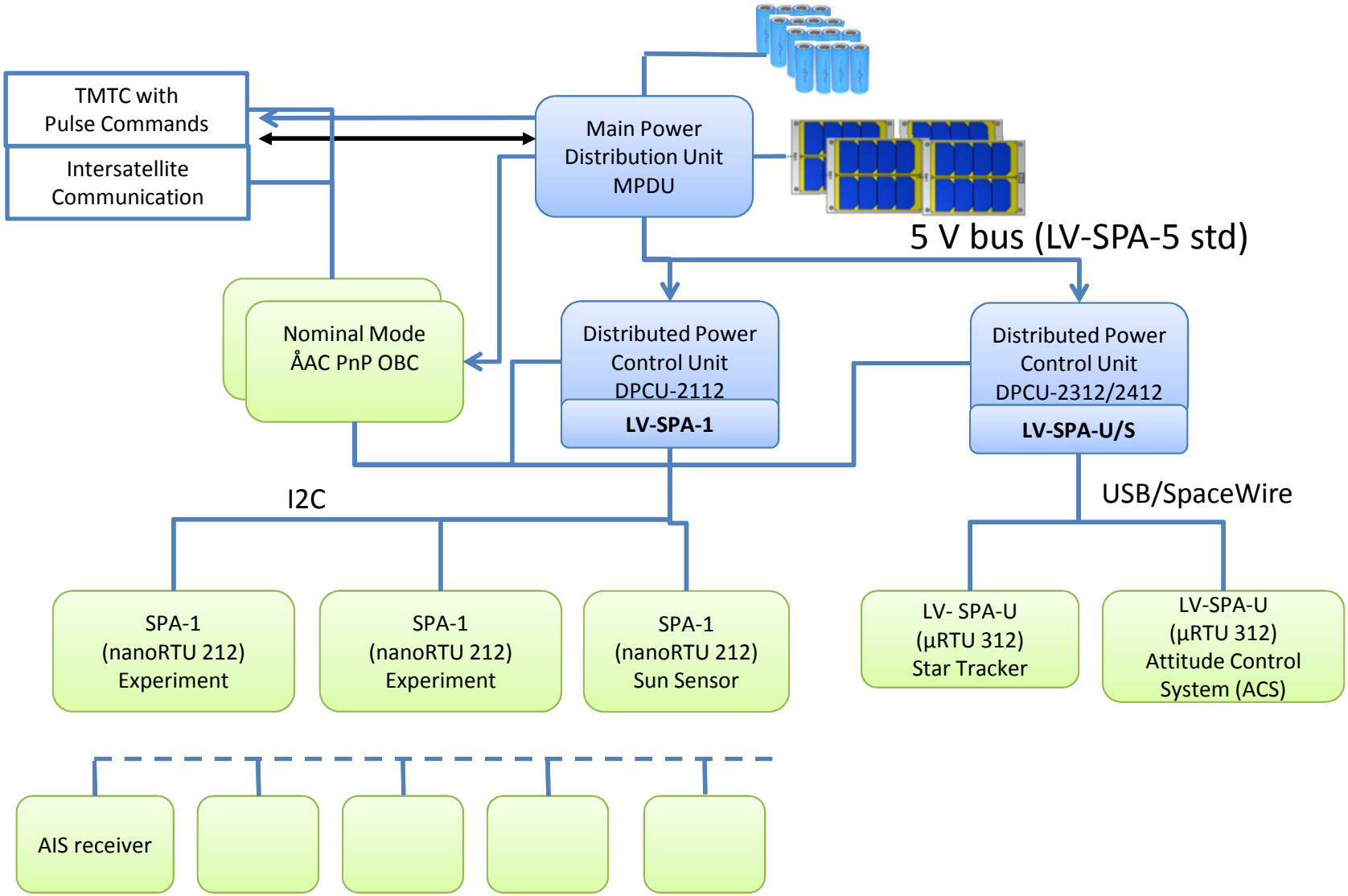
Advanced science with nanosatellites



Courtesy of NASA. O/OREOS. Astrobiology Nanosatellite Mission.
(Organism/Organics Exposure to Orbital Stresses)

Courtesy of NASA.
1.5 m ground resolution F8/1.25m Dobson telescope

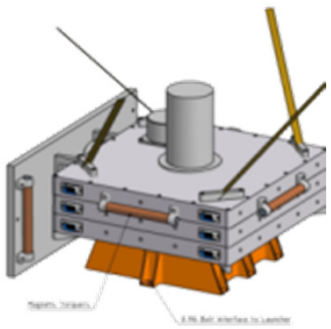
RIA architecture – Prototype a satellite in hours



ÅAC Rapid Integration Architecture component summary

ÅAC RIA platforms

QuadSat-PnP



Virtual Satellite Integration

ÅAC RIA Core components

Avionics	Power
OBC / RTU 800	DPCU 2100
OBC / RTU lite 500	DPCU 2200
µRTU 300	DPCU 2300
nanoRTU 200	MPDU 1100
Non-volatile 16 GB MM	
AIO-30	
HPC	

ÅAC RIA components

GNC	TT&C	Thermal
IRS	VHF	Thermal Switch
Star Tracker	UHF	
Sun Sensor	L-Band	
GPS	OrbCOMM	
Motion Control	S-band	
	TDRS	

ÅAC Education

Plug'n'Play RIA training

Plug'n'Play RIA educational kits

Available Q2 2011

Available Q4 2011

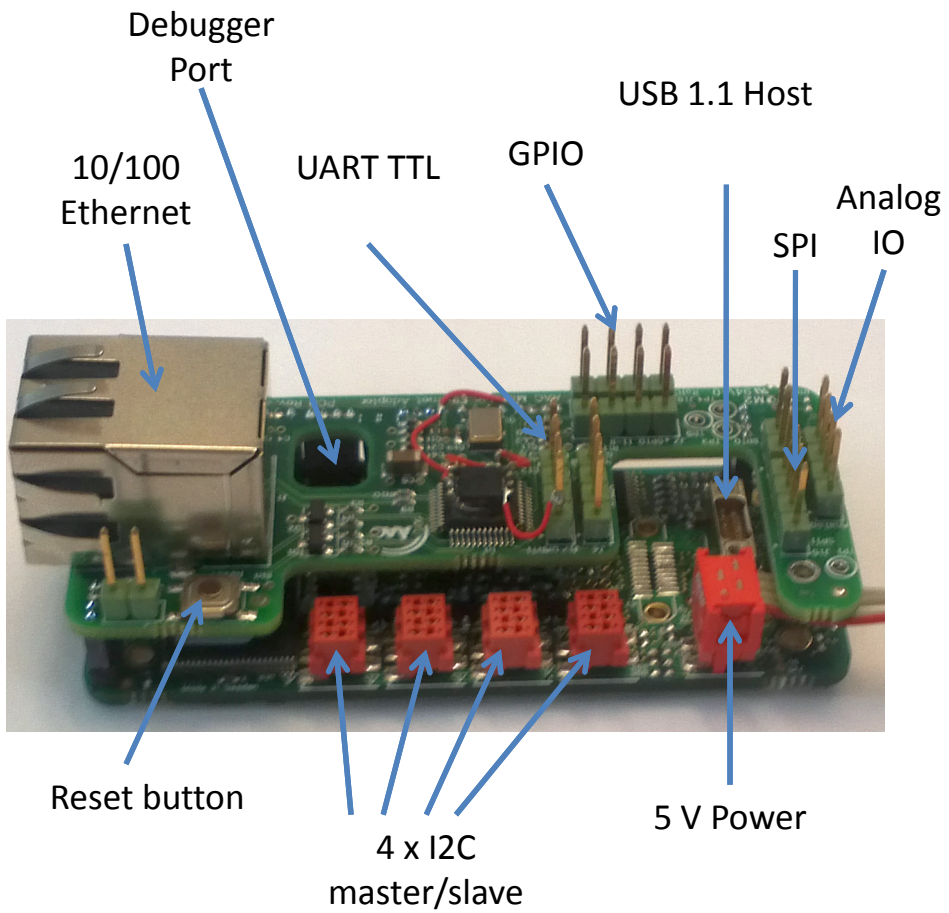
In planning

External supplier

RTU lite 511 with Ethernet add-on

- ÅAC OpenRISC 1200-FT™
- DSP, FPU, MMU
- CPU 18 MHz
- I & D Cache (8 kB/8 kB)
- 64 MB SDRAM @ 72 MHz
- 8 Gbit NAND Flash
- 8 x GPIO TTL
- 4 x I2C
- 1 x SPI
- 1 x USB v1.1
- 1 x Ethernet 10/100
- 1 x RS 422
- 1 x UART TTL
- 4 x 12 bit Analog IO
- Linux OS

- Dimensions: 34 x 68 mm^2



Conclusions

- Highly capable nano/microsatellites platforms available
- Easy to integrate payloads and support for secure Virtual System Integration (VSI) over internet
- State-of-the-art US/European technologies
- Platform development (cost/risk sharing) possible with Rymdstyrelsen, NASA, FMV, US Air Force, (ESA)
- Estimated production price (excluding payload) for a 6U highly advanced radhard spacecraft, ~ 10-15 million SEK
- 11 nations collaborating on Plug-and-Play. Huge library of easy to use subsystems available in 2015
- ÅAC has the technology today and demonstrating it fully in space in 2012.

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July 2010. Version 1.7

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