SAT6A diagram of a diagram

Description automatically generated

## ADCS structure

General: ADS -> ACS -> [Mag.Torq, Reac.Wheel ]   
(only work on ACS has been made)

ACS: (only target tracking, and by proxy Nadir, has been developed)  
A close-up of a white paper

Description automatically generated  
LQR & PI for linear ACS  
A diagram of a complex circuit

Description automatically generated  
SMC for nonlinear

## Sensors/actuator

Camera  
A white background with black text

Description automatically generated

A diagram of a diagram of circles and circles

Description automatically generatedReaction wheels  
A white sheet with black text

Description automatically generated  
-dynamic model  
-wheel configuration

## A table with text and numbers Description automatically generatedDisturbance rejection

Solar radiation  
Air drag  
Magnetic disturbance  
Gravity gradient: neglected when other disturbances are maximized for disturbance rejection  


## Conclusion

Quaternion SMC:  
- linear and nonlinear success for point tracking.  
- Coriolis moment was not compensated, was assumed small enough to be neglected.  
MEKF:  
- succeeded all requirements  
Attitude control testbed:  
- partial success. Can utilize HIL for debugging and verification, has issues for mass centering.  
SMC implementation:  
- for single axis, the SMC was succesfull.  
**Future:**  
**- Fix testbed for multi-axis control**

SAT5

ISS orbit (<1 year lifetime). Payload: AIS system

## ADCS structure A diagram of a device Description automatically generated

## Sensors/Actuators

A table with numbers and text

Description automatically generatedSun sensors  
A close up of words

Description automatically generated  
Gyroscopes  
A close-up of a white background

Description automatically generated  
Magnetometer  
A close up of a number

Description automatically generated  
Magnetorquer   
A white paper with black text

Description automatically generated

## Disturbance rejection

-Magnetometer influencing sensors etc. (controlled by setting a max on duty-cycling = 88%)  
-Solar radiation pressure and winds  
A table with numbers and symbols

Description automatically generated

## Conclusion

-control is successful for single axis with constant magnetic field  
-control was unsuccessful for multi-axis space environment. 3 assumptions for cause of failure  
 -Assumed to be because of single-axial actuation influencing other axes.   
 -Inertia matrix of system is not diagonal, reinforcing first assumption  
 -varying magnetic fields, as would be with earth’s magnetic field.

The satellite was sent in october 2015. It was difficult to communicate with it, because of a change in its orbit. After relaying from a volunteer radio enthusiast in germany, the satellite returned to normal operation.

Fun Fact: The satellite was built as a request of ESA for the first danish astronaut.

# POST-Launch

Launched: 19/8-15  
Currently: Re-entered atmosphere 15/3-16

* Issues with communication, solved afterwards
* No issues mentioned pertaining to ADCS.

SAT4

Payload: AIS system.

Launch: April 2016

ACDS structure  
Segmented into two ACDS-(1 for detumbling, 2 for ACS)  
A diagram of a computer system

Description automatically generated  
MODES: detumbling, point   
Processor for ACDS2: ARM7 (32bit, 600MHz)  
Uses Blackfin processors for Automatic Identification System circuit (need to find out what AIS does).  
Sensors/Actuators  
Magnetorquer

Windings: 275 Dimensions: 0.075m x 0.075m  
Output: 0.5-1.1 µNm (at 700km altitude)

A white background with black text

Description automatically generatedMagnetometer (other reports state a MAG3110FS)  
operating freq: 80Hz  
sensitivity: 0.1 µT

**Gyroscope LPY403A**  
- resolution: up to 120 deg/s  
- sample rate: 140 Hz  
A close-up of a white card

Description automatically generated  
SAT4: pointing control uses 2 gyros??? Also uses an ADC for data conversion.

**Sun sensor**Inhouse built, stores energy in solar cells  
A white rectangular sign with black text

Description automatically generated

# Disturbance rejection

A table with numbers and text

Description automatically generated  
A number and a number of numbers

Description automatically generated with medium confidence  


# Conclusions

## Attitude control system (Brian and Jens, bachelor)

* Magnetorquers bad for 3-axis control, but they’re cheap and easy to use. Effective in single axis control.
* Used a VICON system for ADS. ASK ANDERS LA-COUR ABOUT IT, HE IS SOURCED FOR IT.
* Requirements partial successful

## Att. Det. & point control sys.

* ADS worked, however not within +-2% boundary of error estimate.
* Pointing partially worked, nadir was not a success. Actuation speed was not obtained.
* Further improvements: use non-linear point control, use more complex ADS methods.

# POST-Launch

Launched 25/04-16  
Currently: Operational

SAT3

The objective of AAUSAT3 is to impletent an Automatic Identification System(AIS) for surveillance of Greenlandish waters. It also contains a GPS and a camera.

It has: ADCS1 that focuses on detumbling. ADCS 2 that contains everything

Launch: February 2013

# Modes of operation

A white paper with black text

Description automatically generated

A text on a white background

Description automatically generated

A document with text on it

Description automatically generated A diagram of a state transition diagram

Description automatically generated

A diagram of a computer hardware system

Description automatically generated A diagram of a computer hardware system

Description automatically generated

# Sensors & Actuators

Magnetometers, GPS, gyros, sun sensors, temperature sensors.

A table with numbers and a number of objects

Description automatically generated with medium confidence

A close-up of a paper

Description automatically generated A close-up of a photovoltaic

Description automatically generated A close-up of a list of medical equipment

Description automatically generated with medium confidence

# Error handling

Pretty good. It adds to types of FDI: simple for testing if sensors are operational and Model Based with more complex methods.

A diagram of a system

Description automatically generated

# Conclusion

Mission reached end of life. Properly working for more than 18 months. Still in orbit, last contact 2019.

Battery consumption exceeded the 1W restriction, needing up to 2W of power. Same with the payload, 1.1W. The solar panels showed constant degradation of generated power. They theorise it was due to atomic oxygen. AAUSAT4 appears to have solved this issue.

[Tracking data](https://www.n2yo.com/satellite/?s=39087)

SAT2

Mission payload: gamma ray burst detector

# Modes of operation

* Detumbling
* Idle: Minimum power consumption
* Active pointing mode

# Sensors & Actuators

“The ADCS HW sensor and actuator system consists of three momentum wheels, three magnetorquers, one three-axis magnetometer, six one-axes gyros, six photodiodes (also studied using the solar cells), and six temperature sensors.”

# Error handling

Most extensive definition and control out of all the other satellites. A must to read for next AAUSATs.

# Conclusion

Constant restarts of the satellite, around 10/day. The detumbler doesn’t do its job, satellite tumbles unless detumbled manually.

SAT1

The payload of this satellite is a camera to be pointed to earth.

# Modes of operation

A diagram of a system

Description automatically generated

A white and black text on a white background

Description automatically generated

# Sensors & actuators

A table of data with numbers and text

Description automatically generated with medium confidence

A blue rectangular object with a blue rectangle and a blue rectangle with a blue rectangle and a blue rectangle with a white background

Description automatically generated

Sensors: Sun sensors & magnetometers

# Error handling:

A table with text and numbers

Description automatically generated

# Conclusion:

Magnetorquers are too power consuming. The flywheel planned has been removed because of a lack of space. Sun sensors can provide an attitude error smaller than 4º with appropriate temperature control.

The batteries started failing quite quickly. We found no information of the ADCS performance.