AbC

ADCS Commissioning Services



ADCS







Actuators 👘

NSUS/

2

Our Service

Expertise By Embedded Imagery



3

Optical Sensors

Imperfections



Dynamic range

Misalignment

Distortion #

Hot Pixels

(may increase over time)

Imperfections Dynamic range



NSUS

$\begin{array}{c} \mathsf{Imperfections} \\ \mathsf{Misalignment} \neq \mathsf{/} \mathsf{Distorsion} \neq \end{array}$





Thermal stress

Integration



Vibrations





Imperfections

Hot Pixels



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Pixel Sensitivity Increased

Commissioning Service

Minimize Pointing Precision issues

> Reveal Hardware Defects



Phase 1: Mission Planning

Pointing direction and observation settings Optional software adaptation

Phase 2: On Ground Characterization +- 10 images to download

Phase 3: On Board Characterization AbC Algorithm

Phase 4: Post Processing & Results

Commissioning

On-ground / phase 2

Images From Satellite



Estimate Real Attitude From Image's FOV

Verify Absolute Pointing Error 👘

Verify Attitude Knowledge Error

Characterize Distortion 🗱

List Hot Pixels



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Commissioning

on-board / phase 3



Run AbC Algorithm On A Large Number Of Images

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Calculate Statistics From These Runs

Send Results To The Ground

Process Results

Angle-based Correlation

Algorithm (C++)

Selected Beacon (Star)

Expected Star Location

Real Location

Field Of View



Inputs

Optical Characteristics Correction Matrix (Known Distorsion)

Attitude (Quaternion)

Outputs

Beacon Location

Error Value



Real image



Real image After Some Processing



NSUS

Real images

Stacked



Simple Stack

Characterizes High Frequency Vibrations

Characterizes

Drift & Vibrations

Recentered



1000+ High Pixels Removed



Commissioning

From on-board data / phase 4



AbC Statistics Inferences

Best Realignment Value (AbC Error Value)

Warns About Distorsion Increase (AbC precision decrease)





Advantages AbC Strategy



Independent Service Low Amounts Of Data To Transfer Precise Diagnostic Of ADCS Capabilities Solutions To Compensate Imprecisions Heritage Of Paris Observatory On Astrometry Techniques And Optics

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In-flight Prototype

On board Ops-sat

Polar Orbit Launch: 18 December 2019



System: Embedded Linux

Processor: ARM dual-core Cortex-A9

Memory: 500 MB

Storage: 10 GB

Camera: 2048*1944 RGGB FOV 10°

We are seeking to run it on more hardware (RTOS ...)



ADCS Commissioning

And Even More ...



Abc Algorithm



Other Features

Stray Light



ADCS

Potential Improvement: "Augmented" Sensor





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