



FLORIS Calibration Unit

Audit Plan

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1 Introduction

1.1 Project Overview

The Earth Explorer - Fluorescence Explorer (FLEX) mission will map vegetation fluorescence to quantify photosynthetic activity.

The conversion of atmospheric carbon dioxide and sunlight into energy-rich carbohydrates through photosynthesis is one of the most fundamental processes on Earth – and one on which we all depend.

Information from FLEX will improve our understanding of the way carbon moves between plants and the atmosphere and how photosynthesis affects the carbon and water cycles.

In addition, information from FLEX will lead to better insight into plant health and stress. This is of particular relevance since the growing global population is placing increasing demands on the production of food and animal feed. At the moment, photosynthetic activity cannot be measured from space, but FLEX's novel sensor will observe this faint glow.

The FLEX satellite will orbit in tandem with one of the Copernicus Sentinel-3 satellites, taking advantage of its optical and thermal sensors to provide an integrated package of measurements.

Mission objectives can therefore summarized as follows:

- To assess the quality of fluorescence-derived photosynthesis data against classical optically-based methods (i.e. from fraction of absorbed photosynthetically active radiation times Light Use Efficiency).
- To address in more detail temporal and spatial scaling issues (from towers to satellite footprints).
- To identify and characterize the effects of different types of stress on fluorescence and photosynthesis (especially drought and freezing air temperatures).
- To indicate potential applications of the novel fluorescence observations.

Mission orbit:

- Orbit: Sun-synchronous
- Measurement altitude: 815 km

The FLEX Space Segment consists of a single satellite carrying the FLuORescence Imaging Spectrometer (FLORIS) push-broom instrument. This high-resolution imaging spectrometer will acquire data in the 500– 780 nm spectral range, with a sampling of 0.1 nm in the oxygen bands (759–769 nm and 686–697 nm) and 0.5–2.0 nm in the red edge, chlorophyll absorption and Photochemical Reflectance Index bands.

The monthly global maps will have an on-ground spatial resolution of 300 × 300 m² with a swath width of 150 km.

1.2 Scope of the Document

This plan establishes policy and provisions for Product Assurance (P.A.) audits to be undertaken by ALMATECH during the FLORIS Calibration Unit program.

2 Applicability

The present document is applicable to FLORIS Calibration Unit program.

3 Applicable and Reference Documents

3.1 Applicable Documents

Ref.	Title	Reference	Iss.
AD 105	Cover Letter	FLX-LET-FNM-INS-0003	3
AD 106	Special Condition of Tender	FLX-OF-FNM-INS-0001	4
AD 100	Contract for FLEX Unit/sub-system	Draft Contract	
AD 101	Generic Statement of Work for FLEX Unit/sub-system	FLX-SOW-FNM-INS-0001	2
AD 102	Specific Statement of Work	FLX-SOW-FNM-INS-0005	2
AD 103	Floris Calibration Unit User Requirement Specification	FLX-RS-FNM-INS-0006	5
AD 201	FLORIS Radiation Environment RS	FLX-RS-FNM-INS-0016	4
AD 202	FLEX FEMM Requirements Specification	FLX-RS-FNM-INS-0023	1
AD 203	FLEX GMM &TMM Requirements Specification	FLX-RS-FNM-INS-0024	1
AD 204	FLEX CAD Model Requirements Specification	FLX-RS-FNM-INS-0025	1
AD 205	FLEX Cleanliness Requirements for Sub-contractors	FLX-RS-FNM-INS-0028	3
AD 206	FLEX Instrument General Design Interface Requirements	FLX-RS-FNM-INS-0029	3
AD 208	FLEX PA Requirements for Subcontractors	FLX-RS-FNM-INS-0021	2
AD 209	FLEX PA SW Requirements for Subcontractors	FLX-RS-FNM-INS-0022	1
AD 210	FLEX Configuration Control and Documentation Management Plan	FLX-PL-FNM-INS-0001	3
AD 211	FLEX List of Acronyms and Abbreviations	FLX-LI-FNM-INS-0003	2

3.2 Reference Documents

Ref.	Title	Reference	Iss.	Date
[RD01]	FLORIS Calibration Unit Almatech Proposal	17-10S-225	1.0	15.06.2017
[RD02]	Leonardo Clarification Letter	FLX-LET-FNM-INS-0009	--	18.10.2017
[RD03]	Floris CU Negotiation Meeting #1 between Leonardo and Almatech	FLX-MIN-FNM-INS-0041		15.11.2017

3.3 Acronyms and Abbreviations

The abbreviations and acronyms used in this document are in accordance with [AD 211].

4 Audit Plan and Audit Report

All suppliers not including machining and certified dimensional control will specifically be audited on their general QMS against specific project constraints.

4.1 Audit Plan

The typical audit plan is the presented here below, it can be updated depending on the project needs:

- General quality management system review :
- Processes
- Applicable documents
- Records
- Procurement and procured parts management
- Preparation and production activities
- Traceability activities
- Facility tour
- Controls (during production and final)
- Non-conformance product management and corrective actions implementation
- Training of personnel & Acceptance authority management
- Documentation of procedures
- Metrology and calibration
- Handling storage and preservation
- Cleanliness and contamination control

4.2 List of suppliers

Following suppliers (sorted from most to less critical) are foreseen to be audited at PDR:

4.2.1 Labsphere

- Labsphere is the manufacturer of the Sun Diffuser.
- Sun diffuser is a critical part in the calibration unit
 - It is a single point failure
 - Its cleanliness requirement is stringent and Labsphere does not recommend to clean the Sun Diffuser after delivery from their premise
- Audit is planned at Source inspection with the baseline defined in §4.1 with a special focus on the cleanliness aspect
- Audit is planned at source inspection only as Labsphere is a well-known space parts manufacturer with an important heritage.
- Labsphere already came to Almatech for a first discussion.
- No periodicity defined as source inspections will be performed.

4.2.2 Black anodizing

- Black anodizing supplier is used on most of the parts of the calibration unit.
- Black anodizing supplier is critical because this coating impacts the performances of the calibration unit.
- Baseline of the audit is defined in §4.1.
- Audit is planned before CDR.
- Supplier is not selected yet.
- Only one audit planned up to now.

4.2.3 Harmonic Drive

- Harmonic Drive is the manufacturer of the so called Harmonic Drive.
- Harmonic Drive is critical because it is one of the part that allow the calibration unit to rotate and is a single point failure.
- Baseline of the audit is defined in §4.1.
- Audit is planned before CDR.
- A technical discussion has already been held at Harmonic Drive. The audit is still to be planned.
- Only one audit planned up to now.

4.2.4 Phytron

- Phytron is the manufacturer of the motor of the mechanism.
- Phytron motor is critical because it is one of the part that allow the calibration unit to rotate and is a single point failure.
- Baseline of the audit is defined in §4.1.
- Audit is planned before CDR.
- Audit has already been performed on 12.06.2018 (report: ALM-PRO-3725_1-0).
- Only one audit planned up to now.

4.2.5 ESTL

- ESTL is the company that do the lubrication of all lubricated parts of the mechanism.
- ESTL is critical because it allows to survive the mission lifetime.
- No baseline is defined as no audit is planned.
- The reason why no audit is planned is that ESTL is a well-known lubrication company in Europe with an important heritage. Almatech already worked with ESTL on previous projects.
- An audit can be planned if any need is identified during the project.

4.2.6 ADR

- ADR is the company that manufacture the ball-bearings of the mechanism.
- ADR is critical because it is one of the part that allow the calibration unit to rotate.
- No baseline is defined as no audit is planned.
- The reason why no audit is planned is that ADR is a well-known bearing manufacturing company in Europe with an important heritage. Almatech already worked with ADR on previous projects.
- An audit can be planned if any need is identified during the project.

If deemed necessary, specific audits will be conducted at subcontractor premises before or during the flight parts manufacturing.

The customer is welcome for any audit that they would consider necessary.