

	<p align="center">OrbFIX ESR: Executive Summary Report</p>	<p>Code: OrbFIX-ESR-080 Issue: 1.0 Date: 15/03/2023 Page: 1/5</p>
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ESR: Executive Summary Report

Prepared by:	Rareş Apostol, Andrei Hulea, Claudiu Cherciu
Approved by:	Marius Truşculescu, Alexandru Pandele
Authorised by:	Mugurel Bălan

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1. Document information

1.1. Revision History

Issue	Date	Section
1.0	15/03/2023	First issue, draft version

Table 1.1: Revision History

1.2. Acronyms

ADC	- Analog to Digital Converter
COTS	- Commercial off-the-shelf
GNSS	- Global Navigation Satellite System
LEO	- Low-Earth Orbit
MCU	- Microcontroller Unit
OP	- Orbit Propagator
PPP	- Precise Point Positioning
PVT	- Position Velocity Time
RISE	- Romanian InSpace Engineering

1.3. Applicable and Reference Documents

No.	Title	Reference	Issue/Date
1	OrbFIX De-Risk Proposal		
2	OrbFIX De-Risk Negotiation Meeting	ORBFIX_MOM_N EGO_001	11/11/2019
3	Statement of Work NAVISP-EL1-009: Space GNSS Receiver for In-Orbit Demonstration of Precise Point Positioning (In Space PPP - P2OD)	NAVISP1-SOW- ESA-009-00003	24/11/2017
4	Tailored ECSS Engineering Standards for In-Orbit Demonstration CubeSat Projects	TEC- SY/128/2013/SPD /RW	Rev3 24/11/2016
5	DRSK-D1: System Requirements Report	OrbFIX-SRR-010	v1.0 03/03/2020

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6	Radiation hardness assurance – EEE components	ECSS-Q-ST-60-15C	
7	Total Dose Steady-State Irradiation Test Method	ESCC-22900xx/xx/2023	
8	Single Event Effects Test Methods and Guidelines	ESCC-25100	
9	D1: HIL Test Report	OrbFIX-HIL-010	v1.1 29/10/2021
10	D2: Prototype Report - draft version	OrbFIX-IKP-020	V0.1 24/02/2022
11	D3: Prototype Report - complete version	OrbFIX-PDR-030	V1.1 24/06/2022
12	D4: Critical Design Report - complete version	OrbFIX-CDR-040	V1.1 20/12/2022
13	D5: Manufacturing Report	OrbFIX-MF-050	V1.0 15/03/2023
14	D6: Qualification Procedure Report	OrbFIX-QPD-060	V1.0 15/03/2023

Table 1.3: Applicable and reference documents

2. Purpose and Objective

The purpose of this document is to give an executive summary of the activities deployed in the frame of the OrbFIX project.

This document has been issued in the framework of the OrbFIX project under ESA contract 4000129338/19/NL/BJ/ig by Romanian InSpace Engineering SRL. The focus of this work is the highly accurate, multi-constellation, AI augmented GNSS receiver named OrbFIX.

This document is the deliverable related to all activities developed in the frame of the OrbFIX project.

3. Executive Summary

The OrbFIX project has as its main purpose the development of a Cubesat compatible system which consists of a GNSS receiver hardware that can be augmented using neural networks in order to obtain a higher order of PVT precision. With this in view, the projects' main activities were related to: the development of the PC104 hardware prototype which will perform the

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GNSS acquisition and processing and the firmware development which will focus on the implementation of the artificial neural network which will provide GNSS corrections and communication with other systems.

The development began with a preliminary breadboard configuration of OrbFIX which included two development kits, one for the GNSS receiver and the other for the microcontroller unit in order to validate proper functionality between the two hardware components. It was then followed by the PCB design, in several iterations.

The activity continued with continuous testing and implementation/correction of each iteration. During the hardware and software development, several errors or better implementation practices were identified and corrected, to obtain an end product that performs optimally. Several initially selected components were swapped with more suitable ones and integrated in the following PCB iterations. From a software perspective, the on-board real-time operating system suffered multiple architectural modifications to better perform its tasks while taking into consideration various external parameters such as its available contiguous memory and scheduling.

In order to validate the OrbFIX device to the harsh space conditions, several tests were required: vibration, thermal and radiation. All tests were executed and the outputs were presented in the Test Report.

It can be concluded that the activities developed in the frame of the OrbFIX project resulted in a high-performance multi-constellation, ANN-augmented GNSS receiver that is available for all Cubesat missions, is easily to integrate due to it adhering to the CubeSat standard, provides and stores accurate positioning information and can mitigate incoming interferences.