Publication Year	2021
Acceptance in OA@INAF	2023-02-15T16:30:40Z
Title	ASTRI Mini-Array User Requirements of the SCADA Operator Human Machine Interface System
Authors	FIORETTI, Valentina
Handle	http://hdl.handle.net/20.500.12386/33508
Number	ASTRI-INAF-SPE-9100-008

ASTRI Mini-Array

User Requirements of the SCADA Operator Human Machine Interface System

Prepared by:	Name:	V. Fioretti	Signature:		Date:	Apr 9, 2021
Verified by:	Name:	A. Bulgarelli	Signature:		Date:	Apr 9, 2021
Approved by:	Name:	A. Bulgarelli F. Lucarelli	Signature:		Date:	Apr 9, 2021
Released by:	Name:	S. Scuderi	Signature:		Date:	Apr 9, 2021

All information contained in this document is property of **INAF.** All rights reserved.

Main Authors: V. Fioretti
Contributor Authors: F. Lucarelli, N. Parmiggiani, A. Costa, S. Germani, V. Conforti, A. Bulgarelli, S. Lombardi, A. Stamerra

All information contained in this document is property of **INAF.** All rights reserved.

Table of Contents

1. Introduction **7**
1.1. Purpose 7
1.2. Scope 7
1.3. Content 8
1.4. Definitions and Conventions 8
1.5. Abbreviations and acronyms 8

2. Applicable and reference documents **10**
2.1. Applicable documents 10
2.2. Reference documents 10

3. Overview **11**
3.1. Product Definition 11
3.2. Functional Break Down 11
3.3. Interface Definition 11
3.4. Product Operational Scenarios 12
3.5. User Characteristics 12
3.6. Assumptions and Dependencies 13

4. Characteristics **14**
4.1. Operational Modes 14
4.2. Functional Requirements 14
4.2.1. General features 14
4.2.2. Observation 16
4.2.3. Control, state transitions, and operations 18
4.2.4. Monitoring 20
4.2.5. Data acquisition, data quality and quick-look 22
4.2.6. Alarms 24
4.2.7. Logging 27
4.2.8. Operator Logbook 27
4.2.9. General interface guidelines 27
4.3. Performance Requirements 29
4.4. Constraints 30

5. Interfaces **31**
5.1. User Interfaces 31
5.2. Logical Interfaces 31

6. Design and Construction **32**

7. Support Requirements **35**
7.1. Integration, Installation 35

All information contained in this document is property of **INAF.** All rights reserved.

7.2. Personnel and Training 35

8. Product Assurance **35**

8.1. Quality Assurance 35

8.1.1. Test Requirements 35

8.1.2. Analysis or Simulation Requirements 35

8.1.3. Verification Requirements 35

8.1.4. Development / Qualification Test Requirements 35

8.2. RAMS Requirements 35

8.2.1. Reliability 35

8.2.2. Availability 35

8.2.3. Maintainability 36

8.2.4. Maintenance Approach 36

8.2.5. Security 36

All information contained in this document is property of **INAF.** All rights reserved.

INDEX OF FIGURES & TABLES

All information contained in this document is property of **INAF.** All rights reserved.

Document History		
Version	***Date***	***Modification***
1.0	Apr 9, 2021	First version aligned with version 2.4 of the software system documents.

All information contained in this document is property of **INAF.** All rights reserved.

1. Introduction

The **ASTRI Mini-Array (MA)** is an INAF ground-based project to construct, deploy and operate a set of nine identical dual-mirror Cherenkov gamma-ray telescopes, and several other auxiliary equipment and infrastructures. The ASTRI Mini-Array scientific objective is to exploit the imaging atmospheric Cherenkov technique to measure the energy, direction and arrival time of gamma-ray photons arriving at the Earth from astrophysical sources. In the almost unexplored energy range 1-300 TeV this technique requires an array of optical telescopes (~ 4 m in diameter) at a site located at an altitude of > 2000m. The telescopes will have reflecting mirrors focusing the Cherenkov UV-optical light produced by atmospheric particle cascades (air-showers), initiated by the primary gamma-ray photons entering in the atmosphere, onto ultrafast (nanosecond timescale) cameras. Most of the collected data will come from the large number of charged primary cosmic-ray initiated air-showers, which will also be recorded, then appropriate data analysis methods will be employed to reduce the level of this background and allow an efficient detection of gamma-rays coming from astrophysical sources.
Besides the gamma-ray scientific program, the ASTRI Mini-Array will also perform:

- Stellar Hambury-Brown intensity interferometry: each of the telescopes of the ASTRI Mini-Array will be equipped with an intensity interferometry module. The Mini-Array layout with its very long baselines (hundreds of meters), will allow, in principle, to obtain angular resolutions down to 50 micro-arcsec. With this level of resolution, it will be possible to reveal details on the surface of bright stars and of their surrounding environment and to open new frontiers in some of the major topics in stellar astrophysics.
- Direct measurements of cosmic rays: 99% of the observable component of the Cherenkov light is hadronic in nature. Even if the main challenge in detecting gamma-rays is to distinguish them from the much higher background of hadronic Cosmic Rays, this background, recorded during normal gamma-ray observations, will be used to perform direct measurements and detailed studies of the Cosmic Rays themselves.

The ASTRI MA telescopes (including the Cherenkov Camera) are an updated version of the ASTRI-Horn Cherenkov Telescope operating at Serra La Nave (Catania, Italy) on Mount Etna.

The nine telescopes will be installed at the Teide Astronomical MA System, operated by the Instituto de Astrofisica de Canarias (IAC), on Mount Teide (~2400 m a.s.l.) in Tenerife (Canary Islands, Spain).

The ASTRI MA System will be operated by INAF on the basis of a host agreement with IAC.

1.1. Purpose

This present document defines the user requirements of the **Operator Human Machine Interface (HMI)** and describes the product in terms of functions, interfaces, and user characteristics.

1.2. Scope

The **Operator HMI** is part of the Supervisory Control and Data Acquisition System (**SCADA**), as described in [AD3].

The **Operator HMI** is a software system that the **Operator** uses to operate the **MA System** remotely.

All information contained in this document is property of **INAF.** All rights reserved.

1.3. Content

The document is divided into several sections where the requirements are defined. These sections aggregate different types of requirements. The requirements are defined in tables that show the requirement ID, requirement name, requirement description, requirement verification strategy, and the traceability with higher-level requirements.

1.4. Definitions and Conventions

To specify requirements the following convention has been adopted [AD1]:

ASTRI-[PBS ID]-[TYPEID | REQID]

where PBSID is a unique identifier derived from the PBS document [AD4].

TYPEID must be

- Environmental 1000
- Functional and performances 2000
- Design 3000
- Physical 4000
- Interface 5000
- Product Assurance 6000
- Verification 7000
- Package, Transportation and Handling 8000

REQID is a progressive number.

The Requirement Verification Strategy (RVS) [AD1] can be:

- Test (including demonstration) (T)
- Analysis (A)
- review of design (D)
- Inspection (I)

1.5. Abbreviations and acronyms

ADAS: Array Data Acquisition System
AOC: Array Operation Center
AOS: Array Observing Site
AS: Alarm System
BS: Boot System
CC: Central Control
HMI: Human Machine Interface
MA: Mini-Array
OOQS: Online Observation Quality System

All information contained in this document is property of **INAF.** All rights reserved.

SCADA: Supervisory Control and Data Acquisition system
SCDB: System Configuration Database
SI3: Stellar Intensity Interferometry Instrument

All information contained in this document is property of **INAF.** All rights reserved.

2. Applicable and reference documents

2.1. Applicable documents

The following documents, of the exact issue shown, form part of this specification to the extent specified herein. In the event of a conflict between the documents referenced herein and the content of this document specification, the content of this document specification shall be considered as a superseding requirement.

[AD1] ASTRI Mini-Array Requirements Management Plan ASTRI-INAF-PLA-2000-002, issue 1.0
[AD2] ASTRI Mini-Array Software Quality Assurance Plan, ASTRI-INAF-PLA-3400-001, issue 1.0
[AD3] A. Bulgarelli et al., ASTRI MA Top Level Software Architecture, ASTRI-INAF-DES-2100-001, issue 2.4
[AD4] ASTRI MA Software PBS, ASTRI-INAF-DES-2100-002, issue 2.4
[AD5] A. Bulgarelli, G. Tosti, et al., ASTRI MA Data Model, ASTRI-INAF-DES-2100-003, issue 2.4
[AD6] A. Bulgarelli, G. Tosti, et al., ASTRI MA Top Level Use Cases, ASTRI-INAF-SPE-2100-001, issue 2.4
[AD7] ASTRI-MA Software Development Plan: ASTRI-INAF-PLA-2100-002, issue 1.0
[AD8] N. Parmiggiani et al., ASTRI MA Glossary, ASTRI-INAF-LIS-2100-001 , issue 2.4
[AD8] ASTRI MA Software Engineering Management Plan: ASTRI-INAF-PLA-2100-001, issue 1.0

2.2. Reference documents

[RD1] CTA: https://hal.inria.fr/hal-01350713/document
[RD2] ALMA: https://hal.inria.fr/hal-01061544/en
[RD3] SKA: https://ui.adsabs.harvard.edu/abs/2018SPIE10707E..2ZM/abstract
[RD4] MAGIC: https://arxiv.org/pdf/0907.0946.pdf
[RD5] ASTRI-MA Project Management Plan: ASTRI-INAF-PLA-1000-001, issue 1.9
[RD6] ASTRI-MA Operation Concept: ASTRI-INAF-SPE-1000-001, issue 1.3
[RD7] ASTRI-MA Risk Management Plan: ASTRI-INAF-PLA-1000-002, issue 1.3
[RD8] ASTRI Mini-Array PBS: ASTRI-INAF-DES-2000-001, issue 1.8

All information contained in this document is property of **INAF.** All rights reserved.

3. Overview

3.1. Product Definition

The **Operator HMI** is the **SCADA** user interface and it includes software and communication infrastructure required for the **Operator** and/or the **Astronomer-on-duty** to remotely check the status of the observation, to control and monitor systems, subsystems and assemblies of the ASTRI Mini-Array, to check logs, to monitor the data quality, and to actively respond to alarms.
The **Operator HMI** provides an overview of the MA system and guides the **Operator** and/or the **Astronomer-on-duty** in establishing a connection between its components, while ensuring a fluid navigation of the system with the minimum amount of interactions by the user.
The **Operator HMI** is part of the **SCADA** system and interacts with the **SCADA** subsystems, the **Operator** and the **Astronomer-on-duty**.

All use cases reported in [AD6] shall be considered applicable functional and operational requirements for this product and complement the detailed requirements reported in this document. All documentation reported in Sect. 2.1 is applicable.

3.2. Functional Break Down

The **Operator HMI** shall have the following main functions:

- offer a comprehensive view of the status of the **MA System**, **SCADA** sub-systems, and observations to the **Operator** and the **Astronomer-on-duty**;
- provide the interface to the **Operator** for the **Monitoring System** and **Logging Systems**;
- provide the interface to the **Operator** for control of the **MA System**;
- provide an **Operator Logbooks**, to allow the **Operator** to manually record the most important events of the night;
- record the actions of the **Operator** and of the **Astronomer-on-duty** over the **Operator HMI** and send them to the **Operator Logbooks**;
- remotely operate the **MA System**;
- provide the **Operator** with the ability to react to alarms provided by the **Alarm System**.

3.3. Interface Definition

The **Operator HMI** will include monitoring, control and logging interfaces (displays, interactive panels) between the **Operator** and the **Astronomer on-duty** to the:

- **Central Control System** and all **Control Software** and **Collectors**;
- **Array Data Acquisition System**;
- **Online Observation Quality System;**
- **Logging System;**
- **Monitoring System;**
- **Alarm system;**
- **On-site Archive system**.

All information contained in this document is property of **INAF.** All rights reserved.

Logging System, Monitoring System and **Alarm Systems** monitor the overall performance of the systems through the acquisition of environmental, monitoring and logging points and alarms from instruments and generate status reports or notifications to the **Operator** via the **Operator HMI**.
The **Log Consumer** communicates with the **Operator HMI** to provide real time logging information.
The **Monitoring GUI** is part of the **Operator HMI** and it represents a set of different User Interfaces, accessible from the web, desktop and mobile clients, through which interested users can watch in real-time a streaming of monitoring data and can browse and query the historical one. It's made up of a backend exposing.
The **Alarm dispatcher** notifies and sends alarm data points from the **Alarm System** to the **Operator GUI**, using HTTPs APIs and/or Websocket protocols.
The **Online Observation Quality System** focuses on ongoing problems (data quality checks, a quick-look of the calibrations) feeding the appropriate results to the **Operator**.

3.4. Product Operational Scenarios

The Operational Scenarios of the **Operator HMI** include the selection of the Scheduling Bock to be executed, the cross-check of the status of the array, the observation, data quality and the environmental and atmosphere conditions, the monitoring and reaction to alarms.

All Operational scenarios are to be performed remotely.

The **Operator HMI** shall allow the **Operator** to:

- remotely start the array;
- check the status of the array (ref. ASTRI-UC-0-025);
- check environmental conditions and atmosphere characterisation - e.g. wind speed, NSB level (ref. ASTRI-UC-0-030, ASTRI-UC-0-035);
- perform array calibration (ref. ASTRI-UC-0-050, ASTRI-UC-0-051);
- load and execute the scheduled short-term observation plan (scheduling blocks) (ref. ASTRI-UC-0-020, ASTRI-UC-0-070);
- check observation status and observation data quality (ref. ASTRI-UC-0-060);
- change the schedule manually (e.g. changes in environmental conditions, atmosphere characterisation, array status can change the kinds of observations that can be carried out; the SBs are scheduled or stopped taking into current conditions, ref. ASTRI-UC-0-020, ASTRI-UC-0-070);
- check the status of assemblies (ref. ASTRI-UC-0-025), and administer other resources;
- acknowledge the alarms raised by the **Alarm System** (ref. ASTRI-UC-0-001).

3.5. User Characteristics

The **Operator** is present at the **Array Operation Centers (AOCs)** in the **Control rooms** in different locations.

The **Operator** shall be responsible for supervising and carrying out scheduled observations and calibrations during the night, while the **Astronomer on-duty (AoD)** shall support and supervise the observations.

The MA system shall be operated by at least two **Operators** plus the **Astronomer on-duty**.

The **Operator** is not an expert of the assemblies installed at the **Array Observing Site (AOS)** at Teide, where the telescopes and all Observing Site Subsystems are installed. It means that it must

All information contained in this document is property of **INAF.** All rights reserved.

react to anomalous conditions based on predefined procedures that must be followed. This means that each type of anomalous condition or alarm must be codified and each type of reaction must be defined in advance.

3.6. Assumptions and Dependencies

Not applicable.

All information contained in this document is property of **INAF.** All rights reserved.

4. Characteristics

4.1. Operational Modes

The following operational modes [AD3, ASTRI-9.1.0.0-2056] are supported by the **Operator HMI:**

- **Science Operation mode**: the mode where the science operations are performed.
- **Technical Operation mode during the night:** a mode where monitoring, maintenance and engineering operations are possible but science operations are not possible.
- **Technical Operation mode during the day:** a mode where monitoring, maintenance and engineering operations are possible.
- **Daily nominal operations:** a mode in which nominal maintenance, monitoring, engineering and planning of the night activities are foreseen.
- **Active mode**: the control of SCADA subsystems is enabled.
- **Passive mode**: the control of SCADA subsystems is not allowed.

4.2. Functional Requirements

4.2.1. General features

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2000	Operation mode	The **Operator HMI** shall allow the **SCADA** system to be operated remotely.	T,I,D	[ASTRI-9.1.0.0-2350]
ASTRI-9.1.9.0-2002	Real-time	The **Operator HMI** shall provide an easily accessible, all-in-one-place near-real-time overview and monitor of the Mini-Array.	T,I	[ASTRI-9.1.0.0-2352]
ASTRI-9.1.9.0-2004	Visualization	The visualizations incorporated in the **Operator HMI** shall indicate the on-going state of **SCADA** processes, from the system down to the level of the software subsystems, and of the subsystem/assemblies/device state.	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2006	Operation permission	Only one **Operator HMI** instance shall allow the **SCADA** system to control and monitor the MA	T,I	[ASTRI-9.1.0.0-2386]

All information contained in this document is property of **INAF.** All rights reserved.

		System. Other instances of the **Operator HMI** shall allow monitoring of **SCADA** and **MA** systems in read-only mode.		
ASTRI-9.1.9.0-2008	Operation permission precedence	Any local instance of the **Operator HMI** in the on-site control room shall have precedence in operation-permission with respect to any remote instance without confirmation from the remote instance.	T,I	[ASTRI-9.1.0.0-2386]
ASTRI-9.1.9.0-2010	Operation permission display	The **Operator HMI** shall display the active or passive operational mode of the instance	T,I	[ASTRI-9.1.0.0-2386]
ASTRI-9.1.9.0-2012	Changing operation permission	The **Operator HMI** shall enable the operator to switch between the active and passive operational models of the instance	T,I	[ASTRI-9.1.0.0-2386]
ASTRI-9.1.9.0-2014	Start-up	The **Operator HMI** shall be started up manually (locally on site or remotely) or by the **Startup System**.	T,I	[ASTRI-9.1.0.0-2358]
ASTRI-9.1.9.0-2016	Safety actions	The **Operator HMI** shall enable the **Operator** to bring instruments to a safe mode, in case of possible safety concerns, which are not automatically detected and handled by the system.	T,I	[ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2022	Display panels	The **Operator HMI** shall display results and reports of observation from all the **SCADA** subsystems so that progress of the data acquisition and quality can be monitored and the **Operator** can initiate corrective actions if necessary	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2024	Running sites	The **Operator HMI** shall run at the AOCs.	T,I	Derived from TLA, Sec. 3.2,

All information contained in this document is property of **INAF.** All rights reserved.

				req. 5
ASTRI-9.1.9.0-2026	Internet connection	The **Operator HMI** shall allow a remote connection via internet	T,I,D	[ASTRI-9.1.0.0-2350]
ASTRI-9.1.9.0-2028	Display types	The **Operator HMI** shall visualise different kind of plots: 1. Histograms (1D, 2D, 3D) 2. camera plots 3. time series plots 4. camera plots with a different plot for each PDM	T,I	[ASTRI-9.1.0.0-2354]

4.2.2. Observation

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2050	Display of the observation schedule	The **Operator HMI** shall display the observation schedule	T,I	[ASTRI-9.1.0.0-2362]
ASTRI-9.1.9.0-2052	Selecting SBs	The **Operator HMI** shall allow the **Operator** to select the observing plan and related **Scheduling Blocks** to be executed during the observation night.	T,I	[ASTRI-9.1.0.0-2362]
ASTRI-9.1.9.0-2054	Following the status of SBs	The **Operator HMI** shall allow the **Operator** to follow the status of the execution of the **Scheduling Blocks**	T,I	[ASTRI-9.1.0.0-2070], [ASTRI-9.1.0.0-2088], [ASTRI-9.1.0.0-2364]
ASTRI-9.1.9.0-2056	Starting and stopping SBs	The **Operator HMI** shall allow the **Operator** to start and stop the execution of a **Scheduling Block**	T,I	[ASTRI-9.1.0.0-2070], [ASTRI-9.1.0.0-2090]

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2058	Resuming the execution of SBs	The **Operator HMI** shall allow the **Operator** to resume the execution of a **Scheduling Block**	T,I	[ASTRI-9.1.0.0-2070]
ASTRI-9.1.9.0-2060	Alarms to stop the execution of an SB	The **Operator HMI** shall display alarms related to subsystem conditions that may require stopping a currently executing Run.	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2364]
ASTRI-9.1.9.0-2062	SB verification	The **Operator HMI** shall inform the **Operator** if the verification of the Scheduling Block by the Central Control System fails	T,I	[ASTRI-9.1.0.0-2362], Top Level Use Cases
ASTRI-9.1.9.0-2064	Display of the SB configuration	The **Operator HMI** shall display the configuration parameters (e.g. time and date, start and end) of the **Scheduling Blocks**	T,I	[ASTRI-9.1.0.0-2362], Top Level Use Cases
ASTRI-9.1.9.0-2066	Modifying the SB properties	The **Operator HMI** shall enable the **Operator** to modify the properties of the **Scheduling Block** (e.g. adding or removing telescopes, changing the allocated time) and initiating a rescheduling action	T,I	[ASTRI-9.1.0.0-2070]
ASTRI-9.1.9.0-2068	Logging	The **Operator HMI** shall display the logging information of the ongoing **Scheduling Block**	T,I	[ASTRI-9.1.0.0-2364]
ASTRI-9.1.9.0-2070	Notification of automatic operations	The **Operator HMI** shall notify the **Operator** if automatic operations are applied to the observing plan	T,I	[ASTRI-9.1.0.0-2362], [ASTRI-9.1.0.0-2364]
ASTRI-9.1.9.0-2072	Stop of automatic operations	The **Operator HMI** shall enable the **Operator** to stop automatic operations applied to the observing plan	T,I	[ASTRI-9.1.0.0-2362], [ASTRI-9.1.0.0-2364]

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2074	View of the telescope pointing	The **Operator HMI** shall allow the **Operator** to have a persistent and clear view of all the telescope pointing parameters.	T,I	[ASTRI-9.1.0.0-2378]
ASTRI-9.1.9.0-2076	View of status of the data transfer to the local bulk repository	The **Operator HMI** shall allow the **Operator** to have a persistent and clear view of the status of the data transfer and archiving in the local bulk repository.	T,I	[ASTRI-9.1.0.0-2380]
ASTRI-9.1.9.0-2078	View of status of the data transfer to the off-site archive	The **Operator HMI** shall allow the **Operator** to have a persistent and clear view of the status of the data transfer to the permanent offsite Data Center.	T,I	[ASTRI-9.1.0.0-2382]

4.2.3. Control, state transitions, and operations

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2100	Control on startup, configuration and shut-down	The **Operator HMI** shall allow the **Operator** to switch-on, switch-off, control, configure, and manage all assemblies of the Mini-Array.	T,I	[ASTRI-9.1.0.0-2006], [ASTRI-9.1.0.0-2008]
ASTRI-9.1.9.0-2102	Control of the Central Control System	The **Operator HMI** shall enable the **Operator** to initialize and configure the Observing System based on the configuration retrieved from the **SCDB**.	T,I	[ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2104	Corrective actions	The **Operator HMI** shall allow the **Operator** to initiate corrective actions such as explicitly requesting the start of a given service or any other software component or changing the state of a running component	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2106	SCADA control	The **Operator HMI** shall allow the **Operator** to start, stop, control,	T,I	[ASTRI-9.1.0.0-2006],

All information contained in this document is property of **INAF.** All rights reserved.

		configure, get status and manage all SCADA subsystems, including Control Software and Collectors.		[ASTRI-9.1.0.0-2008]
ASTRI-9.1.9.0-2108	MA system startup	The **Operator HMI** shall allow a full/partial MA system startup and shutdown.	T,I	[ASTRI-9.1.0.0-2360]
ASTRI-9.1.9.0-2110	Status of MA assemblies	The **Operator HMI** shall allow the **Operator to get** the status of all **MA assemblies**.	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2112	Detachment of MA assemblies	The **Operator HMI** shall enable the **Operator** to detach **MA assemblies** from the **SCADA** system.	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2114	Restoring MA assemblies	The **Operator HMI** shall enable the **Operator** to restore **MA assemblies** to the **SCADA** system.	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2118	Single command stop	The **Operator HMI** shall provide the **Operator** with a single command to stop all the motion-related activities of all the **SCADA** subsystems	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2120	Changing the component status	The **Operator HMI** shall enable the **Operator** to change the status of a given controlled software component (e.g., restart a specific software process or a given hardware component).	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2122	Automated shut-down notification	The **Operator HMI** shall notify automated shut down to the user	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2124	Interrupting automatic	The **Operator HMI** shall enable the **Operator** to interrupt	T,I	[ASTRI-9.1.0.0-2354],

All information contained in this document is property of **INAF.** All rights reserved.

	operations	automatic operations and manually define specific predetermined sequences of actions		[ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2126	Control display	The **Operator HMI** shall display to the **Operator** the list of startup and stop operations with associated description, status and time of activation	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2128	Control buttons	The **Operator HMI** shall provide the **Operator** with a quick and easy access command (e.g. a button) to activate all the start-up and stop operations	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2130	Safe	The **Operator HMI** shall enable the **Operator** to put the entire MA System in safe state	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]
ASTRI-9.1.9.0-2132	Central Control	The **Operator HMI** shall control the **Central Control System**	T,I	[ASTRI-9.1.0.0-2074]

4.2.4. Monitoring

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2150	Status of MA subsystems	The **Operator HMI** shall allow to monitor the status of all ASTRI Mini-Array subsystems and assemblies connected with the **Central Control System**	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2152	SCADA subsystem status and reports	The **Operator HMI** shall display results and reports from all the SCADA subsystems	T,I	[ASTRI-9.1.0.0-2354]

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2154	Display of monitoring properties	The **Operator HMI** shall display selected monitoring properties relevant for the proper function or health of the **MA** and **SCADA** subsystems	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2156	View of environmental and atmosphere parameters	The **Operator HMI** shall allow the **Operator** to have a persistent and clear view of all the environmental conditions and atmosphere characterisation parameters at the Array Observing Site.	T,I	[ASTRI-9.1.0.0-2376], [ASTRI-9.1.0.0-2504]
ASTRI-9.1.9.0-2158	Display of SCADA configuration parameters	The **Operator HMI** shall display the configuration parameters of all the **SCADA** subsystems	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2160	Access to the Monitoring Archive	The **Operator HMI** shall provide access to the on-site **Monitoring Archive**	T,I	[ASTRI-9.1.0.0-2268], [ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2162	Retrieving monitor data to be analysed	The **Operator HMI** shall allow the **Operator** to select and retrieve monitor data to be analysed (devices, monitor points, time range) from the on-site monitoring archive	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2164	Selecting and retrieving data from the on-site Monitoring	The **Operator HMI** shall allow the users to select and retrieve re-sampled data from the on-site **Monitoring Archive**	T,I	[ASTRI-9.1.0.0-2268]

All information contained in this document is property of **INAF.** All rights reserved.

	Archive			
ASTRI-9.1.9.0-2166	Environmental condition status	The **Operator HMI** shall display the status of the environmental conditions	T,I	[ASTRI-9.1.0.0-2376]
ASTRI-9.1.9.0-2168	Environmental condition history	The **Operator HMI** shall display the history of the environmental conditions	T,I	[ASTRI-9.1.0.0-2376]
ASTRI-9.1.9.0-2170	Display of operational states	The **Operator HMI** shall display the operational state of each Array element	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2172	Monitoring conditions	The **Operator HMI** shall display the normal, warning, and abnormal conditions associated to the monitoring points	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2174	Highlights	The **Operator HMI** shall clearly highlight to the **Operator** the monitoring properties that are outside of the nominal conditions	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2176		The **Operator HMI** shall notify to the **Operator** the Abnormal Status of components with color codes	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2178	Plotting of monitoring metric evolution with time	The **Operator HMI** will enable the user to select and plot monitoring metric evolution as a function of time	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2180	Selection, filter and plot of monitoring parameters	The **Operator HMI** will enable the user to select, filter and plot the monitoring parameters with access to the main plotting functionalities (e.g. scatter plots, histograms, camera image maps, ...)	T,I	[ASTRI-9.1.0.0-2354]

4.2.5. Data acquisition, data quality and quick-look

All information contained in this document is property of **INAF.** All rights reserved.

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2200	Data acquisition reports	The **Operator HMI** shall receive reports on the status of the data acquisition from **ADAS**	T,I	[ASTRI-9.1.0.0-2114], [ASTRI-9.1.0.0-2370]
ASTRI-9.1.9.0-2202	OOQS reports	The **Operator HMI** shall receive reports on the status of the data processing from **OOQS**	T,I	[ASTRI-9.1.0.0-2162]
ASTRI-9.1.9.0-2204	Cherenkov and SI3 data acquisition quality	The **Operator HMI** shall allow the **Operator** to have a first look at the quality of the Cherenkov and SI3 acquired data.	T,I	[ASTRI-9.1.0.0-2372]
ASTRI-9.1.9.0-2206	Data acquisition rate	The **Operator HMI** shall display the status of the average Camera Data acquisition rate.	T,I	[ASTRI-9.1.0.0-2370]
ASTRI-9.1.9.0-2208	Data acquisition packets and files	The **Operator HMI** shall display the number of the ADAS lost packets from the start-up and the number of SI3 acquired files from the start-up.	T,I	[ASTRI-9.1.0.0-2114], [ASTRI-9.1.0.0-2370]
ASTRI-9.1.9.0-2210	Sky field display	The **Operator HMI** shall allow the **Operator** to have a visual feedback of the sky field around the MA system pointing direction.	T,I	[ASTRI-9.1.0.0-2374]
ASTRI-9.1.9.0-2212	Quick-look results	The **Operator HMI** shall display quick-look results of the Cherenkov and Intensity Interferometry observation during the data acquisition generated by the **OOQS**	T,I	[ASTRI-9.1.0.0-2152], [ASTRI-9.1.0.0-2372]
ASTRI-9.1.9.0-2214	Plotting	The **Operator HMI** shall provide plotting capabilities from monitoring the data quality results sent by **OOQS**	T,I	[ASTRI-9.1.0.0-2162], [ASTRI-9.1.0.0-2372]

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2216	OOQS interface	The **Operator HMI** shall display the Cherenkov event through connection with the **OOQS**	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2372]
ASTRI-9.1.9.0-2218	Data quality display	The **Operator HMI** shall allow the user to visualise data quality information about all the nine telescopes in a overview page	T,I	[ASTRI-9.1.0.0-2372]
ASTRI-9.1.9.0-2220	Selecting and retrieving data from the on-site Quality Archive	The **Operator HMI** shall allow the users to select, retrieve and display data from the on-site **Quality Archive**	T,I	

4.2.6. Alarms

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2250	Display of warnings and alarms	The **Operator HMI** shall display warnings and alarms from all the SCADA subsystems	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2252	Notifying warning and alarms	The **Operator HMI** will bring alarm and warning conditions to the attention of the **Operator.**	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2254	Acknowledgement of alarms	The **Operator HMI** shall allow the users to acknowledge each alarm.	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2256	Required acknowledgement of severe alarms	The **Operator HMI** shall require the users to acknowledge alarms of the highest severity level.	T,I	[ASTRI-9.1.0.0-2314]
ASTRI-9.1.9.0-2258	Shelving of alarms	The **Operator HMI** shall provide the users the ability of shelving (suppress/inhibit) repeating	T,I	[ASTRI-9.1.0.0-2354]

All information contained in this document is property of **INAF.** All rights reserved.

		alarms for a configurable period of time if the alarms are not severe.		
ASTRI-9.1.9.0-2260	Logging	The **Operator HMI** shall record with logs when alarms are manually shelved by the users.	T,I	[ASTRI-9.1.0.0-2328], [ASTRI-9.1.0.0-2326]
ASTRI-9.1.9.0-2262	Removing alarms from display	The **Operator HMI** shall allow the users to remove the alarm from the display	T,I	[ASTRI-9.1.0.0-2316]
ASTRI-9.1.9.0-2264	Hierarchical navigation	The **Operator HMI** shall provide a hierarchical navigation interface for alarms with hierarchy defined by the **AS**	T,I	[ASTRI-9.1.0.0-2322], [ASTRI-9.1.0.0-2324]
ASTRI-9.1.9.0-2266	Display of automated actions	The **Operator HMI** shall display the automated actions taken as a result of a warning or alarm	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2268	Automatic operational mode transitions	The **Operator HMI** shall inform the **Operator** of automatic operational mode transitions taken as a result of a warning or alarm	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2270	Predefined operator actions	The **Operator HMI** shall enable the **Operator** to only perform a list of predefined mitigation actions as response to warnings and alarms	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2272		The **Operator HMI** shall provide a link to an information or instruction page for each alarm and monitored item	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2274	Forbidden actions	The **Operator HMI** shall inform the **Operator** if forbidden actions are attempted	T,I	[ASTRI-9.1.0.0-2354], [ASTRI-9.1.0.0-2356]

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2276	Warning colors	The **Operator HMI** shall allow the **Operator** to visually determine the alarm level. A warning light will be associated with the alarm, where the color of the warning light has characteristics of a dominant wavelength depending on the alarm level.	T,I	[ASTRI-UC-9.1.7-035], [ASTRI-UC-9.1.7-040]
ASTRI-9.1.9.0-2278	Alarm validity	The **Operator HMI** shall allow the **Operator** to visually determine the alarm validity (time stamp up to date). The non-valid warning and alarm light will be associated with an empty symbol.	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2280	Acoustic alarms	The **Operator HMI** shall produce an acoustic alarm in association to severe alarm notifications that must prompt an acknowledgement by the **Operator.**	T,I	[ASTRI-UC-9.1.7-035], [ASTRI-UC-9.1.7-040]
ASTRI-9.1.9.0-2282	Configuration	The **Operator HMI** shall display a configurable set of monitored values by the Alarm System associated to each Device/Assembly	T,I	[ASTRI-UC-9.1.7-040]
ASTRI-9.1.9.0-2284	Search of alarms	The **Operator HMI** shall provide a search functionality for alarms and monitored items	T,I	[ASTRI-9.1.0.0-2354]
ASTRI-9.1.9.0-2286	Views	The **Operator HMI** shall be able to present different compound views of the Alarm System, (General View , Self Monitoring, Atmosphere, Instruments, ICT, ...)	T,I	

All information contained in this document is property of **INAF.** All rights reserved.

4.2.7. Logging

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2300	Log querying	The **Operator HMI** shall provide an interface for querying the logs provided by the **Logging System** (**LS**) and by ACS.	T,I	[ASTRI-9.1.0.0-2200] [ASTRI-9.1.0.0-2206]
ASTRI-9.1.9.0-2302	Automatic logging	The **Operator HMI** shall send automatic logging information on the frontend system to the **Logging System**	T,I	

4.2.8. Operator Logbook

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2350	Action logging	The **Operator HMI** shall log the actions of the user and send them to the **Operator logbooks**.	T,I	[ASTRI-9.1.0.0-2200]
ASTRI-9.1.9.0-2352	Creation and archive of shift logs	The **Operator HMI** shall enable the **Operator** to create shift logs and archive them in the **Operator logbooks**	T,I	[ASTRI-9.1.0.0-2200]
ASTRI-9.1.9.0-2354	Shift log querying	The **Operator HMI** shall allow the **Operator** to query shift logs from the **Operator logbooks**	T,I	[ASTRI-9.1.0.0-2200]

4.2.9. General interface guidelines

Req. ID	Name	Description	RVS	Derived from

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2400	Panels	The **Operator HMI** shall be organised in a set of panels, each of them with a specific purpose.	T,I	
ASTRI-9.1.9.0-2402	Adding and modifying panels	The **Operator HMI** panels shall have the possibility to be independently added or modified, without affecting the rest of the HMI.	T,I	
ASTRI-9.1.9.0-2404	Documentation	The **Operator HMI** shall include documentation for each panel, covering all functionality, which will be at a level of detail suitable for a professional **Operator**.	T,I	
ASTRI-9.1.9.0-2406	Semantic zooming	The **Operator HMI** shall incorporate semantic zooming to facilitate investigation of problems	T,I	
ASTRI-9.1.9.0-2408	Panel synchronization	The **Operator HMI** shall incorporate panel synchronization, i.e. interacting with a given panel corresponding to an automatic reaction in another panel.	T,I	
ASTRI-9.1.9.0-2410	Colorblind friendly	The **Operator HMI** shall be accessible by people that are colour blind, to the extent that they shall be able to discern all text and other information as easily as a person without colour blindness.	T,I	
ASTRI-9.1.9.0-2412	Views	The **Operator HMI** shall provide the view of the full MA system	T,I	[ASTRI-9.1.0.0-2352]
ASTRI-9.1.9.0-2414	Safety features	The **Operator HMI** display will clearly emphasize safety features of the system.	T,I	

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2416	Hierarchical navigation	The **Operator HMI** shall provide a hierarchical navigation interface of data and assemblies information	T,I	

4.3. Performance Requirements

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-2450	Start-up	The **Operator HMI** shall be started up locally in site or remotely	T,I	[ASTRI-9.1.0.0-2358]
ASTRI-9.1.9.0-2452	System run	The **Operator HMI** shall run and show its main panels regardless of the state of the system.	T,I	[ASTRI-9.1.0.0-2368]
ASTRI-9.1.9.0-2454	Asynchronous methods	The **Operator HMI** shall be based on asynchronous methods, so that a specific interaction by the user will never block the rest of the application.	T,I,D	
ASTRI-9.1.9.0-2456	Display latency	The **Operator HMI** shall provide up-to-date information to the user, including the status of on-going actions with a maximum time interval for update of status/progress information within 2 seconds.	T,I	
ASTRI-9.1.9.0-2458	Command latency	The latency between the command execution on the **Operator HMI** and the corresponding action shall be lower than 2 seconds	T,I	

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-2460	Simultaneous monitor and control	The **Operator HMI** shall monitor and control all Array elements.	T,I	
ASTRI-9.1.9.0-2462	Simultaneous user connections	The **Operator HMI** shall enable up to 10 simultaneous user connections	T,I	
ASTRI-9.1.9.0-2464	Accessibility	The full restart of the **Operator HMI** shall be accessible within 1 minute, with access to all the system functionalities possible within 5 minutes	T,I	
ASTRI-9.1.9.0-2466	Panel blocking	The **Operator HMI** panels shall not blocked by unrelated user actions	T,I	

4.4. Constraints

The HMI shall be based on web technology, which will allow for it to be used from a remote location.

All information contained in this document is property of **INAF.** All rights reserved.

5. Interfaces

5.1. User Interfaces

Details of the user interface design are part of the design phase.

5.2. Logical Interfaces

This section describes a summary of the main interfaces of the **Operator HMI** with the system.

Hardware Interfaces
The backend of the **Operator HMI** software components shall run on the On-site Data Centre. The frontend interfaces run in the AOC on remote machines, having the appropriate credentials for either passive/view or control modes.

Software Interfaces
The **Operator HMI** interfaces with all the other SCADA subsystems in order to visualize any information relevant for the **Operator** and the **Astronomer-on-duty**.

Communication Interfaces
The **Operator HMI** shall use ACS mechanisms to communicate with other ACADA components, unless specified otherwise in the corresponding ICDs.

The **Operator HMI** shall connect directly to the following databases part of the **On-Site Archive System**:

- **Monitoring Archive;**
- **Quality Archive;**
- **Alarm Archive;**
- **Science Archive;**
- **System CDB.**

The communication between the front-end and the back-end components of the **Operator HMI** shall use the HTTPS protocol.

All information contained in this document is property of **INAF.** All rights reserved.

6. Design and Construction

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-3000	Software design	The **Operator HMI** is a web client that shall connect to the **SCADA** web server.	D,T,I	[ASTRI-9.1.0.0-2366]
ASTRI-9.1.9.0-3004	Backend	The backend of the **Operator HMI** software components runs in the machines in the On-site Data Centre	D	
ASTRI-9.1.9.0-3006	Frontend	The frontend interfaces of the **Operator HMI** software run in the control rooms, or on remote machines, having the appropriate credentials for either passive view or control modes.	D	
ASTRI-9.1.9.0-3008	Modularity	The **Operator HMI** shall be designed in a modular way	D	
ASTRI-9.1.9.0-3010	Theme	The **Operator HMI** panels shall share a design theme with a consistent look and feel.	T,I	
ASTRI-9.1.9.0-3012	Logical views	The **Operator HMI** shall provide different logical views, such as a pseudo-geographical view (i.e., all telescope positions), a component view (e.g., Telescope monitoring, data quality), logical views, etc.	T,I	
ASTRI-9.1.9.0-3014	Telescope selection	The **Operator HMI** shall allow the user to select one from the nine telescopes to visualise the results of that specific telescope	T,I	
ASTRI-9.1.9.0-3016	Plot update frequency	The **Operator HMI** shall allow to configure the update frequency for plots and other information	T,I	
ASTRI-9.1.9.0-3018	Cherenkov Camera data quality	The **Operator HMI** shall visualise the following plot to show the Cherenkov Camera data quality checks:	T,I	[ASTRI-9.1.0.0-2372]

All information contained in this document is property of **INAF.** All rights reserved.

	display	From S(2,2) package: 1. Camera plot sampled at 1Hz, before and after the calibration; 2. camera plot showing a plot with ADC distribution for each PDM; 3. camera plot showing a plot with PE distribution for each PDM; 4. Plot with the trigger rates of each PDM for each camera; 5. Plot with the trigger rates of each camera; 6. Histogram for ADC values of each camera, the user can select a camera and visualise the histograms for ADC values of the camera's PDMs. The histograms show a fit with a Gaussian distribution. Exclude from the histograms the pixels with value out of the valid range. 7. Histogram for PE values of each camera, the user can select a camera and visualise the histograms for PE values of the camera's PDMs. Exclude from the histograms the pixels with value out of the valid range. 8. Two types of histograms are computed for both ADC and PE values: ○ Histograms aggregating all data since the run start ○ Histograms aggregating only the last X events or the events acquired in the last Y seconds From VAR packages 9. Camera plot with pixels sampled at 1Hz (configurable) for both VAR(10,2) and VAR(10,3) packages. 10. Camera plot for each camera showing all the camera's PDMs and for each PDM a temporal plot with ADC value of all PDM's pixels 11. Pointing deviation info 12. PSF size and deviation from nominal size 13. Ratio between H/L gain of ADC values		

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-3020	SI3 data quality display	The **Operator HMI** shall visualise the following plot to show the SI3 Data Quality checks: 1. The rate for each detector of each telescope. 2. The total rate for each telescope. 3. Textual information about the rate.	T,I	[ASTRI-9.1.0.0-2372]
ASTRI-9.1.9.0-3022	Atmosphere and SI3	The **Operator HMI** shall visualise the Atmosphere characterisation conditions in the same panel with the SI3 trigger rate	T,I	[ASTRI-9.1.0.0-2376]

All information contained in this document is property of **INAF.** All rights reserved.

7. Support Requirements

7.1. Integration, Installation

Details of the user interface design are part of the design phase.

7.2. Personnel and Training

Details will be provided in the next issue of this document.

8. Product Assurance

8.1. Quality Assurance

8.1.1. Test Requirements

A detailed verification and validation plan shall be provided by the Supplier.

8.1.2. Analysis or Simulation Requirements

A detailed verification and validation plan shall be provided by the Supplier.

8.1.3. Verification Requirements

A detailed verification plan shall be provided by the Supplier.

8.1.4. Development / Qualification Test Requirements

A detailed validation plan shall be provided.

8.2. RAMS Requirements

8.2.1. Reliability

Not applicable.

8.2.2. Availability

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-6000	Accessibility	The **Operator HMI** shall be accessible for night and day operations by the Operator.	D	[ASTRI-9.1.0.0-2352]

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-6002	Duration time	The **Operator HMI** will be operated for the duration of ASTRI Mini-Array lifetime	D	
ASTRI-9.1.9.0-6004	Availability during the night	The **Operator HMI** shall be available during 99% of the time over the course of one observation night.	D,T	

8.2.3. Maintainability

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-6050		A full restart of the **Operator HMI** frontend shall be possible by reloading the web pages used by the **Operator**.	T,I	
ASTRI-9.1.9.0-6052		The **Operator HMI** shall ensure enough flexibility and scalability to allow new elements to be introduced without significant development effort.	D	

8.2.4. Maintenance Approach

Req. ID	Name	Description	RVS	Derived from
ASTRI-9.1.9.0-6060		The replacement of the **Operator HMI** components and software updates shall be foreseen to ensure the correct functionality of the system.	D	

8.2.5. Security

Req. ID	Name	Description	RVS	Derived from

All information contained in this document is property of **INAF.** All rights reserved.

ASTRI-9.1.9.0-6070	Authorization and Authentication	The **Operator HMI** shall provide an authorisation and authentication system. This system shall allow the identification of the person that is performing the role of the **Operator** and the management of the **Operator** capabilities to operate the system.	D,T,I	ASTRI-9.1.0.0-2384
ASTRI-9.1.9.0-2018	Connected users	The **Operator HMI** shall display the list of connected users	T,I	[ASTRI-9.1.0.0-2384]
ASTRI-9.1.9.0-6072	HTTPS protocol	The communication between the front-end and the back-end components of the **Operator HMI** shall use the HTTPS protocol.	D,T	ASTRI-9.1.0.0-2366

All information contained in this document is property of **INAF.** All rights reserved.