



D4.5.1 Report on the acquisition of aeroportable instrumentation for the optical and microphysical characterization of atmospheric particulate. [B8]



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1. INTRODUCTION

This deliverable is prepared in the context of the ITINERIS project, within the Work Package 4 (Atmosphere) that deals with the integration of Research Infrastructures working in the atmospheric domain through synergistic approaches and cross boundaries developments.

The activity aims to enhance the country's participation in the EUFAR (EUropean Facilities for Airborne Research) consortium, an international non-profit association that coordinates the operation of European instrumented aircraft and exploits the skills of environmental and geo-sciences experts in airborne measurements. Italy, with the CNR (Consiglio Nazionale delle Ricerche) and the OGS (Istituto di Oceanografia e Geofisica Sperimentale), participates in this network of infrastructures with airborne scientific instrumentation and aircraft. In order to strengthen this participation, through this project we intend to acquire scientific instrumentations that can be mounted on piloted aircraft. Given the general aims of the WP in which this activity is inserted, this instrumentation will be usable for the in-situ characterization of atmospheric particulate, on airborne platforms.

During the project, the instrumentation will be acquired and customized for avionic use. Moreover, feasibility studies for its implementation on the aircraft will be carried out. The mechanical interfaces for assembly inside the cockpit and possibly on the fuselage of the aircraft will be studied, electrical consumption and thermal conditioning will be sized, and the particulate collection lines will be defined.

This deliverable reports the progress report on the acquisition of airborne instrumentation, in the frame of the WP4.5 activities.

2. UPGRADE OF CNR-ISAC AIRBORNE OBSERVATIONS CAPABILITY

The Operating Unit (OU) responsible for this activity is CNR-ISAC-BO (Istituto di Scienze dell'Atmosfera e del Clima). CNR-ISAC has selected a set of detectors dedicated to the study of optical and microphysical properties of atmospheric aerosol, as well as the meteorological conditions.

The instrument selection was set on the specific limits and operative conditions of an aircraft owned by the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), a PA - 34 twin-engine Seneca III turbocharged with an operating altitude of 8 km, or on a platform with similar performance.

Sampling lines suitable for airborne use, as well as sensors for determining the dynamic and thermodynamic parameters of the atmosphere have also been identified.

The selected instrumentation represents a complete set for the characterization of atmospheric particulates, and is shown in the list below:

- Aethalometer for black carbon concentration, including biomass burning (BB) fraction
- SMPS Scanning mobility particle Spectrometer 10 to 800 nm range (customized for airborne use)
- APS - aerosol particle sizer 0.5 to 20 um (customized for airborne use)
- Nephelometer for scattering and backscattering coefficient
- Dust monitor 0.15-40 um (customized for airborne use)

- CPC CEN (customized for airborne use)
- Airborne Meteorological System (airborne use)
- Airborne isokinetic Aerosol inlet (airborne use)
- Other possible inlets
- Data Logger (customized for airborne use)
- Certification for airborne use of the payload
- Calibration standards
- Sofi software (solution for *source apportionment*) for data analysis

3. RESEARCH COLLABORATION AGREEMENT BETWEEN CNR-ISAC AND OGS

To initiate the operation of CNR-ISAC-BO instrumentation on the Piper Seneca III owned by OGS, a formal Research Collaboration Agreement between ISAC-CNR and OGS is needed. Unfortunately, the signature of such agreement requires long formal interactions among the two Research Performing Organizations, and it is still ongoing.

The procurement of the airborne instrumentation of Piper Seneca III requires multiple steps from purchase procedures, to airborne customization, airworthiness certification, and in the end the installation of airborne instrumentation.

To avoid further delays, we decided to limit the procurement notices to only cover procurement and airborne customization. We excluded any interventions on the aircraft that would necessitate completing airworthiness certification. The plan is to tender the completion of airworthiness certification and installation on the aircraft later, once the Research Collaboration Agreement is finalized.

This strategy allows us to make progress on tasks that can proceed independently while ensuring that collaborative tasks are properly addressed once the necessary agreements are in place.

4. EQUIPMENT PROCEDURES

The Operating Unit of Bologna organized the purchase procedures at ISAC level, together with Lecce and Lamezia Terme Units. The instrumentations for airborne measurements are part of two EU tender procedures (GARA 1 and GARA 2) and several under threshold purchases.

The following table (**Error! Reference source not found.**) reports the procedures published, for which the successful bidder has been identified in 2023.

Table 1: Procedures published, for which the successful bidder has been identified in 2023.

| INSTRUMENT DESCRIPTION | CPV code | Base price | PROCEDURE | Activity | Start of procedure | End of procedure |
|---|------------|------------|-----------|----------|--------------------|------------------|
| Bat airborne probe for atmospheric turbulence | 38340000-0 | 50.000 € | AD | 4.5 | B3 | B10 |
| Airborne isokinetic aerosol inlet | 38340000-0 | 96.000 € | AD | 4.5 | B3 | B10 |
| Dust monitor customized for airborne use | 38340000-0 | 38.000 € | AD | 4.5 | B3 | B10 |
| CPC airborne customized | 38340000-0 | 70.000 € | AD | 4.5 | B3 | B10 |

The following table (*Error! Reference source not found.*) reports the procedures published, for which the bidder identification is in progress.

Table 2: Procedures published, for which the bidder identification is in progress.

| INSTRUMENT DESCRIPTION | CPV code | Base price | PROCEDURE | Internal Organization for EU-Tenders | Activity | Start of procedure | End of procedure |
|------------------------|------------|------------|-----------|--------------------------------------|----------|--------------------|------------------|
| Data Logger | 38340000-0 | 30.500 € | AD | | 4.5 | B3 | B10 |
| Nephelometer | 38340000-0 | 32.000 € | EU-tender | EU-2-ISAC L1 | 4.5 | B3 | B10 |

The following table (*Error! Reference source not found.*) reports the procedures that will be published in 2024.

Table 3: Procedures that will be published in 2024.

| INSTRUMENT DESCRIPTION | CPV code | Base price | PROCEDURE | Internal Organization for EU-Tenders | Activity | Start of procedure | End of procedure |
|---|------------|------------|------------|--------------------------------------|----------|--------------------|------------------|
| Aethalometer | 38340000-0 | 40.000 € | EU- tender | EU-1-ISAC L1 | 4.5 | B3 | B11 |
| SMPS airborne version | 38340000-0 | 147.000 € | EU-tender | EU-1-ISAC L3 | 4.5 | B3 | B11 |
| APS customized for airborne use | 38340000-0 | 100.000 € | EU-tender | EU-1-ISAC L3 | 4.5 | B3 | B11 |
| Certification for airborne use of the payload | 38340000-0 | 60.000 € | AD | | 4.5 | B5 | B11 |
| Sofi software for data analysis | 38340000-0 | 25.000 € | AD | | 4.5 | B6 | B11 |
| Other possible inlets | 38340000-0 | 25.000 € | AD | | 4.5 | B6 | B11 |
| Calibration standards | 38340000-0 | 15.000 € | AD | | 4.5 | B6 | B11 |

5. CONCLUSIONS

Thanks to the upgrade made available through ITINERIS project the CNR-ISAC-BO OU will deeply implement the observational capacity of a new airborne platform. We plan to install all the new instrumentation for a testing phase in extreme controlled conditions at the NF of Monte Cimone. Meanwhile we will take care of the customizations needed, aviation certification (already in progress) and the arrangement of Seneca III in order to host the instrumentation. The Seneca III upgraded will be available before the end of project.

The infrastructural strengthening will improve the capacity to attract new users through the access programs of ITINERIS. Moreover, this will develop the conditions for harmonising standards, metadata and policies amongst the different RIs, that are very diverse and on different levels of maturity, but face similar challenges in their operations in regard to FAIR compliance and Access management.