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# THE CHIME SPECTROMETERS: TECHNICAL CHALLENGES AND ADVANCED DEVELOPMENTS.

**Abstract**

Copernicus, the European Union's programme for observing and monitoring the Earth, represents one of the most successful space programmes coordinated and managed by the European Commission in partnership with ESA, the Member States and Agencies. Copernicus relies on global data acquired from satellites as well as ground-based, airborne and seaborne systems that generate information freely made available to service providers, public authorities and international organizations to improve the quality of life of citizens in Europe and in the world. The six services offered by Copernicus cover the following fields: Atmosphere, Marine, Land, Climate Change, Security and Emergency. 2020 marked a major step of the Copernicus expansion programme with the selection of six missions to enter into B2CD implementation, namely CHIME, LSTM, CO2M, CRISTAL, ROSE-L, and CIMR. CHIME stands for the Copernicus Hyperspectral Imaging Mission for the Environment. The development of the CHIME space segment was awarded to an industrial consortium led by Thales Alenia Space (FR), as Mission Prime, and OHB (DE), as Instrument Prime. Within the instrument team, important responsibilities have been assigned, among others, to AMOS (BE) and Leonardo (IT). In particular, AMOS is responsible for the development of the CHIME spectrometers. The spectrometer system (SPS) is the centrepiece of the CHIME instrument, ensuring the accurate spectral dispersion of the imaged ground swath over wide focal planes. The SPS consists of three identical spectrometer units drawn from the compact demagnifying freeform Offner optical solution developed at AMOS. The SPS throughput is guaranteed by the broadband convex diffraction grating, while the image quality and distortion control are enabled using freeform mirrors. This paper describes the technical challenges involved in the design, manufacturing and verification of the CHIME spectrometer system and associated advanced developments. The technical risks have been mitigated since the Phase A/B1 through the deployment of a specific technology programme including the predevelopments of critical components of the spectrometer like the diffraction grating and the long entrance slit. This programme is further deployed in phase B2/C with the objective of bringing critical technologies to TRL6 maturity for the Instrument PDR and with the start of qualification activities for materials and processes.