

Title: IEEE-SA, P4001: Standards for Characterization and Calibration of Hyperspectral Imaging Devices

Authors:

John R GILCHRIST<sup>1</sup>, Torbjorn Skauli<sup>2</sup>, Christopher Durell<sup>3</sup>

1. Clyde Hyperspectral Imaging & Technology Ltd;
2. Univ of Oslo;
3. Labsphere Inc.

Abstract

Hyperspectral imaging is an innovative and exciting technology that holds incredible diagnostic, scientific and categorization power. Current industry innovation is a testament to the creative power and imagination of the diverse community seeking to optimize this technology. However, fundamental instrument performance is not consistently well characterized, well understood or well represented to suit distinct application endeavors or commercial market expectations. Establishing a common language, technical specification, testing criteria, task-specific recommendations and common data formats are essential to allowing this technology to achieve its true altruistic and economic market potential.

To address these inconsistencies, the [Institute of Electrical and Electronics Engineers](#) (IEEE) ) Geoscience and Remote Sensing Society (GRSS) sponsored [Project 4001](#) (P4001), a Hyperspectral Working Group under the auspices of IEEE's [Standards Association](#). Since its inception in 2018, the IEEE P4001 Working Group has been working to specify testing and characterization methods for HSI device manufacturers, as well as recommend data structures and terminology for HSI products. Draft versions of P4001's standards will be finalized by the end of 2021 and will then be balloted, with an expected publication date towards the end of 2022.

This presentation reviews the progress to date of the working group and maps out the timescales and work to be done to complete the standard.

The P4001 Hyperspectral Working Group is divided into three sub-groups:

- Characterization: defines performance and characteristics of HSI systems, including spectral and spatial resolution, radiometric performance, co-registration, and stray light
- Data Structures: recommends conceptual data models and processing flows of the data, with an emphasis for consistent metadata to be produced by HSI systems
- Terminology: establishes terms and definitions to ensure consistency and promote interoperability

P4001 focuses on the ultraviolet through the shortwave infrared spectral range (~250 to 2500 nm) and prioritizes camera technologies that are in most widespread use. However, many aspects of the standard will have a wider applicability with respect to camera technology and

wavelength range, and future updates will expand the range of technologies and topics covered. Industrial, laboratory and geoscience use cases are informing the development of the standard. Utilization of the P4001 HSI standard will lead to HSI systems having consistent characterization and calibration criteria, as well as interoperable data products with a common lexicon for data and metadata.

The P4001 Hyperspectral Working Group currently consists of 232 observers and 34 voting members, with HSI experts from countries around the world. P4001 collaborates with other Standards Development Organizations (SDOs), including the International Organization for Standardization (ISO), the International Society for Photogrammetry and Remote Sensing (ISPRS), the European Machine Vision Association (EMVA) and the Open Geospatial Consortium (OGC). Several P4001 members share the development of this standard through their professional networks and conference presentations to promote widespread adoption and future development.

The P4001 Working Group invites industry professionals to contribute to developing the standard. Meeting details and contact information will be provided at the end of the presentation.