

15 Years of Hyperspectral Imaging in Finland

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SPECIM has served the hyperspectral imaging market by supplying advanced push-broom type sensors for 15 years. During this time 70 AISA sensors have been supplied to airborne remote sensing applications. The sensors make a significant portion of the worldwide hyperspectral fleet in research, commercial and defense areas. The key to the success has been to produce and offer high performance instrumentation at a cost which makes it economically and operatively more feasible for an individual user, like a university and remote sensing service provider, to invest in and operate an own sensor than rely on rental services.

Technologically the success has been built on SPECIM's innovative, proprietary, push-broom type hyperspectral imaging technology. Among various hyperspectral imaging techniques, push-broom imaging is the only one capable of acquiring full spectral information at the same time while providing the multiplex advantage of imaging a full line of pixels simultaneously. A push-broom imager consists of an imaging spectrograph and 2-dimensional detector array (camera), and does not include any moving parts. SPECIM technology enables to build the sensors in a compact form, which is easy to install and transport and works reliably with minimal maintenance requirements. Current detector arrays are capable of acquiring more than 100 images/ s, enabling full hyperspectral data collection with broad range of mission parameters, from low altitude high ground resolution missions to high altitude large area projects . Also the sensors can be deployed in broad range of aircraft, from UAVs to helicopters and various fixed wing airplanes.

During the 15 years, the spatial resolution in VNIR push-broom sensors has grown from 500 to 1600 pixels and will reach 2000 pixels next year. SWIR sensors with 320 spatial pixels have been available nearly 10 years now, and the resolution will soon expand to 1000 pixels in a commercial SWIR sensor. The first push-broom LWIR (8-12 um) sensor will fly this year. The biggest technical challenge with push-broom imagers is to integrate two or more spectral ranges into a single instrument. SPECIM is currently working on the first fully integrated VNIR+SWIR sensor which will produce seamless, co-registered image data from 380 nm to 2500 nm through single fore optics.

The potential in commercial hyperspectral remote sensing is much larger than has been realized currently. The growth is hindered by the lack of application specific data processing tools. Here the researchers and sensor companies must work more closely together in order to transfer the results of the research work to the form of routine application tools. With this happening, similar development in the use of hyperspectral imaging can be expected as has happened with the Lidar technology.

During the 15 years SPECIM's hyperspectral imaging business has grown 20-25% annually. In addition to remote sensing, hyperspectral imaging is penetrating to several industries at a growing rate. SPECIM has delivered thousands of sensors to its industrial and scientific clients. The products range from small hyperspectral engines for color and life science instruments to turn-key solutions to rapidly growing chemical imaging applications.