

A robust and growing market for hyperspectral imaging is in the field of precision agriculture. Small and light sensors placed aboard hand-launched UAVs represent an entirely new set of eyes for agriculturalists wishing to learn more about crop and soil conditions, and the presence of hard-to-detect diseases.

Headwall is an industry pioneer in designing hyperspectral sensors that move the science of precision agriculture forward. These can be very small and light instruments used aboard hand-launched multi-rotor and fixed-wing UAVs. Headwall's Micro-Hyperspec® covers the VNIR, Extended VNIR, NIR and SWIR spectral ranges, allowing crop scientists to collect and then analyze large volumes of hyperspectral data from which better planting and harvesting decisions can be made. By 'flying' a hyperspectral payload, so much more territory can be covered in a short amount of time.

Headwall's complete airborne solution brings together everything needed in one optimized package: Hyperspectral sensor, LiDAR (optional), GPS/IMU, data management and storage, and a full complement of airborne hyperspectral software. The wide field-of-view characteristic of Micro-Hyperspec® allows for outstanding flight-path efficiency while excellent spatial and spectral resolution of Headwall's aberration-corrected optics delivers a level of intelligence far beyond normal camera technology.

On the ground, hyperspectral imaging plays a key role in several areas. Plant phenotyping is one, where scientists can genetically 'engineer' crops based on specific spectral characteristics that become visible through hyperspectral imaging. Another is product quality, which directly relates to safety. Hyperspectral sensors can inspect, at a very high speed and along wide conveyors, the relative 'goodness' of anything from specialty crops to poultry and seafood. The sensors can identify foreign matter wherever it exists, and even distinguish the presence of fecal material and diseases that might otherwise be missed by more traditional imaging techniques. A third common deployment area for hyperspectral imaging is in the field of seed and grain sorting, delivering higher-quality product to agriculturalists worldwide.



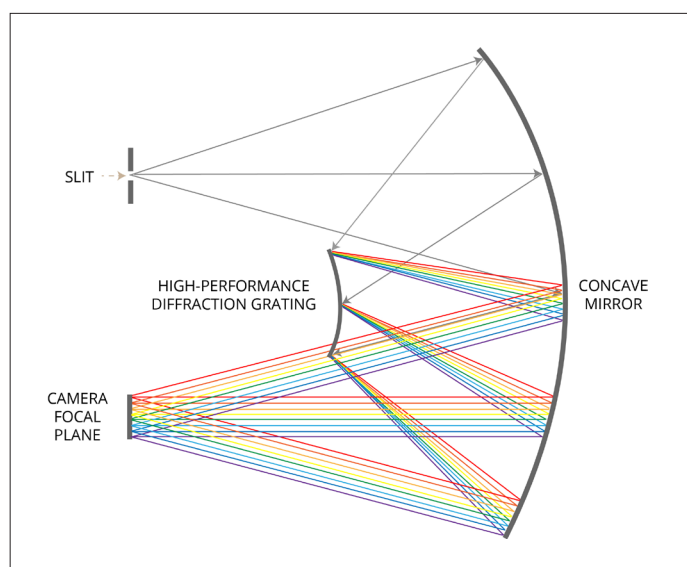
**H**eadwall is the world's leading manufacturer of hyperspectral imagers (Hyperspec®) for a wide range of industries including remote sensing, advanced machine vision, precision agriculture, and others. The Company also manufactures OEM spectrographs and spectral engines that are exceptionally precise with respect to high spectral and spatial resolution and signal throughput.

The core technology fundamental to these products is the holographic diffraction grating, which Headwall manufactures to exacting dimensions and tolerances and to customer specification. This allows for small and rugged

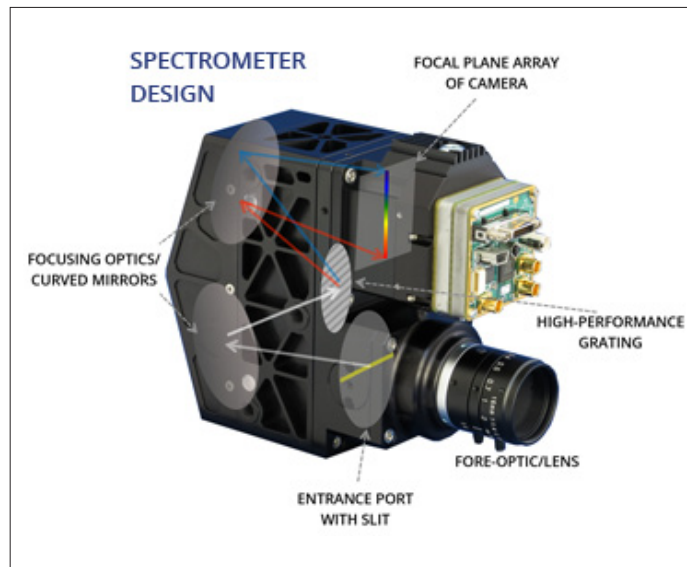
optical imaging instruments that deliver aberration-corrected performance and a very wide field-of-view. Used in Headwall's *concentric-style* imagers along with mirrors, the designs are simple yet elegant and feature no moving parts.

In addition to hyperspectral, Headwall also manufactures Raman imaging instruments that are available in a wide range of laser excitation wavelengths. Raman Explorer and Raman Discovery are very well suited for chemical imaging applications as well as biotechnology and medical applications.

Hyperspectral Ranges	
UV-VIS	250-825nm
VNIR	380-1000nm
Extended VNIR	550-1700nm
NIR	900-1700nm
SWIR	950-2500nm
MWIR*	3-5 microns
LWIR*	8-12 microns
*MWIR and LWIR available upon request	



Raman Explorer	
248nm	single input
355nm	single input
532nm	single input
532nm/658nm	dual input
642nm	single input
785nm	single input
785nm	dual input
830nm	single input
Raman Discovery	
532nm	dual input



**About Headwall Photonics:** Headwall is the leading designer and manufacturer of imaging spectrometers and spectral instrumentation for industrial, commercial, and government markets. Headwall's high performance spectrometers, spectral engines, and holographic diffraction gratings have been selected by OEM and end-user customers around the world for use in critical application environments. As a pioneer in advanced, patented optics technology, Headwall enjoys a market-leading position through the design and manufacture of spectral instrumentation that is customized for application-specific performance.

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