**WILDFIRE AIRBORNE SENSOR PROGRAM (WASP)**

**Background**

Originally developed under a NASA grant to investigate new airborne sensor technologies for wildfire detection and mapping. The system has been flying since 2003 and has undergone a number of significant upgrades during that time period. It is now suitable for use as a general purpose multispectral mapping system capable of delivering high resolution color or thermal infrared, georeferenced images in near realtime after the aircraft lands or while in flight using a digital radio link.

**System Description**

**Imaging Sensors**

The WASP sensor suite includes 4 cameras mounted to a common framework. Each camera covers a different portion of the electromagnetic spectrum, allowing users to view a scene in any combination of color (or color-infrared), short wave infrared, midwave infrared, and long wave infrared. The cameras provide high spatial resolution, able to resolve objects as small as 4" in color (color-infrared) or 24" in the infrared. Temperature sensitivity in the thermal infrared (mid wave and long wave) is about 0.05 K. The nominal field of view for each camera is about 35 deg providing a ground swath of 2,000' at an altitude of 3,000' above ground level (AGL).

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| --- | --- | --- | --- | --- |
|  | Color (RGB or CIR) | Shortwave | Midwave | Longwave |
| Imager array size | 4000 x 4000 | 640 x 512 | 640 x 512 | 640 x 512 |
| Pixel size (microns) | 9 | 25 | 25 | 25 |
| Focal length (mm) | 55 | 25 | 25 | 25 |
| FOV (deg) | 37.5 | 37 | 37 | 37 |
| Resolution at 2,000' AGL | 4" (0.1m) | 24" (0.6m) | 24"(0.6m) | 24"(0.6m) |
| Wavelength range | 400 - 900 nm | 1100 - 1700 nm | 3000 - 5000 nm | 8000 - 9200 nm |
| Temperature Sensitivity |  |  | 0.05K | 0.05K |

WASP Camera Specifications



WASP Sensor Suite of 4 Cameras

**Mapping Capability**

WASP can deliver high mapping accuracy without ground control using a precision inertial navigation system (INS), a POS/AV 310 from Applanix. The INS combined with precision calibration of each camera allows the WASP system to provide geo-location accuracy errors without ground control of < 1 m when using differential GPS . RIT has also developed a streamlined automated data processing workflow that produces ortho-photos in real-time onboard the aircraft.

**Thermal Mapping capability**

WASP employs a unique in-flight thermal calibration capability that allows the thermal infrared cameras (midwave and long wave) to measure scene temperature directly from the imagery within the limits of knowledge about target emissivity and atmospheric effects.

**Limitations and Constraints**

**Environmental**

While the WASP system has demonstrated robustness over a wide range of environmental conditions, the system should not be operated in precipitation or conditions with high levels of airborne contaminants (heavy dust or smoke) .

**Altitude/Speed**

To avoid gaps in coverage, there is an altitude dependent maximum ground speed that is a result of the relatively slow frame rate of the high resolution color camera. The maximum frame rate for the currently installed camera is about 1 frame every 4 seconds. This results in a minimum altitude of 2,000' AGL when operating at a ground speed of 110 kts. Higher ground speeds would require a higher operating altitude or lower altitude would require lower ground speed.

**Mass Properties**

The WASP system as configured (cameras, INS, electronics) weighs about 250 lbs.