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USING NIGHT-TIME, THERMAL INFRARED IMAGERY TO REMOTELY MONITOR THE HYDROTHERMAL SYSTEM AT HOT SPRING BASIN, YELLOWSTONE NATIONAL PARK

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During Fall 2006 and 2007, the Remote Sensing Services Laboratory (RSSL) at Utah State University acquired 8-12 micron, night-time, airborne thermal infrared (TIR) imagery over Hot Spring Basin. Hot Spring Basin (HSB) is a remote, vapor-dominated, hydrothermal area located outside the boundary of the Yellowstone caldera and not far from an area of rapid ground deformation. The RSSL used an Inframetrics 760 thermal infrared scanner during the Fall 2006 acquisition and a FLIR ThermaCAM (SC640) during the Fall 2007 acquisition. The high-spatial resolution (~1 m) 2007 thermal infrared (TIR) imagery advanced the Park's mapping and monitoring of geothermal features in an area of ongoing ground deformation.

The calibrated, TIR mosaic of HSB clearly shows heat being radiated from the bright white thermal barrens along major fractures (NNW to NW, N-S, ~E-W, NE). These fractures influence the orientation of streams such as Wrong and Shallow creeks as well as the hydrothermal basins. Faults and fractures within the Lava Creek tuff and fluid flow within the overlying compacted glacial sediments control the location of active hydrothermal features. North to northwest natural fractures occur within Lava Creek tuff at a known hydrothermal explosion crater. North-south and east-west trending natural fractures occur within compacted glacial muds. The 2007 night-time, thermal infrared imagery shows the radiation of heat through blocks of fractured tuff and overlying glacial sediments. During this time of active uplift, radiation of heat along north-south and east-west trends is evident.

During 2008, field reconnaissance of HSB and observations of hydrothermal explosions around the Sour Creek Dome indicated changes in the hydrothermal system. An August 2008 field expedition to recover temperatures loggers showed significant changes in an area of ground that appeared non-thermal in 2006. During 2008, intense hydrothermal of the ground had obliterated white pods of a probable volcanic ash within compacted brown glacial sediments. A comparison of the 2006 TIR imagery with the 2007 TIR imagery shows changes in this area of intensely altered ground. Ongoing work will confirm whether this change in hydrothermal activity has been captured during the Fall 2008 image acquisition over HSB