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UNESE MSIR Summary, FY15-FY16

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Summary of FY15 and FY16 MSIR (Multi-Spectral and InfraRed) work for UNESE
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FY15 Task 1.2.2.6, MSIR Imaging of Disturbed Earth
Work in FY15 was very low level and focused on planning for future FYs. Specific activities were attendance at the UNESE kickoff meeting at North Las Vegas in May 2015, and coordination with the Remote, Surficial and Subsurface team regarding integration of activities and test bed planning.

FY16 Task 2.2.2.6, MSIR Imaging of Disturbed Earth
Work in FY16 included raking on a pad at the U16b tunnel to generate disturbed earth, collection of World View 3 (WV3) multi-spectral imagery, and analysis of that imagery to assess next steps. NSTec/ STL was the lead lab for working with NSTec/NV to determine a site and method for raking to generate disturbed earth, and STL was the lead lab for acquisition of the WV3 imagery. The WV3 data was acquired on 16 March 2016, and the WV3 data provided to LLNL on 9 June 2016. LLNL used the RX spectral anomaly detector and end-member analysis to see if either method was sensitive to the raked area. For reference, the raked area is marginally detectable in a visible image of the scene, but would probably not be detected if one did not know where to look. Both methods of spectral analysis revealed the pad itself to be anomalous, and erosion of the pad material downhill from the pad was also highlighted as anomalous and spectrally similar to the pad. None of the methods were able to significantly distinguish the raked area of the pad from the rest of the pad. (In some cases of spectral analysis, if you know where to look, you can make out the straight lines of the edge of the raked region, but no better than using the visible imagery.) We postulate that this is due to the pad being generated from clearing native surface material to make the pad, with the result that the pad is relatively unweathered material. Raking simply exposes more unweathered material, so one does not see significant spectral changes for the raked area compared to the non-raked pad area. This information provides the guidance that we need to rake an area of native surface material to potentially expose underlying unweathered material which would create the effects we are expecting. Discussions are presently under way to identify a site that can be mechanically raked or hand raked to generate the desired disturbed earth conditions. Ideally that site would be proximate to the U16b pad so we can use the current WV3 data as reference data, and look for seasonal variations in the pad and other spectra. The Figures below show the pad area being raked, the square raked area in visible imagery, and one of the spectral analysis results.

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Figure 1. A harrow tool was pulled behind a vehicle to generate the raked area on the pad near U16b.

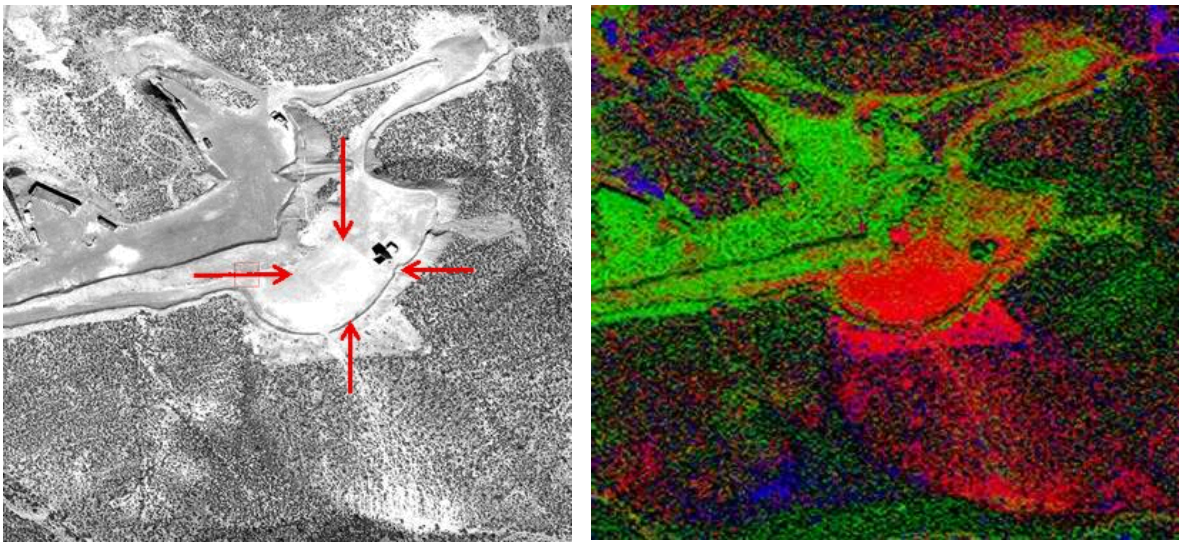

Figure 2. (Left) Black and white image from the WV3 high spatial resolution black and white camera showing the raked region as a square, slightly lighter region, whose corners are approximately indicated by the red arrows. (Right) Endmember analysis highlights the pad as distinct from the surrounding regions, including runoff material downhill from the pad, but does not distinguish the raked region from the rest of the pad. In the upper corner of the raked region, both images show that lighter underlying material has been brought to the surface, but the spectral analysis does not distinguish between the raked region and the pad itself.