A Demonstration of Multi-agent Event detection, Communications, and Planning & Scheduling to enable Coordinating Multiple Spacecraft Assets for Joint Science Campaigns

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We demonstrate the application of: multi-agent organization, automated science event detection [Castano et al. 2005], inter-agent communication via interplanetary internet [Burleigh et al. 2006], and automated planning & scheduling [Estlin et al. 2007, Chien et al. 2000] to enable opportunistic science observations to be autonomously coordinated between multiple spacecraft. Coordinated spacecraft can consist of multiple orbiters, landers, rovers, or other in-situ vehicles (such as an aerobot). Opportunistic science detections can be cued by any of these assets where additional spacecraft are requested to take further observations characterizing the identified event or surface feature (for a more complete description see [Estlin et al. 2010]).

We show video footage, demonstration data, and software traces from a series of demonstrations completed in the JPL Marsyard involving in-situ seismographic stations (landers), a rover [Schenker et al. 2001], and two simulated spacecraft (similar to [Chien et al. 2005] on EO-1), using communications infrastructure developed for the interplanetary internet [Burleigh et al. 2006]. The demonstration shows parts of detection and response for atmospheric events adapted from software operation on the MER rovers on Mars [Castano et al. 2007] as well as seismographic events [Huang et al. 2010], highlighting the ability of multiple assets to observe the same phenomena from multiple complementary perspectives (e.g., as in [Chien et al. 2005] for terrestrial applications).

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