O2.01 Automated Optical Tracking and Identification of Tumbling 3D Objects

Tracking and Identification of 3D Tumbling Objects
Develop techniques to track and construct 3-dimensional views of tumbling objects in the atmosphere or space using digital optical tracking images for a variety of missions. These views will be used to determine the objects' approximate geometric sizes and shapes. The potential application is to help track and identify debris quickly after an accident or flight anomaly. The data will be provided by sequential digital images from one or more tracking cameras, ideally operating autonomously. The goal is to track and identify between 50 to 100 objects with typical cross-sections varying from tens of square meters down to one square meter or less within several minutes after an accident. The initial investigation will determine the minimum size that can be imaged using current technology, the probability of correctly estimating an object's size and shape, the processing speed, and the means for transmitting analyzed data to the command center.

GPS or Radar-aided Autofocus
Investigate using range information from radar, GPS, or other sources, for autofocusing long-range optics systems. Optical tracking provides valuable data during aerospace operations, but large distances between the target and the optical system can lead to distortions caused by atmospheric disturbances. Range information might be useful for a computer-controlled optical focusing system to decrease this distortion. The initial investigation will determine if this approach could be useful using one or multiple cameras, how it might be implemented, and if range information could be combined with other distortion-reduction techniques.

New Optical Tracking Systems
Investigate innovative and unconventional ways to use optical or hyperspectral imaging systems to visualize and track vehicles during launch and landing operations. Possibilities might include, but are certainly not limited to, unmanned aerial vehicle platforms or balloons. The system must be implemented unobtrusively in a spaceport environment. The initial investigation should result in a proof-of-concept demonstration in an appropriately scaled environment.