After the two impactor populations are identified, along with the indeterminate cases, population characteristics (density, relative velocity, and directional distributions) will be used in conjunction with damage equations to estimate the impactor's characteristic size. At that point, cumulative number or flux distributions of the MM and OD components begin to serve the space environment modeling community.

Multi-Purpose Crew Vehicle Camera Asset Planning: Imagery Previsualization

K. Beaulieu

Using JSC-developed and other industry-standard off-the-shelf 3D modeling, animation, and rendering software packages, the Image Science Analysis Group (ISAG) supports Orion Project imagery planning efforts through dynamic 3D simulation and realistic previsualization of ground-, vehicle-, and air-based camera output.

A total of 11 cameras will be onboard the Multi-Purpose Crew Vehicle (MPCV) and Service Module during Exploration Flight Test 1 (EFT-1), the first test flight of Orion, scheduled to launch in September 2014. These 11 cameras will collect imagery data essential to the fulfillment of EFT-1 flight-test objectives defined by Lockheed Martin and NASA. The optimization of the onboard camera suite – the evaluation of proposed camera and lens hardware options and definition of settings, position, and orientation parameters – has been achieved using imagery previsualization techniques.

Provided simulation data for a dynamic event; camera sensor and lens specifications; and industry-standard modeling, animation, and rendering software are used to produce high-quality, accurate previsualization imagery. EFT-1 dynamic events that have been modeled using simulation data provided by Lockheed Martin include the Launch Abort System (LAS) jettison, Crew Module/Service Module separation, and the Crew Module forward bay cover (FBC) jettison.

LAS-jettison imagery will be captured by three cameras mounted inside and pointed out of Crew Module windows. Lockheed Martin and NASA require this imagery to verify a successful LAS jettison without recontact during nominal ascent. Previsualization imagery of the LAS jettison, captured by the overhead docking hatch window, is shown in figure 1.

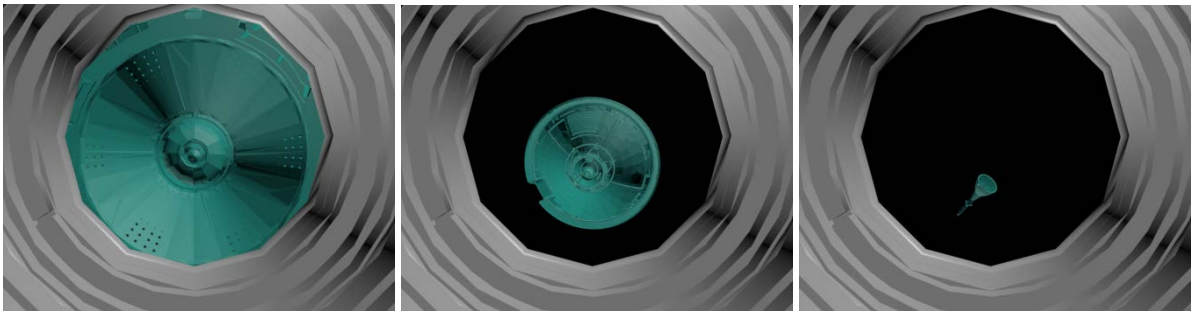

Figure 1.– Sample previsualization of EFT-1 LAS jettison.

Three high-speed cameras will be mounted in the Crew Module forward bay. These cameras will capture imagery of dynamic events during the EFT-1 descent and landing phases. The dynamic events include FBC jettison, drogue parachute deployment, main parachute deployment, and parachute steady state. Postflight ISAG analysis of the position and orientation of the FBC during jettison will be required to verify there was no recontact and validate Lockheed Martin FBC trajectory models. Custom targets defined by ISAG will be installed on the interior of the FBC. Modeling of the targets on the FBC interior, incorporating Lockheed Martin-provided FBC jettison dynamics simulation data and producing high-speed camera previsualization imagery, has been instrumental in optimizing the plan to collect this data. Sample previsualization imagery of FBC jettison as viewed from the Crew Module forward bay D camera is shown in figure 2.

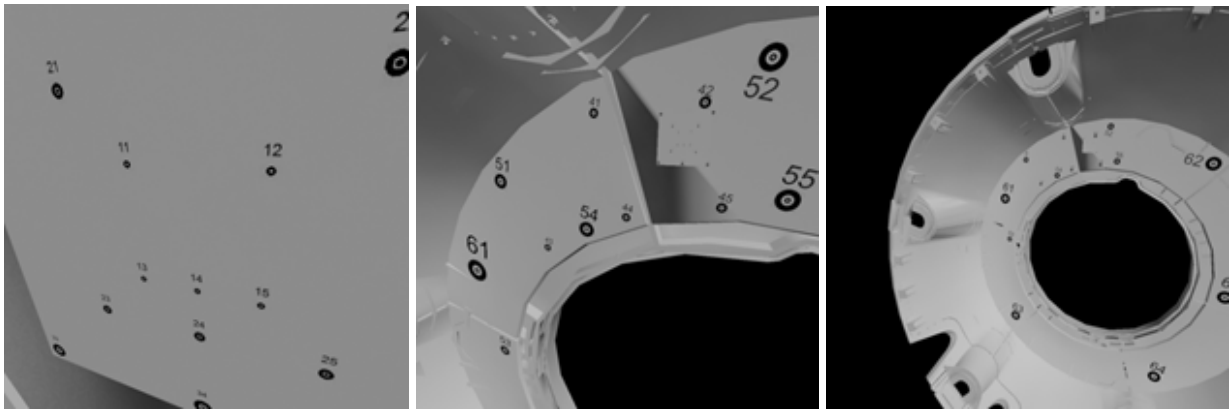

Figure 2.– Sample previsualization of EFT-1 FBC jettison.

ISAG also supports EFT-1 ground- and helicopter-based camera system optimization planning efforts. Imagery previsualization has been an instrumental tool in this process, and ISAG continues to expand this capability.