CHAMPOLLION: A COMET LANDER AND SAMPLE RETURN DEMONSTRATION MISSION Paul R. Weissman, (Jet Propulsion Laboratory, Mail stop 183-601, 4800 Oak Grove Drive, Pasadena, CA 91109, pweissman@issac.jpl.nasa.gov)

The Champollion Mission, currently under study at JPL, is designed to perform the first landing of scientific instruments on the surface of a cometary nucleus, and to demonstrate technologies for collecting and returning extraterrestrial samples to a mother spacecraft, and possibly to Earth. Comets contain a cosmochemical record of the conditions and composition of the primordial solar nebula at the time of the formation of the planetary system. The *in situ* study and return of cometary samples are thus among the highest priority goals of the planetary exploration program.

The current Champollion mission plan is to launch in April-May, 2003 on either a Delta 7925 or a Med-Lite 7425 launch vehicle, using a solar-electric powered carrier spacecraft to take Champollion to a rendezvous with periodic Comet Tempel 1. Flight time with the SEP stage is 2.7 years, considerably shorter than typical ballistic trajectories. Rendezvous occurs post-perihelion at about 2.5 AU from the Sun. After a series of slow flybys, the spacecraft will be placed in a low orbit around the nucleus of P/Tempel 1. Champollion would plan to spend 3-5 months at the comet in order to map completely the nucleus surface at high resolution, prior to deploying the lander spacecraft. In addition, radio tracking data will be used to determine the nucleus mass and gravity harmonics, and will be combined with imaging data to estimate the bulk density of the cometary nucleus.

The 3-axis stabilized Champollion lander will slowly descend to the surface using autonomous navigation, nulling out the lander velocity just before contact with the nucleus. At touchdown an explosive, deployable harpoon will anchor the spacecraft to the surface to permit drilling operations and other relevant measurements. Operations on the nucleus surface are expected to last 3 1/2 days. Scientists on the ground will update sequences based on quick-look analyses of earlier measurements. The current Champollion payload includes panoramic and near-field cameras, a combined infrared spectrometer/microscope for examining collected samples, a one-meter drill for obtaining cometary samples at depth, a gas chromatograph/mass spectrometer for analyzing collected surface and sub-surface samples, and a physical properties experiment to measure the strength, density, temperature, conductivity and other properties of the nucleus surface.

The 76 kg. Champollion lander will then collect a sub-surface sample, detach itself from the anchor, take off, rendezvous with the carrier spacecraft, and transfer the sample to the carrier spacecraft. This will thus demonstrate the feasibility of remote sample collection, automated orbital rendezvous, and transfer technologies, which could then be used on other sample return missions, such as from Mars or from an outer solar system satellite. Depending on the launch vehicle used and the resources which NASA can allocate to the mission, the cometary sample may then either be analyzed onboard the carrier spacecraft or returned to Earth for analysis in terrestrial laboratories. Flight time back to Earth would be 4.2 years, delivering the sample in June, 2010. The sample would be enclosed in a direct entry capsule that would decelerate in the Earth's atmosphere and then parachute safely to the surface.

Development of Champollion will be accomplished in collaboration with other advanced technology development and demonstration programs at JPL.