The intercenter team developed a suite of tools that are easier to use, higher fidelity, and converge more readily than previous tools. Additionally, the suite includes tools that were not previously available (except in the commercial application of one tool). All of the tools provide for greater accuracy than previous tools by implementing higher fidelity modeling and trajectory propagation.

MALTO is the only medium-fidelity tool developed during this software development effort. It is intended to be the starting point for nearly all low-thrust trajectory and mission preliminary design studies. It is designed to run faster and with fewer inputs than a high-fidelity tool. MALTO is the tool of choice for naming trade studies with optima in independent variables (i.e., three-dimensional trade-space). MALTO is also the only tool in the suite that is used to perform solar sail analyses.

**Mystic** is one of three high-fidelity tools with a unique ability to incorporate optimization of the entire trajectory or mission. Mystic is most applicable towards determining overall optimum trajectory (e.g., minimum fuel or minimum trip time for a given propellant load) due to its unique optimizer called "Static/Dynamic Control" (SDC).

**Express** is another high-fidelity tool that allows segments to piece together a desired mission trajectory. The available options for segments are similar to different types, i.e., continuous thrust, coast, starting or ending maneuvers, etc. For a selection of design trajectories with a set of predefined segments allows an emphasis to be made on multiphase propulsion in terms of low-thrust, high-thrust, and variable thrust, and also allows the user to enforce such constraints as crew wake/sleep cycles that apply to human missions.

**OTIS** is the new fully intended tool to be used in a high-fidelity heliocentric analysis tool as well as more commonly known use for Earth-centered analyses. It is easier to use with the simplified input/parse and utilizes new mathematics (using collocation and pseudospectral methods and selectable options). OTIS comes forward from older versions the capability to model propulsion systems at a high level of fidelity, thus providing for sizing of the subsystem and component level.

**SNAP** is the only tool in the suite that focuses primarily on planet-centered analysis. It is a high-fidelity propagator that accepts various types of pointing control laws to determine fuel, time, and path requirements. Simple heliocentric trajectory analyses can also be done with SNAP.

Thirty-two reference missions were selected for beta testing to provide feedback to the developers, verify agreement between high-fidelity tools, quantify variation between low, medium, and high-fidelity tools, and establish a broad range of example cases for new users. The mission set was intended to capture future science missions and allow for full demonstration of low-thrust mission capabilities such as:

- Non-Keplerian orbits
- Solar Electric Propulsion
- Nuclear Electric Propulsion
- Solar Sail
- Interplanetary
- Interorbital
- Interstellar
- Entry
- ASCENT
- STAGED
- COMPARISIONS

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