NASA is interested in innovative Earth-to-Orbit (ETO) propulsion systems and component technologies, as well as design and analysis tools used to support the assessment of the technical viability of those systems. Next generation launch systems will require propulsion systems that deliver high thrust-to-weight ratios, increased trajectory averaged specific impulse, reliable overall vehicle systems performance, low recurring costs, and other innovations required to achieve cost and crew safety goals.

Proposals should address technical issues related to Earth-to-Orbit (ETO) LOX/Hydrocarbon engines and LOX/Hydrogen second stage engines including engine and main propulsion systems design and integration, turbomachinery, combustion devices, valves, actuators, and ducts. Areas of specific interest for technology advancement and innovations include the following:

- Advancements in design and analysis tools applicable to assessment of ETO propulsion systems including engine systems, turbomachinery, valves, and combustion device concepts. Of particular interest are design and analysis tools that provide improved understanding and quantification of component, subsystem, and system operating environments and that significantly enhance the overall systems engineering evaluation of potential ETO propulsion concepts. Examples include low and high fidelity tools suitable for component and parameter sensitivity analysis and optimization, dynamic environment prediction, quantification of system benefits to changes.

- Improved propulsion systems stability prediction analysis and design tools, along with stability aid concepts and demonstration of approaches (i.e., rotordynamic coefficients, turbopump cavitation, instabilities, combustion stabilities, structural-acoustic, propellant management, and fluid dampers.)

- Innovative tools for predicting the complex fluid and structural interactions within rocket nozzles and experimental methods and data for validating these tools. Specific areas of interest include nozzle side loads induced by nozzle flow separation during engine start and shutdown transients and the effect of fluctuating pressure during engine main stage.

- Improvements to tools that predict the environments in and around the engine during booster operation.
• Data to validate the accuracy of high fidelity design and analysis tools used for the prediction of internal rocket engine environments.

• Design concepts that improve performance, reduce cost, reduce weight or improve reliability of the propellant feed systems, valves. Of particular interest are:
  - Design concepts for high power density turbines,
  - Design concepts for low net positive suction pressure pumps,
  - Design concepts for low cost, reliable valves and their actuation system,
  - Demonstration of robust bearing design concepts for large, high speed rotors,
  - Identification and demonstration of high strength materials that are resistant to combustion in a high pressure, oxygen rich environment.