

## **Life-Cycle Assessments of Selected NASA Ground-Based Test Facilities**

In the past two years, two separate facility-specific life cycle assessments (LCAs) have been performed as summer student projects. The first project focused on 13 facilities managed by NASA's Aeronautics Test Program (ATP), an organization responsible for large, high-energy ground test facilities that accomplish the nation's most advanced aerospace research. A facility inventory was created for each facility, and the operational-phase carbon footprint and environmental impact were calculated. The largest impacts stemmed from electricity and natural gas used directly at the facility and to generate support processes such as compressed air and steam. However, in specialized facilities that use unique inputs like R-134a, R-14, jet fuels, or nitrogen gas, these sometimes had a considerable effect on the facility's overall environmental impact.

The second LCA project was conducted on the NASA Ames Arc Jet Complex and also involved creating a facility inventory and calculating the carbon footprint and environmental impact. In addition, operational alternatives were analyzed for their effectiveness at reducing impact. Overall, the Arc Jet Complex impact is dominated by the natural-gas fired boiler producing steam on-site, but alternatives were provided that could reduce the impact of the boiler operation, some of which are already being implemented.

The data and results provided by these LCA projects are beneficial to both the individual facilities and NASA as a whole; the results have already been used in a proposal to reduce carbon footprint at Ames Research Center. To help future life cycle projects, several lessons learned have been recommended as simple and effective infrastructure improvements to NASA, including better utility metering and data recording and standardization of modeling choices and methods. These studies also increased sensitivity to and appreciation for quantifying the impact of NASA's activities.