Nitrocision®
The world leader in liquid nitrogen-based cutting and cleaning technology.

Case Study

Nitrocision® and NASA Lift Off

Shuttle Explosion Prompts Booster Rocket Investigation

In February 2003, the world watched as Space Shuttle Columbia disintegrated over Texas as it returned to Earth after a successful space mission. NASA immediately began investigations into the cause of the tragedy, and ordered a full system review to ensure all portions of the Space Shuttle met the agency's stringent safety parameters. While the investigation revealed that foam loss from an external tank was responsible for the explosion, the system review identified a small flaw within the igniter of the booster separation motors – small motors that propel the large Solid Rocket Boosters (SRBs) away from the Space Shuttle after it has been lifted into a low Earth orbit. Unwilling to accept any systems flaw, NASA decided to update the igniter, which required removal of the booster separation motors from the SRBs.

NASA engineers began working to find a solution to the daunting task of removing the booster separation motors from the SRBs. The challenge they faced? In order to remove the existing separation motors, engineers had to cut through four inches of nearly impenetrable thermal insulating material. Called Booster Trowelable Ablative (BTA), this insulation is a high performance material specifically designed to protect the reusable solid booster rockets from the extreme heat and pressure of launching the Space Shuttle and then crashing back into the ocean.

NASA needed a solution and it needed it quickly. "No procedure existed for removing the booster separation motors without damaging the SRBs," said Donald Noah, a former NASA Contract Engineer. Manual removal of the separation motors was labor intensive and dangerous – it required NASA personnel to literally chisel the thermal insulation off the motors from the aft skirt of the rockets. "Having staff manually remove the material was not ideal – the risk to our staff was high and the time invested was too significant. We needed to find a better way." One-of-a-Kind Problem Requires One-of-a-Kind Solution."

NASA evaluated several cutting methods in an effort to find one that would provide the necessary precision cutting results while protecting staff members from the potentially volatile rockets. One existing process, water jet blasting, was not ideal because it created cross contamination problems and ordinance logistics issues. NASA was introduced to Nitrocision, an Idaho-based company that specializes in cryogenic liquid nitrogen cutting and coating removal technology. According to a NASA Project Engineer, "Nitrocision possessed the potential to accomplish the BTA removal in both an economical and timely manner."

"The use of liquid nitrogen as a cutting mechanism was compelling for several reasons," continued Noah. "The portability of Nitrocision's NitroJet into sensitive areas was extremely helpful and the capacity for making precision cuts through such challenging materials was of significant value to the project. The fact that the liquid nitrogen could accomplish the job without endangering the surrounding flight hardware

or creating a secondary waste stream made the technology very attractive."

The NitroJet liquid nitrogen technology was put through rigorous testing to confirm that it could quickly cut through the ablative without damaging other hardware or creating risk for NASA personnel. After completing the tests, NASA adopted the NitroJet technology and since 2003 has removed 56 booster separation motors from 14 aft skirt assemblies.

Results of the NitroJet implementation have been easily monitored. NASA is well within environmental compliance for removal of the insulation material because the liquid nitrogen contains no chemicals, evaporates almost immediately and has no secondary waste stream. Additionally, NASA has seen significant time savings; the manual removal of a booster separation motor set would have taken two weeks. With NitroJet from Nitrocision, it takes only two days.

"The return on investment has been significant," said Noah. "The time savings are extremely important to us, and accomplishing our mission without endangering our staff is the most important accomplishment for us. The entire NASA family has a stellar personnel safety record and this technology has helped continue that record."

NitroJet has worked so well, in fact, that additional work was completed in the summer of 2006 "Intromission has worked in a highly professional manner, accomplishing the work ahead of schedule and permitting the savings of countless days to the Solid Rocket Booster Element Return to Flight schedule," said a NASA Project Engineer.

Additionally, Nitrocision's work on the Solid Rocket Booster ignition project earned the company the Space Flight Awareness (SFA) Supplier Award. "The SFA Supplier Award is bestowed upon a company that has shown consistent safety performance, high quality products, technical excellence, superior cost performance and adherence to schedules," said a NASA Contract Procurement Manager. "Nitrocision completed the assignment safely, ahead of schedule, and without affecting form, fit or function of the structure."

For more information on the NitroJet technology, visit our webpage at www.nitrocision.com.