

Spinoff 2002

National Aeronautics and Space Administration
Office of Aerospace Technology
Commercial Technology Division

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Foreword

Two hundred years after President Jefferson chose Lewis and Clark to explore the vast Louisiana Purchase lands extending to the Pacific, and 100 years after the Wright brothers conducted the first powered flight on a strip of Atlantic beach, the spirit of exploration, discovery, and invention is reaching ever farther into the new ocean of space.

And the United States of America, through NASA, proudly leads the way.

I am honored at this time in our country's history to lead America's civil aeronautics and space research efforts. Building on an extraordinary record of accomplishment, the people of NASA continue to develop revolutionary technologies needed to understand and protect our home planet and explore the universe. These technologies are helping NASA pioneer the future on a daily basis as we improve aviation safety and efficiency, probe more deeply into the mysteries of the universe, learn how to propel robotic emissaries more swiftly throughout the solar system, and work to better understand the dynamics of Earth's climatic system.

Our showcase project is the International Space Station, a permanently crewed research outpost in near-Earth orbit. Based on promising experiments already underway, Space Station research will significantly advance basic science, enable applications beneficial to millions of people, and enhance our ability to send explorers to other planets. Further, the drama of seeing astronauts living and working 24/7 on the Space Station will no doubt capture the imagination of students of all ages and motivate them to excel in subjects that will help them to become the next generation of explorers.

I am similarly proud of NASA's longstanding role as an agent of invention and technological progress in our society.

In 2002, NASA marks the 40th anniversary of the Technology Utilization Program, established under congressional mandate to promote the transfer of aerospace technology to the private sector. The program has been highly successful. Through NASA's efforts and those of innovative entrepreneurs, thousands of "spinoff" products and processes have been derived from NASA-developed technology. Collectively, they represent an immense contribution to the Nation's economy.

As NASA's research and development activities expand to meet the demands of our ambitious aeronautical and space research goals, the possibilities of applying technology to improve people's lives continue to grow. In one key area, medical research, NASA is teaming up with the National Cancer Institute to develop new biomedical technologies for cancer detection, diagnosis, and treatment, and with the Biotechnology Industry Organization to expand space-based biotechnology research and development activities. Millions of people promise to benefit from these important partnerships.

With compelling research like this, and with each scientific discovery, telescope image, launch, patent, and newly inspired child, the pursuit of NASA's new vision for the future—to improve life here, to extend life to there, and to find life beyond—will continue, I trust, to engage the public in an adventure without end.



Sean O'Keefe
Administrator
National Aeronautics and Space Administration



Introduction

Since its inception 40 years ago, NASA's Technology Transfer Program has led the way for our Nation to benefit from cutting-edge aerospace technologies. In addition to contributing to U.S. economic growth, these technologies are improving the quality of life on Earth while finding new ways to protect and preserve it. NASA's research and development efforts have advanced areas in medicine, communications, manufacturing, computer technology, and homeland security. These breakthroughs, translated into commercial products, are enhancing the lives of Americans everywhere.

When a congressional mandate led NASA to develop the Scientific and Technical Information (STI) Program, the Agency began a wide dissemination of its research and development results. In doing so, NASA recognized that many of its technologies were transferable to industry for the development of commercial products. As a result, the Technology Utilization Program was born in 1962. The successful program went through several changes over the years, as its philosophy, mission, and goals adapted into the Technology Transfer Program we know today. The program strives to make the latest technologies available to industry as soon as they are developed.

Each year, NASA's *Spinoff* publication showcases new products and services resulting from commercial partnerships between NASA and private industry. In the 2002 issue, the NASA field centers reflect upon the growth that has

made these innovations available to the public. The **Research and Development** section examines past achievements, current successes, and future goals for each of the 10 centers. The **Commercial Benefits** section proudly highlights 51 new spinoff products, including a heart pump for patients needing a heart transplant, as well as an air purifier that destroys anthrax spores. The **Technology Transfer and Outreach** section describes the outreach achievements and educational successes made possible through the NASA Commercial Technology Network. Each section of *Spinoff 2002* provides compelling evidence of the Technology Transfer Program's success and value.

With commercial products and successes spanning from work on the Apollo missions to the International Space Station, the 40th anniversary of the Technology Transfer Program invites us to celebrate our history while planning the future. I am proud to present the *Spinoff 2002* commemorative issue as a testament to the benefits of NASA's partnerships with U.S. industry.



Dr. Robert L. Norwood
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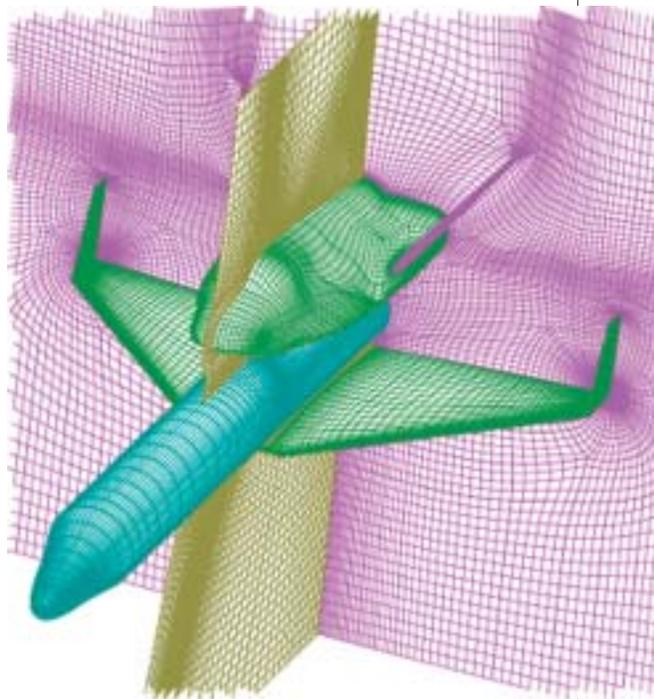
Getting a Grip on Grid Generation

Program Development Company of White Plains, New York, is spinning a web around engineering and manufacturing industries with a mesh-generation tool that provides smooth lines throughout the entire volume of a design, no matter how geometrically complex it may be. The company's GridPro technology is an automatic, object-oriented, multi-block grid generator that provides ease of use, high quality, rapid production, and parametric design. When paired with a 3-D graphic user interface called az-Manager, GridPro presents users with an extremely efficient, interactive capability to build topology, edit surfaces, set computational fluid dynamics (CFD) boundary conditions, and view multi-block grids.

The origins of the GridPro technology date back to a 1989 **Small Business Innovation Research (SBIR)** contract with NASA's Glenn Research Center, in which Glenn was seeking a multi-block grid generation program that would

run automatically upon identifying a pattern of grid blocks supplied by a user. Moreover, Glenn desired a system with recognition capabilities to make the necessary adjustments to patterns that were not created exactly to scale. With the Research Center's support, Program Development responded to these needs with a software tool that optimizes grids to be smooth and orthogonal throughout, and to be clustered near locations of high boundary curvature. At the heart of this technology is an intelligent code that frees users from error-prone judgment and allows them to construct high-quality grids with a few clicks of a mouse.

GridPro was purchased by Glenn Research Center and Ames Research Center, and was integrated to work with NASA's own CFD analysis codes, namely GlennHT and WIND CFD. The technology was also used by Glenn to successfully address a recent case involving several hundred cooling holes in a complex turbomachinery blade. GridPro resolved the



Program Development Company's GridPro technology was used to create the conceptual design of a two-stage-to-orbit launcher.

cooling hole problems by producing a high-quality grid in significantly less time than would be required for most grid generators.

According to Program Development, a two-stage-to-orbit vehicle can be created in just 1 day using GridPro. The company attributes this rapid processing to its powerful topology engine, and graphically oriented, user-friendly tutorials. Once a topology is created, it can be used as a template for future applications, therefore expediting the process for further design work.

GridPro also differs from most grid generators on the market, because it does not use surface projection schemes. Models that employ such methods must undergo the painstaking process of creating a new grid every time the surface on the geometry is altered. With GridPro, a user simply needs to replace the

geometry in the topology template, and restart the previous grid file to create an entirely new grid. This advanced feature translates into a dramatic reduction in design analysis time. To reduce time even further, GridPro also enables the user to group link topology files and weld independently created grids into one large grid.

GridPro is currently used in many engineering fields, including aerospace, turbo-machinery, automotive, and chemical industries. Customers include Dow Chemical, Solar Turbines, Concepts-Northern, Toshiba, and Mitsubishi. Academic institutions such as Penn State University, Rutgers University, University of Illinois, and Stanford University also rely on GridPro. ❖



The multi-block grid-generator provides smooth lines throughout the entire volume of a design, despite geometrical complexities.