



2022
ANNUAL SUMMARY

From the President



DD24045_9845

In 2022, Southwest Research Institute celebrated its 75th anniversary. Throughout the last year, we celebrated our visionary founder Tom Slick, who established the Institute in 1947 with a goal of making the world a better place by providing applied research. We celebrated the people who came and joined the nascent organization located on the outskirts of San Antonio over seven decades ago. And we celebrated the bright and curious scientists, engineers and support staff of today who continue to join the Institute to help solve our clients' most challenging problems.

Despite the uncertainties of the recent past, 2022 turned out to be another outstanding year of technical advancements and solid financial performance due to our staff's remarkable capabilities, collaborations and innovative thinking.

Our research activities continue to provide solutions to some of humankind's most difficult challenges from deep sea to deep space. In this last year, we invested in developing our own hydrogen infrastructure to research the transition to a hydrogen economy. SwRI staff also established a sustainable technologies working group and a 5G special interest group to incorporate this next-generation information technology promising to transfer data 100 times faster than 4G.

In addition to having our staff collaborate with University of Texas at San Antonio professors on Connect projects, the Institute launched new cooperative research initiatives with The University of Texas at Austin and Tecnológico de Monterrey, a private, nonprofit university system in Mexico.

Our consolidated FY22 revenue set a record for the Institute and the staff found innovative ways to serve clients as our contract backlog grew to a historic new level. Our space science program had grown to the extent that we recently established a new Space Sector organization, comprising three divisions: the Space Science, Space Systems, and Solar System Science Divisions. The Institute also completed two new flagship buildings. The newly constructed Applied Power annex is 65,000 square feet and includes skybridge access to additional facilities. Our 74,000-square-foot Space System Integration Facility nearing completion will support the rapid design, assembly and testing of spacecraft.

I would like to thank our staff, the executive leadership team, Board of Directors and Advisory Trustees for their many contributions in FY22. I am grateful for the agility and commitment our staff has shown over the past couple of years as we have managed the many formidable challenges of the pandemic and its impact on the research business.

And now, as we reflect on our 75th anniversary — a significant milestone in the life of any organization — we look forward to the next era with confidence and high expectations. We closed fiscal year 2022 with a record research volume of \$798 million, a staff of nearly 3,000 and strong momentum as the Institute plants seeds for the next 75 years and beyond. Whatever challenges and opportunities may lie ahead, Southwest Research Institute's dedicated staff will rise to the occasion.

A handwritten signature in black ink that reads "Adam L. Hamilton".

Adam L. Hamilton, P.E.
President & CEO

Consolidated revenues hit a record high at nearly

\$798
million

Consolidated net assets were

\$708
million

Capital expenditures exceeded

\$81
million

Internal research spending exceeded

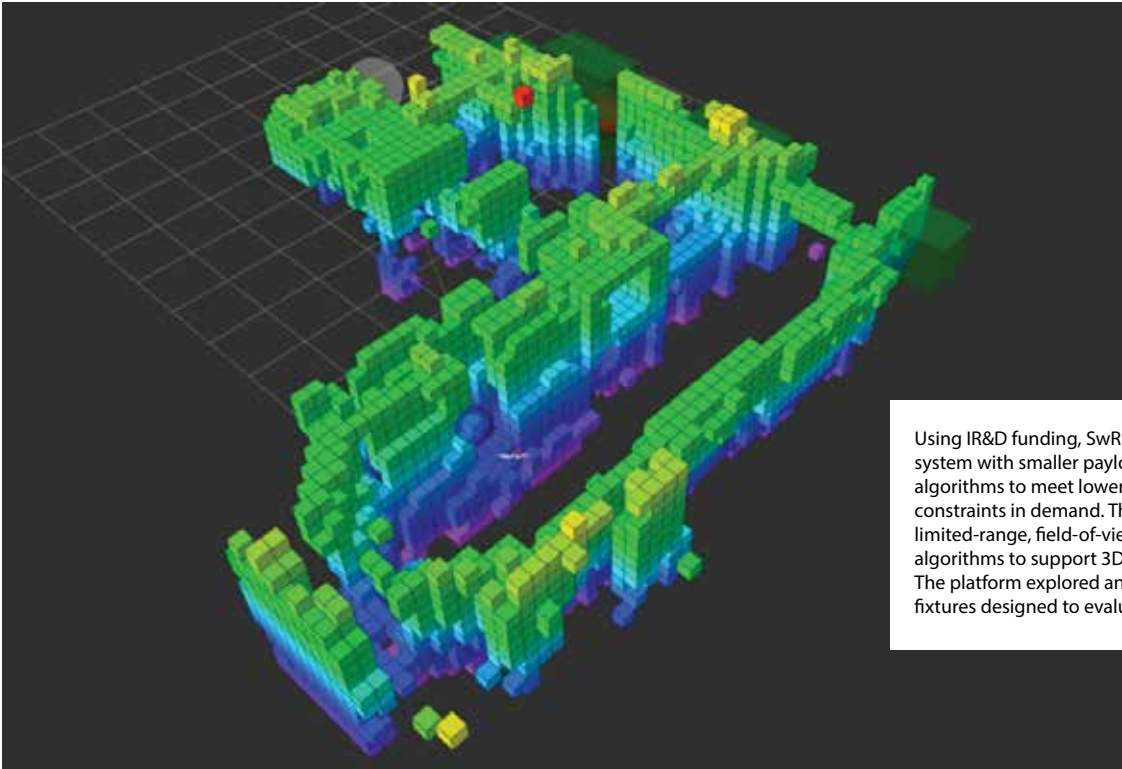
\$7
million and funded 89 new projects

IR&D 2022

As a nonprofit research and development organization, SwRI uses part of our revenue to invest in tomorrow's innovations, to broaden the Institute's technology base and to encourage our staff's professional growth. In 2022, SwRI initiated 89 new projects, investing more than \$7 million in internal research, including quick-look and focused research programs. IR&D fulfills the Institute's objective of conducting

innovative activities for the benefit of industry, the government and humankind.

By investing in internal research, we are investing in the technology our clients may need in the future. The program also allows our engineers and scientists the freedom to explore innovative and unproven concepts for the benefit of clients without contractual restrictions and expectations.



Using IR&D funding, SwRI developed an unmanned aerial system with smaller payloads and updated exploration algorithms to meet lower size, weight and power constraints in demand. The mapping system uses a limited-range, field-of-view time-of-flight sensor and algorithms to support 3D exploration using less data. The platform explored and mapped several different test fixtures designed to evaluate its capabilities.

D025818t

Since 2010, the Institute has used internal research funding to establish SwRI leadership in the emerging suborbital research field. In one unmonitored experiment aboard Blue Origin's New Shepard rocket, novel tetrahedrons passively gathered regolith similar to asteroid surface materials, turning themselves inside out to store the samples for transport. The SwRI design was very efficient, nearly filling the entire collection volume with almost half of the mechanism's own mass in collected materials.



D025819

Milestones 2022

HONORS

- Dr. William Bottke:** AGU Fellow
- Dr. Stephen Fuselier:** Co-chair, National Academies Solar & Space Physics Decadal Survey
- Dr. Peter Lee:** Director of the Society of Tribology & Lubrication Engineers
- Dr. Elizabeth Trillo:** National Association of Corrosion Engineers Fellow
- Dr. James Walker:** President of the International Ballistics Society

AWARDS

- Dr. James L. Burch:** NASA Distinguished Public Service Medal
- Bobby Holliday:** Association of Old Crows Clark G. Fiester Program Management Award
- Dr. Hal Levison:** American Astronomical Society's Division on Dynamical Astronomy Dirk Brouwer Career Award
- Chris Sharp, Gary Neely, Bryan Zavala & Sandesh Rao:** SAE John Johnson Award for Outstanding Research in Diesel Engines
- Dr. Natalie R. Smith:** 2022 ASME International Gas Turbine Institute Dilip R. Ballal Early Career Engineer Award
- Madeline Vaughn:** Electronic Warfare Professional Young Crow Award



R&D World Magazine recognized the Integrally Geared Supercritical CO₂ Compressor as being among the 100 most significant innovations for 2022. The compressor, developed by SwRI and Hanwha Power Systems, converts thermal energy from a heat generation source, such as concentrated solar power, to electrical energy. This is SwRI's 51st R&D 100 award. SwRI's compressor team included Dr. Natalie Smith, Dr. Jason Wilkes and Dr. Tim Allison.

D024717_1370



D025793_3067



D0233541_7094

SwRI has deployed a 14-passenger automated shuttle on its grounds as a tour bus and a technology demonstration platform. The shuttle uses SwRI-developed Ranger technology to match stored images of roadway surfaces with live images from ground-facing cameras to navigate Institute roads to within 2 centimeters. The vehicle, which has a safety driver onboard, uses lidar to observe its surroundings and react to pedestrians, vehicles and other objects.

1,081

PAPERS PUBLISHED

336

PRESENTATIONS GIVEN

121

WEBINARS HOSTED

14

PODCASTS AIRED

39

INVENTION DISCLOSURES SUBMITTED



D025820

SwRI is supporting NASA's efforts in planetary defense to better understand how to crash a spacecraft into an asteroid or comet on a collision course with Earth to nudge its trajectory, diverting an impending impact into a harmless near miss. To complement NASA's recent Double Asteroid Redirection Test, SwRI conducted small-scale, high-velocity impact experiments to characterize the momentum enhancement associated with an asteroid's recoil from the crater ejecta, or debris, erupting from the impact crater following hypervelocity impact.



D025356_3123

In 2022, SwRI initiated phase II of the ARPA-E NEXTCAR project to increase energy savings to greater than 30% using Level 4 automation technologies. The approach builds on the success of eco-routing, eco-driving and power-split optimization, expanding to explore cooperative control, smart lane change/merge, and dedicated connected and automated vehicle operations.

D025823



SwRI's new 74,000-square-foot Space System Integration Facility supports the design, assembly and testing of constellation spacecraft and the responsive integration of mission-specific payloads.

37

PATENTS AWARDED

80

PATENT APPLICATIONS FILED

2,796

EMPLOYEES

285
DOCTORATES

563
MASTERS

888
BACHELORS

225
ASSOCIATES

HIGHEST DEGREE EARNED

Technical Highlights 2022



D025611_8450

SwRI specialists in the Defense and Intelligence Solutions Division designed a novel cylindrical slot array to fit near the base of an existing shipboard antenna to take advantage of unused space. The low-profile array encircles the mast, extending the operating frequency range of the antenna while avoiding an expensive redesign of the upper mast.



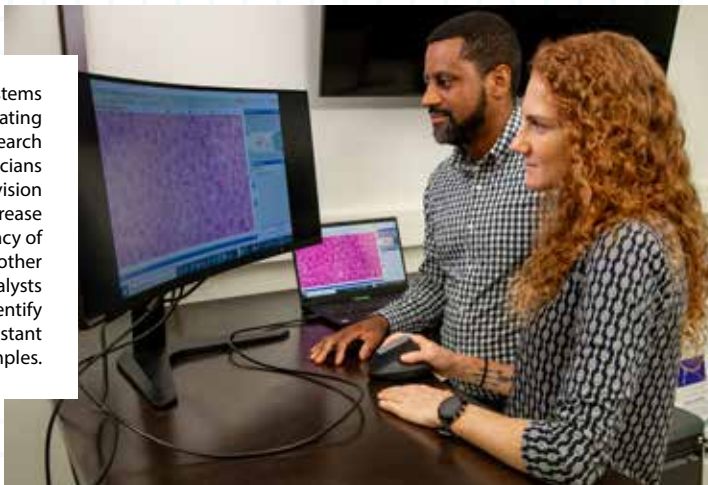
D025243_1578

SwRI's Powertrain Engineering Division is using hydrogen-powered engines and vehicles to investigate a variety of clean automotive technologies with the goal of reducing greenhouse gas emissions. We also kicked off H₂-ICE (Hydrogen-Internal Combustion Engine), a joint industry program addressing heavy-duty applications.



D025822

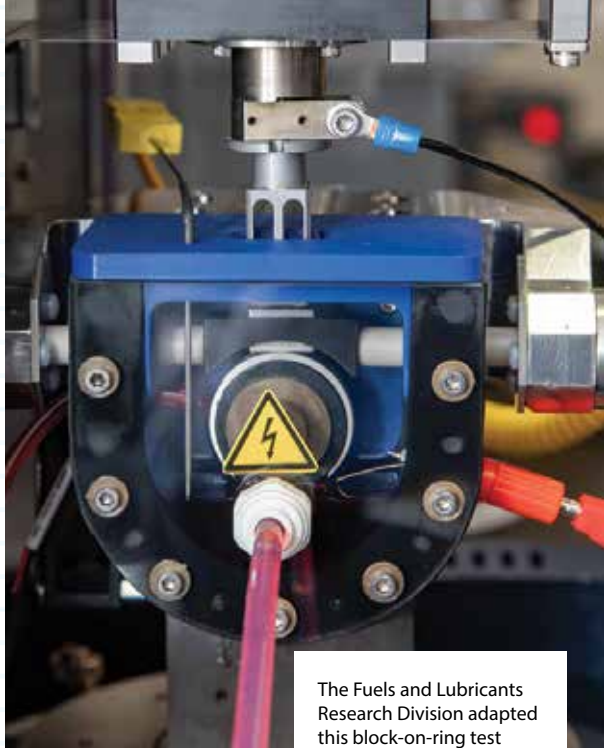
SwRI's Chemistry and Chemical Engineering Division develops cost-effective means of synthesizing new formulations for plant-based medicines. In 2022, chemists developed a synthetic version of scopolamine, a popular antinausea treatment, marking the first time SwRI has fully synthesized a drug compound that is naturally derived from plants.



D025431_4859

The Intelligent Systems Division is collaborating with several local research institutions and physicians to develop machine vision algorithms that will increase the speed and accuracy of cancer detection and other diagnoses. Here, analysts adapt algorithms to identify chemotherapy-resistant polyploid cells in samples.

D025821



The Fuels and Lubricants Research Division adapted this block-on-ring test system so that the contact interface can now also be subjected to an electrical field (AC or DC), to replicate electric vehicle drivelines and test fluids, materials and coatings.

D025473



The Mechanical Engineering Division has expanded its materials characterization capabilities with a field emission scanning electron microscope. The ability to produce clear, sharp images of objects magnified a million times will support research into a wide range of materials systems, including thin films and nanomaterials.

D0253559_7801



The microbiology laboratory in the Applied Physics and Applied Power Divisions continued to expand its capabilities and capacities to include studying the efficacy of antibacterial compounds, conducting microcosm studies, monitoring bioburdens and validating decontamination strategies.

D025738_1349



The Space Science and Space Systems Divisions developed a groundbreaking new mass spectrometer for NASA's Europa Clipper mission to study the potential habitability of Jupiter's moon Europa. The Mass Spectrometer for Planetary EXploration (MASPEX) instrument has a mass resolution hundreds of times finer than anything that has flown to space before.

Southwest Research Institute
6220 Culebra Road
San Antonio, Texas 78238-5166
United States

Nonprofit Org.
U.S. POSTAGE
PAID
Permit No. 234
San Antonio, Texas



Deep Sea to Deep Space®



ABOUT THE INSTITUTE

Southwest Research Institute is a premier independent, nonprofit research and development organization. With 11 technical divisions, we offer multidisciplinary services leveraging advanced science and applied technologies. Since 1947, we have provided solutions for some of the world's most challenging scientific and engineering problems.

©2023 Southwest Research Institute

All rights reserved under U.S. Copyright Law and International Conventions. No part of this publication may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without permission from the publisher.

Deep Sea to Deep Space is a trademark of Southwest Research Institute.

The newly constructed Applied Power annex on the cover is 65,000 square feet and includes skybridge access to additional facilities. More than 2,700 staff members work in 244 buildings with nearly 2.4 million square feet of offices and laboratories on the 1,500 acres shown above.

EMPLOYMENT

Southwest Research Institute's staff provides client services in the areas of communication systems, modeling and simulation, software development, electronic design, vehicle and engine systems, automotive fuels and lubricants, avionics, geosciences, polymer and materials engineering, mechanical design, chemical analyses, environmental sciences, space science, training systems, industrial engineering and more.

SwRI is always looking for talented technical staff for its San Antonio facilities and for locations elsewhere in the United States. We welcome your referrals. Check our employment opportunities at [swri.jobs](https://www.swri.jobs).

An Equal Employment Opportunity/
Affirmative Action Employer
Race/Color/Religion/Sex/Sexual Orientation/
Gender Identity/National Origin/Disabled/Veteran
Committed to Diversity in the Workplace

210.522.2122

ask@swri.org

[swri.org](https://www.swri.org)



Like. Share. Follow. Listen.