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Industrialization of Thermal Protection Systems for Hypersonics: an FFRDC Perspective

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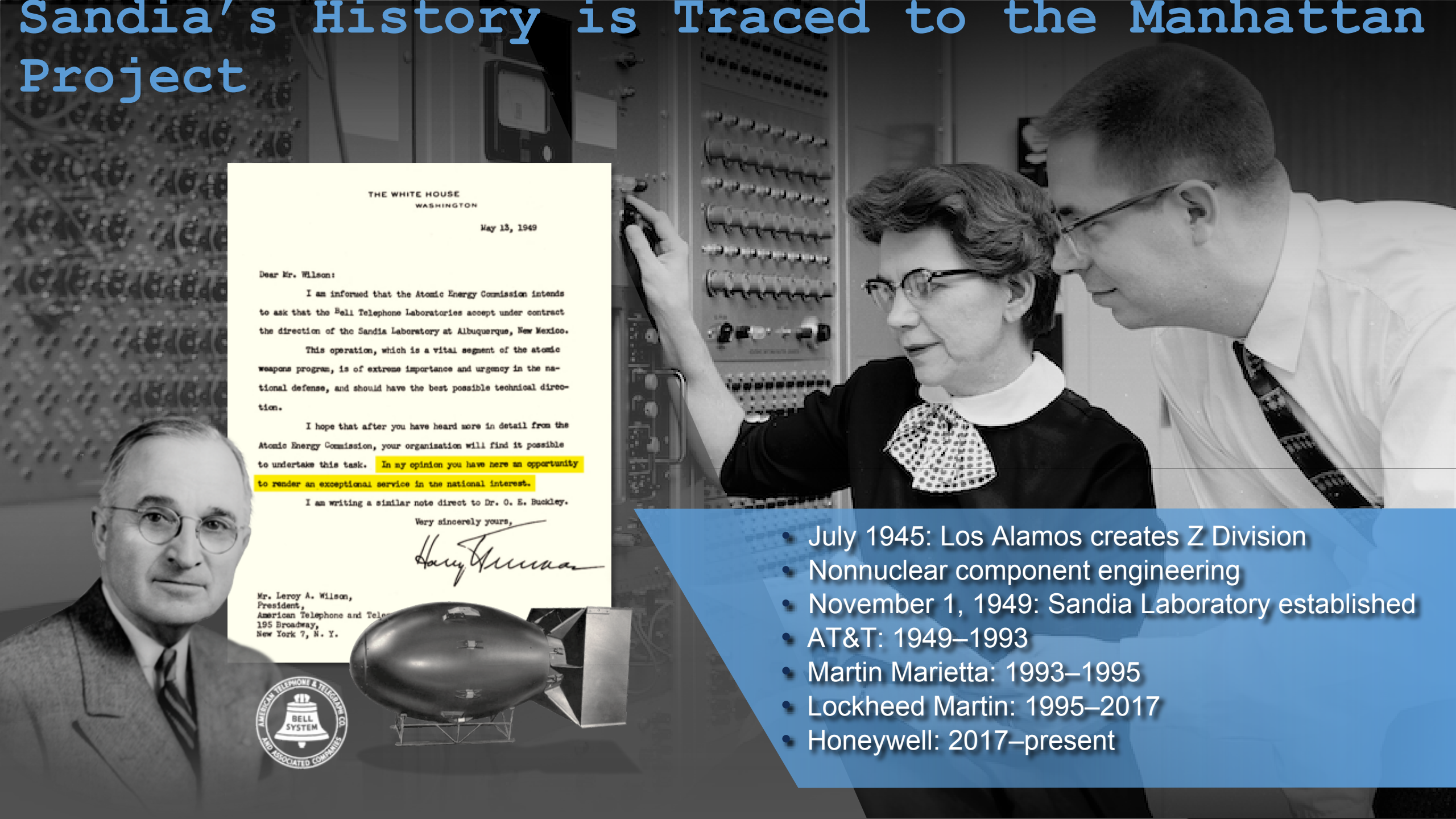
Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Bottom Line Up Front

- Sandia has a history of successfully designing, testing and fielding hypersonics
- Hypersonic flight is fraught with unique challenges, one of which is developing materials to address thermal requirements
- Sandia has the end-to-end capability to model, develop and test materials in sounding rocket flights
- We are actively transferring the Common Hypersonic Glide Body to industry and are committed to partnering to ensure the successful deployment of hypersonic weapon systems
- Sandia is working to establish a new facility to bridge the gap between the research base and the industrial base

Sandia's History is Traced to the Manhattan Project



THE WHITE HOUSE
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

Harry Truman

Mr. Leroy A. Wilson,
President,
American Telephone and Tele
195 Broadway,
New York 7, N. Y.

- July 1945: Los Alamos creates Z Division
- Nonnuclear component engineering
- November 1, 1949: Sandia Laboratory established
- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–2017
- Honeywell: 2017–present

Sandia is a Federally Funded Research & Development Center

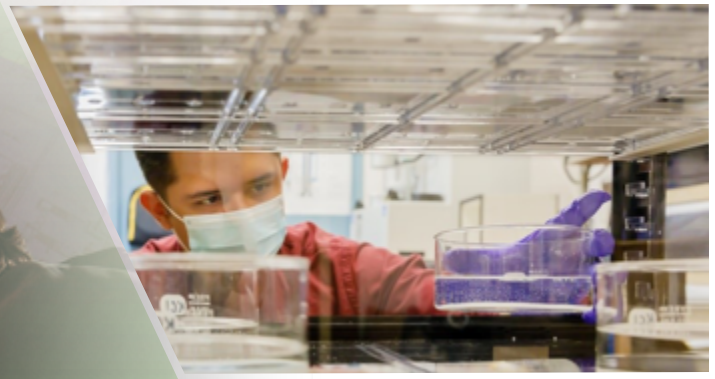
FFRDCs are long-term strategic partners to the federal government, operating in the public interest with objectivity and independence and maintaining core competencies in missions of national significance

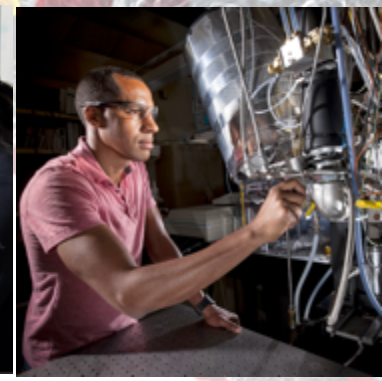
Government owned, contractor operated

National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc.

National Security is our Business

For more than 70 years, Sandia has delivered essential science and technology to address the nation's most challenging security issues





PURPOSE

Render exceptional service in the national interest

VISION

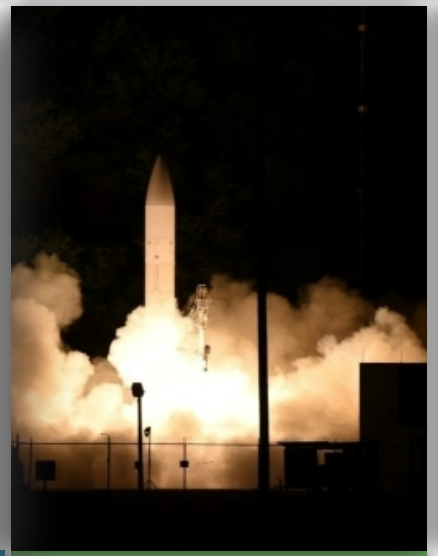
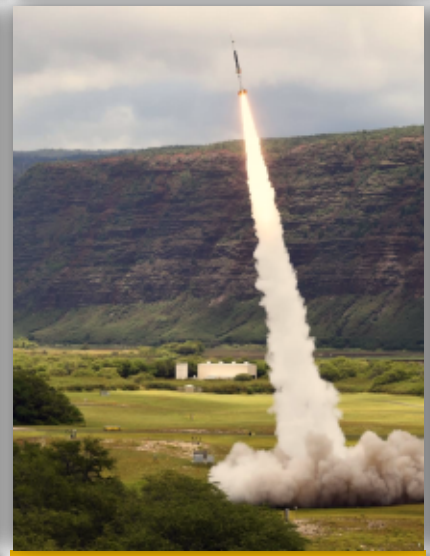
On behalf of our nation, we anticipate and solve the most challenging problems that threaten security in the 21st century

MISSION

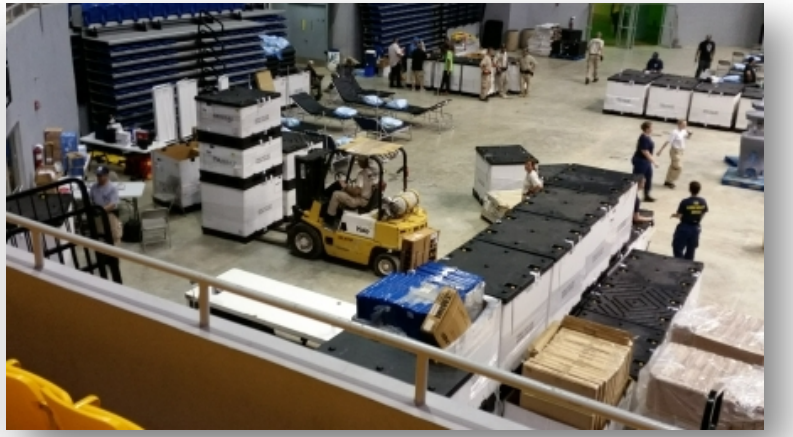
Our unique mission responsibilities in nuclear weapons create a foundation from which we leverage capabilities, enabling us to solve complex national security problems

ACI
A C5 Group Company

Sandia's History in Hypersonic Glide Bodies

POST-WWII	1970-1985	2003-2011	2017-2020	2021-2023	FUTURE
					
Post-WWII: Reentry Vehicles	1970's: Pre-SWERVE & SWERVE 1985: Successful SWERVE Flight Test	2003: Prompt Global Response Grand Challenge 2011: AHW-FT1A	2017: CPS FE-1 2018-2025: Autonomy for Hypersonics (A4H) 2020: CPS FE-2	Navy/Army CHGB Product Transition Navy/Army FT-3, JFC-1, JFC-2 Missile Defense Agency Advanced Target SHOTL	Sandia Design Agent Role Sandia transfer of C-HGB variants to industry Sandia's Roadmap for the Future is realized

Transition of CHGB to Industry



DESIGN, TEST, AND DEPLOYMENT OF ADVANCED MATERIALS TO ADDRESS THERMAL PROTECTION SYSTEM REQUIREMENTS (AS HIGH AS 2200°C FOR HYPERSONICS)

Current Needs

SUPPLY CHAIN RESILIENCE AND INDEPENDENCE THROUGH NOVEL, AND DOMESTICALLY PRODUCED, FEEDSTOCKS

NOVEL DESIGN AND MANUFACTURING PROCESSES THAT WILL HASTEN DEPLOYMENT TO INDUSTRY

Sandia's Current Research in TPS

Materials Science

- Ongoing research on Carbon/Carbon composites
- Advancing materials beyond Carbon/Carbon composites
- Identifying Advanced materials for
  - Aeroshell windows and antennas
  - Oxidation resistant aeroshell materials
  - Advanced insulation materials

Modeling and Simulation

- Developing and building models which use data from materials science & environmental performance to improve our understanding of TPS
- Multi-physics codes to understand TPS response to hypersonic flight regimes; e.g., SPARC (Sandia Parallel Aerodynamics and Re-entry code)

Manufacturing Processes

- Manufacturing of Carbon/Carbon
- Establishing relationships with material suppliers, machine shops and industry partners
- Utilizing flexible acquisition and advanced manufacturing to remove bottlenecks
- Preparing for future Programs of Record by anticipating DOE/DOD needs

Sandia Approach

A multi-pronged approach to address technical challenges and hasten deployment of R&D to industry

Research and Development

Continued research in advanced materials and computer models to improve our understanding of environmental performance

Test and System Integrati

Leveraging programs such as H4H to accelerate the adoption of low TRL R&D by the industrial base

Resiliency

Creating resiliency in both the supply chain and the future workforce

Collaborations

Research staff working along side industry partners and manufacturers to design for manufacturing

CAMINO: Center for Advanced Manufacturing Innovation

URGENT NATIONAL SECURITY DRIVER

EXPIRATION OF CURRENT LEASE

SNL ND MISSION TIES

PARTNERSHIPS

MISSION-SPECIFIC PROTOTYPING

- Current State -

National Innovation Base

Poor existing connection

Industrial Base R&D

Large-scale Manufacturing

- Proposed CAMINO Facility -

A NATIONAL RESOURCE FOR SPECIALIZED AM CAPABILITIES

ADVANCED MANUFACTURING CAPABILITIES

NOVEL MATERIALS SYNTHESIS AND DISCOVERY

MISSION FOCUSED PROTOTYPING

Co-locates Industry, Government, & Academia.

- Ease of R&D partnerships with and academia
- Accelerated workflows, rapid prototyping, & to "tech mat" roadblocks solutions
- Accelerates and supports tech transfer

CAMINO

Dynetics A Leidos Company · Oak Ridge National Laboratory · CNM · NSC · Sandia National Laboratories · NM

... and many others

Existing Sandia Test Facilities & Programs:

Couples TRL & MRL progressions - ensuring high TRL isn't reached without the ability to manufacture at scale.

Creates New Solutions to Old Problems

- Cables, connectors, & backshells
- TPS Systems
- AM qualification and insertion

Partnerships are critical to our success!

”Bridging the gap between the “Innovation Base” (academia, national labs, small business) and the “Industrial Base” is a major issues in ensuring US military superiority.”

- FY20 Industrial Capabilities Assessment

HAVE A QUESTION?