SAND2011-0817P

Fellowships, Internships, and Full Time Employment Opportunities at Sandia National Laboratories

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Component Science and Mechanics
Sandia National Laboratories

Outline

- Introduction to Sandia National Laboratories
- Broad Research Overview – The Four Mission Areas of Sandia
  - Nuclear Weapons
  - Defense Systems
  - Energy Resources
  - Homeland Security
- High Need/Recruiting Areas
- Personal Research Experiences
- Opportunities at Sandia National Laboratories
  - Internships
  - Masters programs
  - PhD research programs

National Laboratories

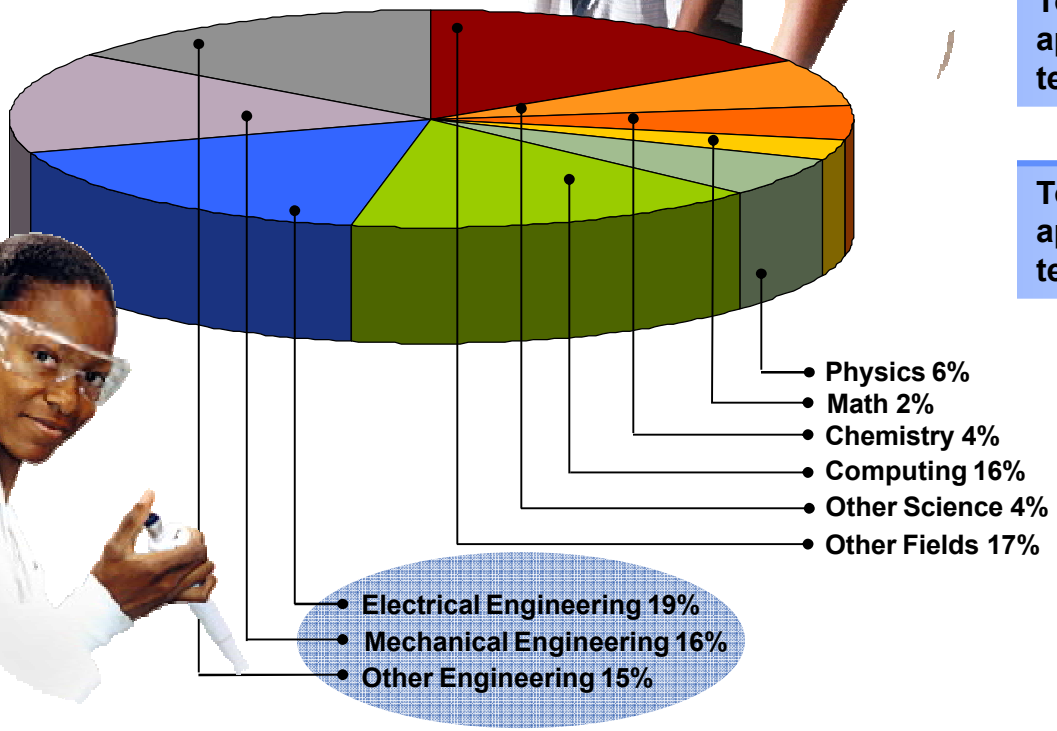
Sandia National Laboratories

Sandia National Laboratories in Albuquerque, New Mexico

Sandia's Personnel

- On-site workforce: 11,200
- FY08 permanent workforce: 8,400
- FY08 gross payroll: $886.1M
- FY08 budget: $2.3B

Technical Staff (3,844) by Degree (End of FY08)



Disciplines of Most Technical Hires (FY03 – FY05)

Top 3 hire fields comprise approximately 55% of technical hires	▪ IT ▪ ME ▪ EE
Top 5 hire fields are approximately 70% of technical hires	▪ Physics ▪ Chemistry
Top 11 hire fields represent approximately 90% of technical hires	▪ Chemical Eng ▪ Materials Science ▪ Math ▪ Biology ▪ Nuclear Eng ▪ Aerospace Eng

Nuclear Weapons Mission Area

- Research, Design, and Development of Non-Nuclear Components (96% of Total NW Parts)
- Life Extension of Nuclear Weapons
- Neutron Generator (NG) Manufacturing
- Stockpile Support – maintenance, military liaison, surveillance, dismantlement, logistics
- Nuclear Materials Protection

Trident Submarine

C4/D5 Missile

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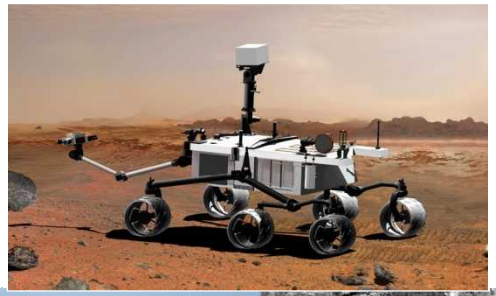
Defense Systems Mission Area

- Science & Technology Products
- Surveillance & Reconnaissance
- Integrated Military Systems
- Remote Sensing and Verification
- Information Operations
- Proliferation Assessment



National Laboratories

Energy Resources Mission Area

Who is leading globally in energy research…

Energy & Fuels:
Institutions Ranked by Citations

Rank	Institution	Citations 1998-2008
1	Sandia National Labs	4,147
2	Natl. Renewable Energy Lab	3,773
3	CSIC (Spain)	3,678
4	Chinese Academy of Sciences	3,541
5	Indian Institutes of Technology	3,166

Source: Thomson Reuters Science Citation Index

- U.S. national labs lead the way
- National labs and U.S. universities comprise 9 of the top 20 research institutions
- Sandia is 1st in total citations of energy and fuels research and 3rd in papers cited in photonics research.

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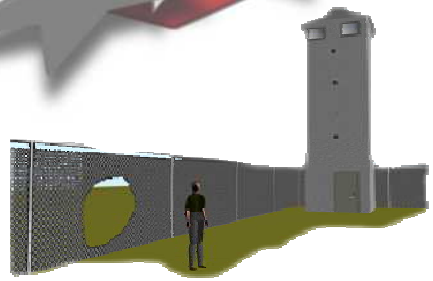
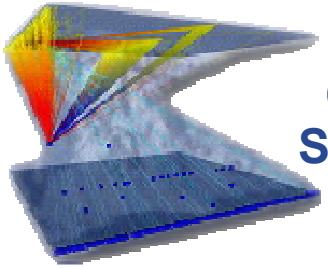
Homeland Security Mission Area



Synthetic Aperture Radars



Cyber Security

TWA Flight 800

Explosive Detection Portal

Radiation Remediation Foam

Tunnel Characterization

Unabomber and Shoe Bomber Investigations

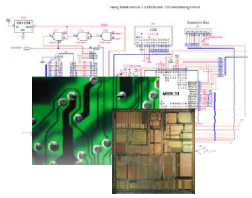
Explosive Destruction System

Analysis of the I-35 Bridge Collapse

Sandia National Laboratories

Active Recruiting Areas

- Computational Science and Engineering



Architectures

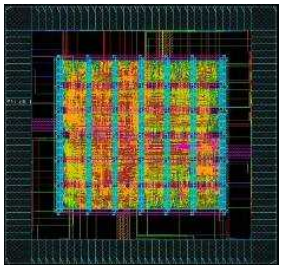
Algorithms

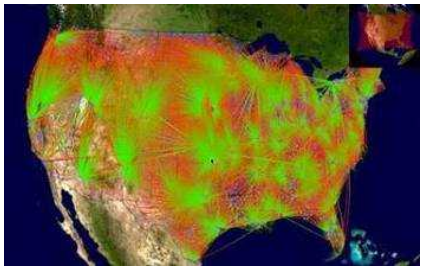
Applications

One 1994 computer day ≈
One 2006 computer minute

1997: 1 Teraflop in a *room*.
2007: 1 Teraflop on a *chip*.

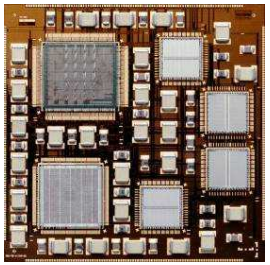
- Cyber Security
  - Includes Infrastructure Modeling, Cryptographic Chips, and Microelectronic Development





- Space Systems

Galileo Spacecraft



Rad-hard chips
& MEMS devices

Laser Dynamic Range Imager Orbiter Inspection System (LOIS)

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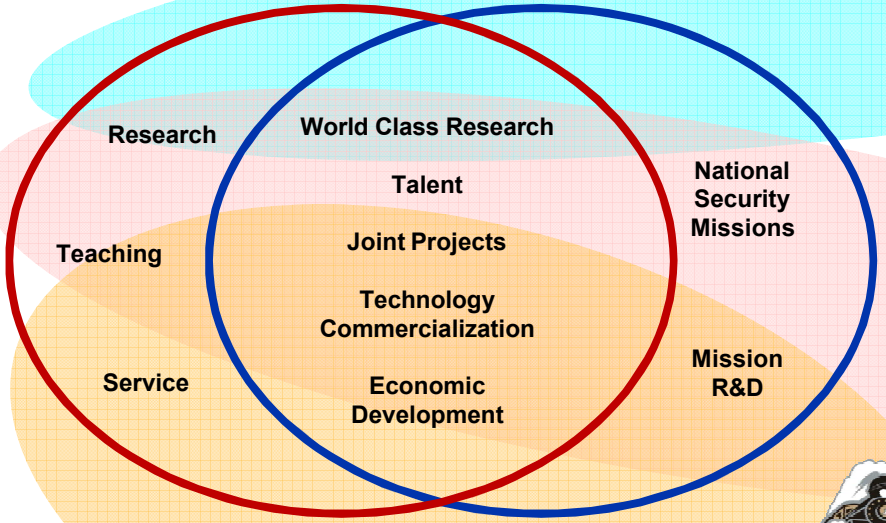
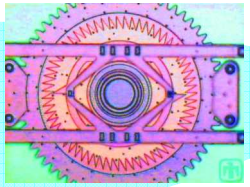
University Partnerships Deliver World Class Science + Top Talent…



Universities… are the nation's primary source of new knowledge.



Sandia's world class research

- $25M in university research annually
- Faculty research sabbaticals
- PECASE awards

Universities… create the nation's talent pool.

Sandia's next generation of scientists and engineers

150 new technical employees annually
400 technical interns annually
90 Sandia graduate fellows
140 Post-docs

Universities… enhance research impact and funding through collaboration.

Carnegie Mellon

Strategic university alliances:
- ASCI, RAMP, CINT, MESA, etc.
- Campus Executive Program

Sandia's commitment to education

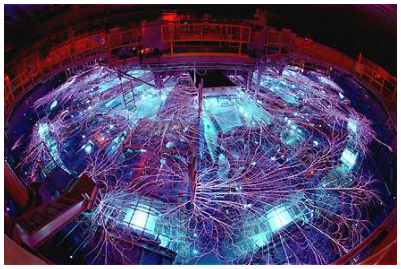
Sandia National Laboratories

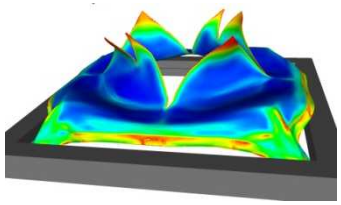
1520 – Solid Mechanics/Structural Dynamics

Mission: Provide the research, development, and applications expertise in solid mechanics and structural dynamics required for Sandia to accomplish its mission in nuclear weapons and other national security areas

Solid Mechanics

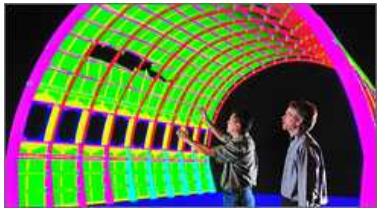
- Nonlinear Computational Mechanics
- Experimental Solid Mechanics
  - Diagnostic Development & Application
  - Production Testing
  - Certification & Failure Margin Testing & Discovery
- Material Response

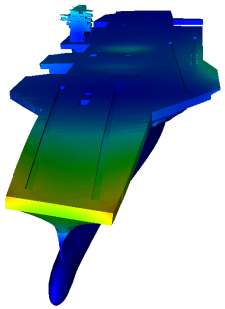


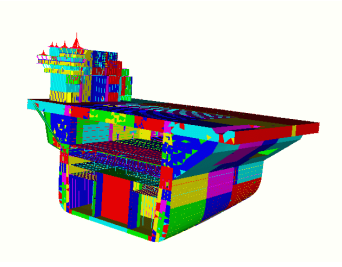


Structural Dynamics

- Modal, Shock & Vibration, acoustics
  - Computational
  - Experimental
- Nonlinear Structural Dynamics
- Smart Structures & Controls
- Nondeterministic Methods & Optimization

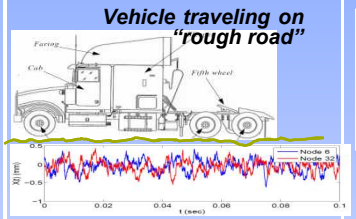
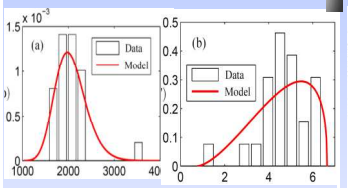
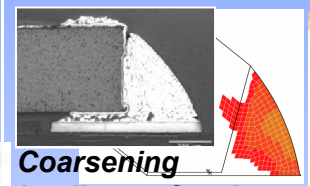
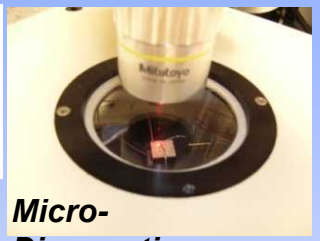
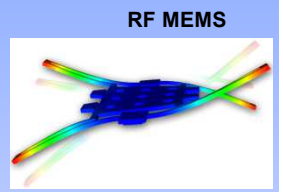
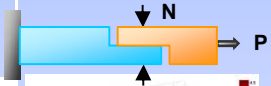
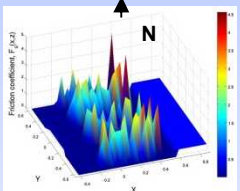
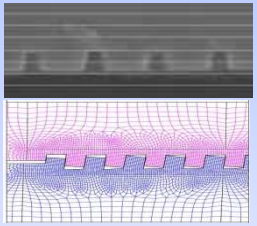
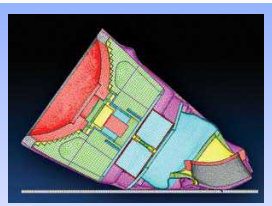
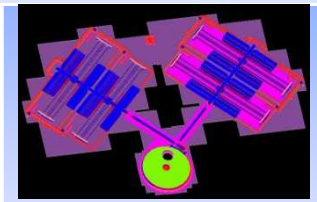
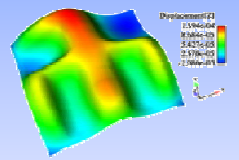






1526 – Component Science and Mechanics

Mission: To conduct frontier research in mechanics and provide technical solutions to accomplish Sandia's goals in Micro- and Nano-systems vision and Science-Based Engineering process.

	Probabilistic Mechanics	Micro- and Nano-Mechanics
Scientific Knowledge and Technology Development	 *Dynamic Environment*  *Parameter Uncertainty*	 *Coarsening leading to Cracks*  *Micro-Diagnostics*  *Coupled-physics*   *Energy Dissipation in Joints*  *Elastodynamics of Rebound*  *Nano-Patterning*
Safety and Critical Components	 *Component Modeling*	 *Solder Joints*  *MEMS Switch*  *Adaptive Surface*

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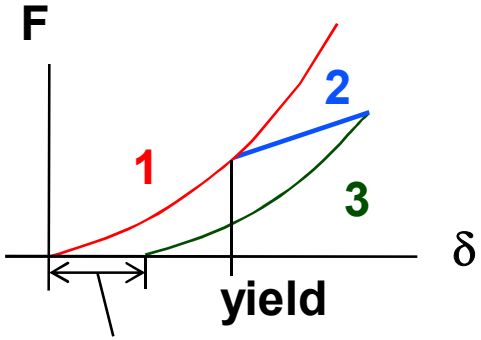
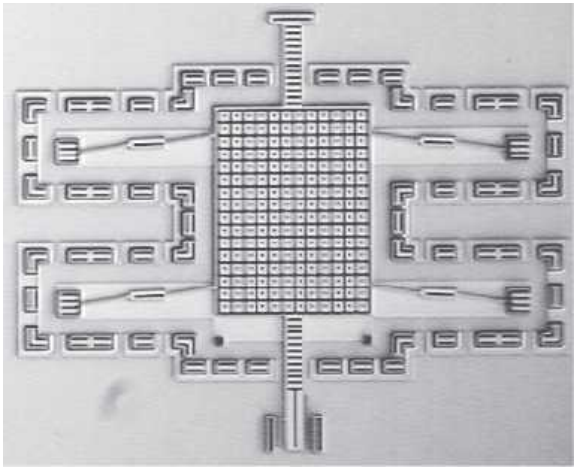
My Research Areas

Elastic-Plastic Modeling for Rebound Dynamics



plastic deformation

Bistable Mechanisms



Analytical Nonlinear Dynamics

$$\mathcal{L}(w(\mathbf{x},t)) = f(\mathbf{x},t) + \mathcal{N}(w(\mathbf{l},t))$$

$$\|\mathrm{L}_2(\tilde{\eta}_n^{(j)})\| = \sqrt{\int_0^L \left(\tilde{\eta}_m^{(j)} \phi_n^{(j)}(\mathbf{x}) + \sum_{m=1}^{n-1} \tilde{\eta}_m^{(j)} \phi_n^{(j)}(\mathbf{x}) + y^{(j)}(\mathbf{x},t) - y^{(i)}(\mathbf{x},t) - \sum_{m=1}^{N} \eta_m^{(i)}(t_0) \phi_m^{(i)}(\mathbf{x}) \right)^2 \mathrm{dx}}$$

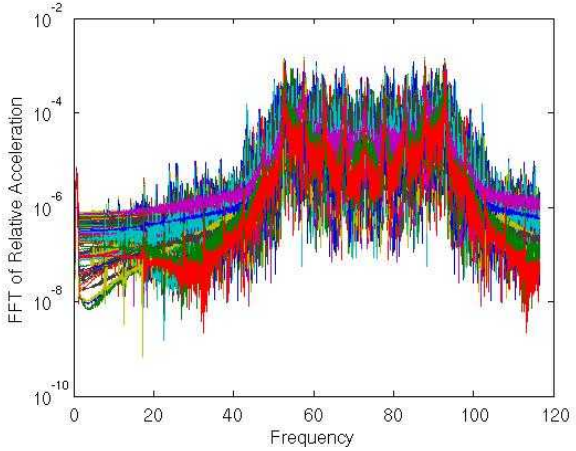
$$\frac{d\boldsymbol{\chi}_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0))}{d\boldsymbol{\eta}^{(j)}(t_0)} = \begin{bmatrix} \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);1)}{d\eta_1^{(j)}(t_0)} & \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);2)}{d\eta_1^{(j)}(t_0)} & \cdots & \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);N)}{d\eta_1^{(j)}(t_0)} \\ \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);1)}{d\eta_2^{(j)}(t_0)} & \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);2)}{d\eta_2^{(j)}(t_0)} & & \vdots \\ \vdots & & \ddots & \\ \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);1)}{d\eta_N^{(j)}(t_0)} & \cdots & & \frac{d\chi_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0);N)}{d\eta_N^{(j)}(t_0)} \end{bmatrix}$$

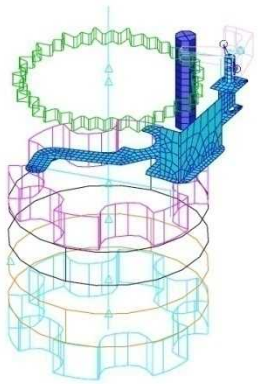
$$\eta_n^{(j)}(t) = \tilde{\eta}_n^{(j)} e^{\lambda_n^{(j)}(t-t_0)} + \int_{t_0}^{t} e^{\lambda_n^{(j)}(t-\tau)} q_n^{(j)}(\tau) d\tau$$

$$\Xi = \left\{ \frac{d\boldsymbol{\chi}_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0))}{d\boldsymbol{\eta}^{(j)}(t_0)} \right\}^T \frac{d\boldsymbol{\chi}_{t_0}^{t_0+\tau}(\boldsymbol{\eta}^{(j)}(t_0))}{d\boldsymbol{\eta}^{(j)}(t_0)}$$

Fluid-Structure Interaction

Model Reduction for Probabilistic Analysis





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Full Time Job Opportunities

- I personally know several managers that are looking to hire many Mechanical Engineers this year:
  - Advanced microsystems packaging design engineer (ME or ECE, masters, hardware and modeling)
  - ECE systems engineers
  - Thermal, fluid, and aero sciences – theory, modeling, code development, experimentation, and diagnostic development
  - Coupled thermal/fluid or fluid/structure code development
  - Development and implementation of advanced diagnostics (laser based or other) with a background in ME, ChemE, or a related field
  - Large finite element thermal analyst
  - Structural dynamics and solid mechanics theoreticians and experimentalists
  - Dynamics and vibration modeling (see me for both full time and internships)
- If any of these positions sounds like a good fit, let me know, and I'll take your resume/CV directly to the hiring manager

Student Internships

Institutes

- National Institute for Nanoscale Engineering (NINE)
- Physical Sciences Institute
- Computer Science Research Institute
- Center for Cyber Defenders
- Enabling Predictive Simulation Research Institute
- Sandia Institute for Modeling and Simulation
- National Security Engineering Institute

Internships and Co-ops

- **Year-round and summer**
- **Must be a U.S. citizen with full-time enrollment status**
- **Minimum cumulative GPA of 3.2/4.0 for undergraduates or 3.5/4.0 for graduate students**
- **STEM and business disciplines**
- **Apply online at Sandia's website: www.sandia.gov**
- **Pay based on job classification and the number of academic credit hours completed prior to internship**

Master Program Fellowships

- The Critical Skills Master's Program (CSMP)
  - For engineering and computer science degrees
  - Aiming to hire 30 candidates this fiscal year

- Masters Fellowship Program (MFP)
  - For minority applicants
  - Aiming to hire 20 candidates this fiscal year

- Specifics for both programs:
  - For engineering and computer science degrees
  - Minimum GPA of 3.2
  - Pursue a graduate degree while on an annual stipend
  - Upon completion, return to Sandia as a member of the technical staff
  - Must apply to the program specific job posting at the Sandia website
  - For more information, contact:
    - Michael Kline, Staffing,
      mkline@sandia.gov
    - Bernadette Montano, University Programs
      tbmonta@sandia.gov

PhD Research Opportunities

- Postdoctoral Fellowships
  - Pay is one of the highest for engineering post docs in the country
  - Special opportunities exist as:
    - Truman Fellowship (high-risk, high-value research in the national interest)
    - Alexander Hollaender Fellowship (biology and environmental research)
    - John Von Neuman Fellowship (computational science)

- Early Career R&D
  - Conduct your own research that is funded by Laboratory Directed Research & Development (LDRD) for up to 2/3 of your time

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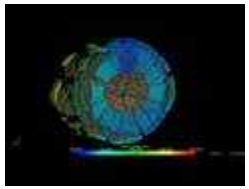

Apophis destruction simulation
140,800+ views

Z Machine at Sandia Labs
64,200+ views

Rocket Powered Train Impact Test
59,000+ views

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