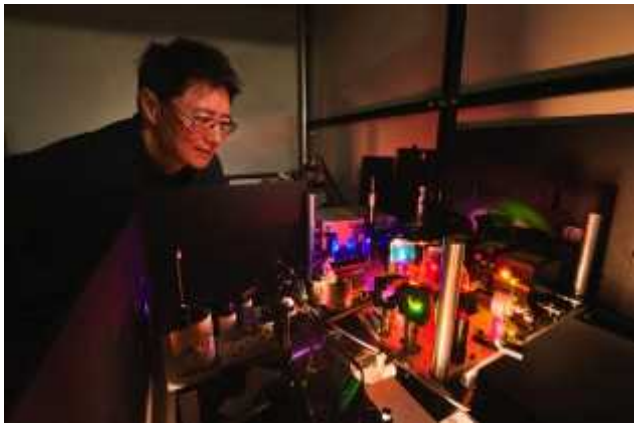
SAND2015-2554PE

*Exceptional service in the national interest*

Sandia National Laboratories



# Science, Technology, Engineering, and Math (STEM) Sandia National Laboratories

Phil Hoover

March 30, 2015

U.S. DEPARTMENT OF ENERGY | NNSA

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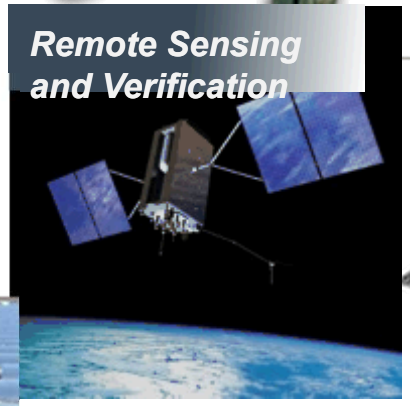
# 1970's at Beaver High School

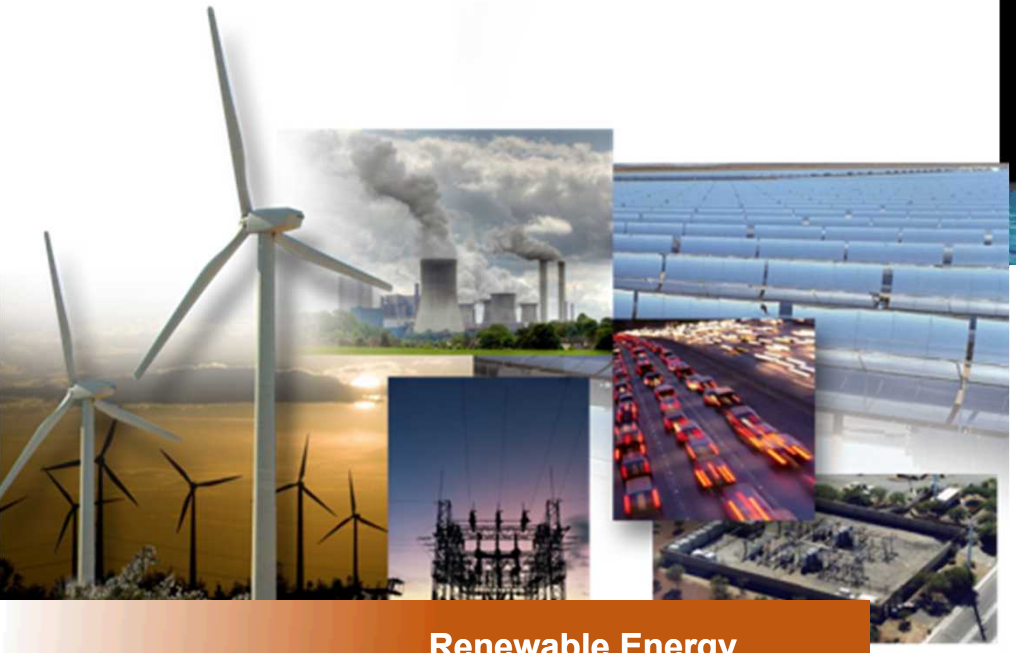
# Sandia National Laboratories is Large and Diverse

- Nuclear Weapons
- Defense Systems and Assessment
- Energy and Climate
- International Homeland and Nuclear Security



Remote Sensing and Verification

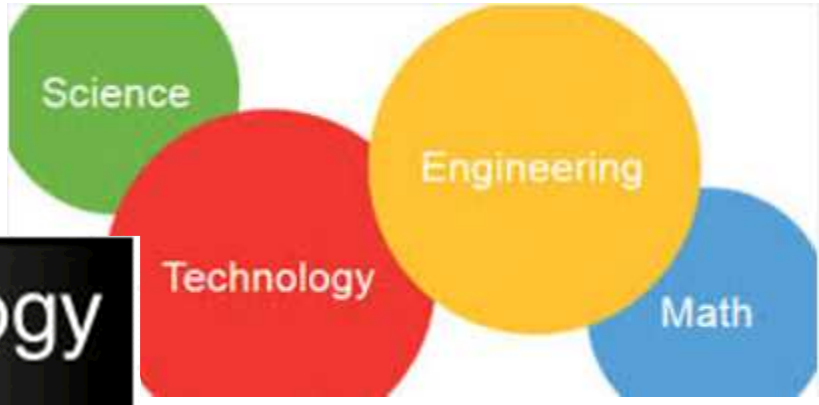
Surveillance & Reconnaissance

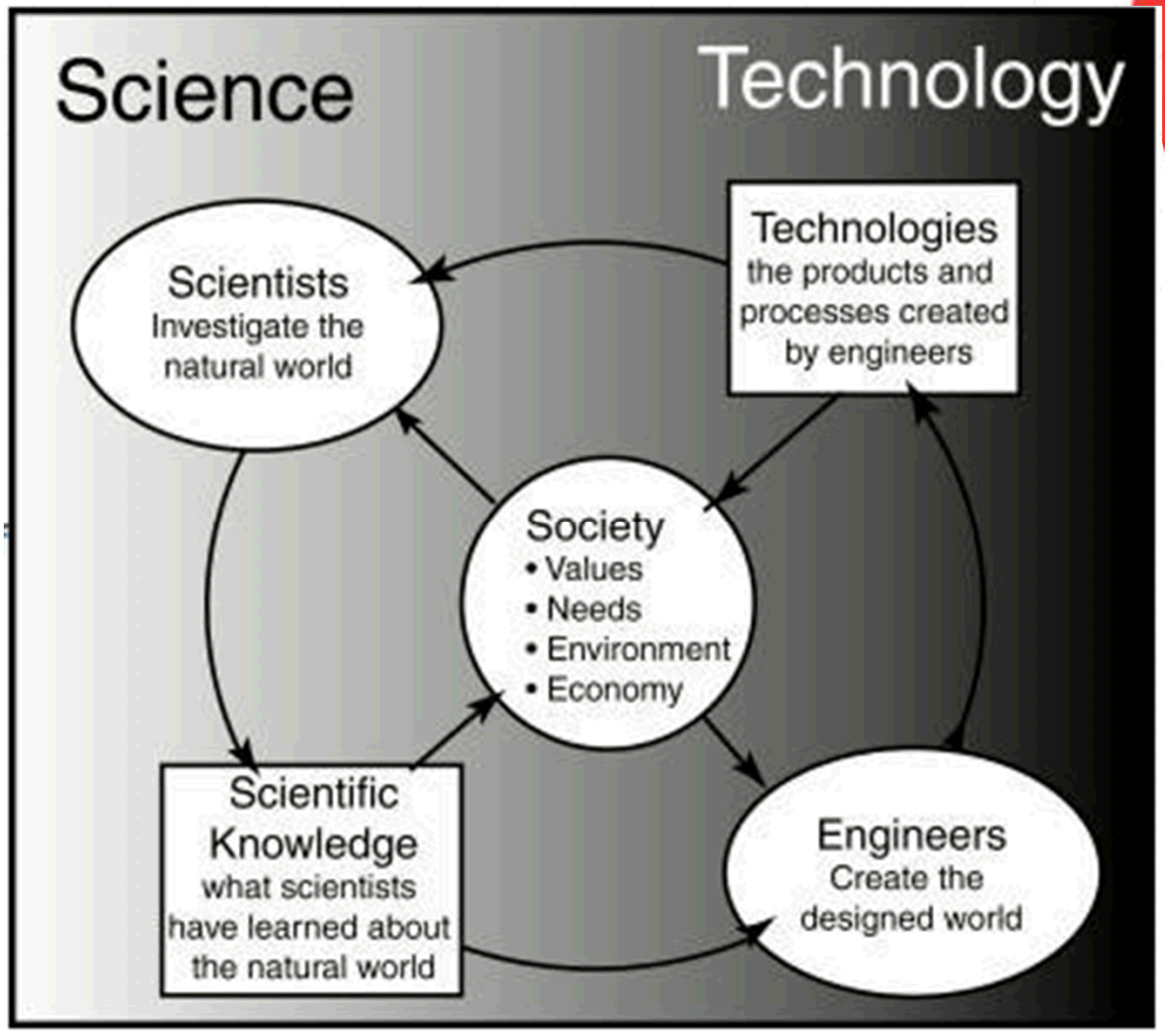


Renewable Energy

Homeland Defense and Force Protection

# What is STEM?




***STEM** - all fields of fundamental science and engineering, except for medical sciences (National Science Foundation)*

## STEM Disciplines

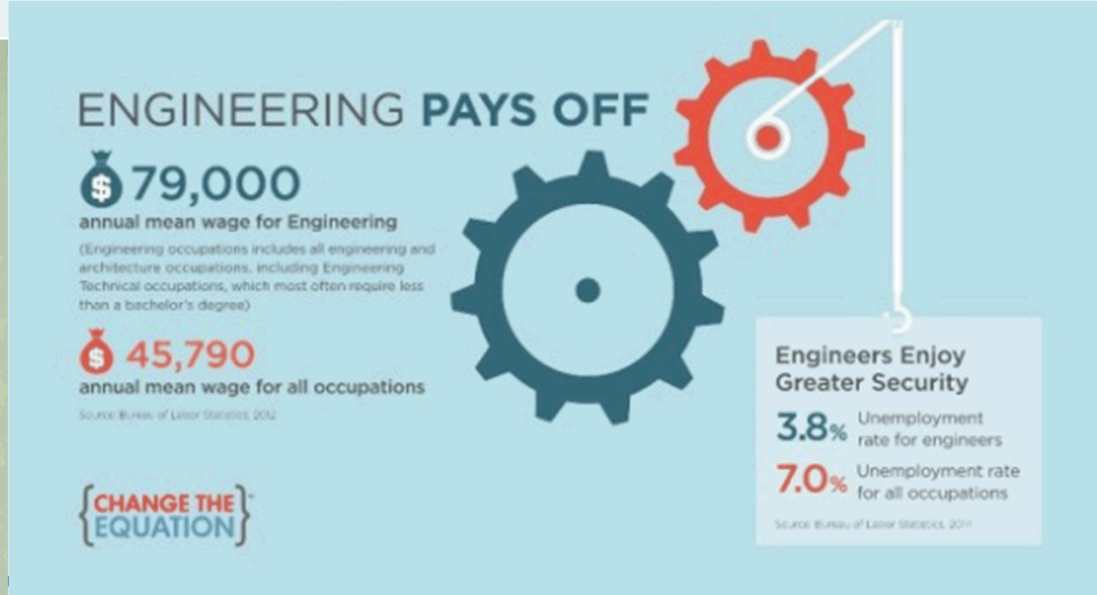
- Chemistry
- Computer Science
- Engineering
- Environmental Science
- Geosciences
- Life Sciences
- Mathematics
- Physics/Astronomy

# Why Study STEM?

- High employment rate
- Fastest growing occupations
- Higher pay

**Engineering Fields**

| | | |
|---|---|---|
| Agriculture | Fire Protection | Mining |
| Aerospace | Geological | Nuclear |
| Agriculture | Human Factors | Petroleum |
| Biomedical | Industrial | Quality |
| Chemical | Manufacturing | Safety |
| Civil | Marine | Software |
| Computer | Materials | Transportation |
| Electrical | Mechanical | Water |
| Environmental | Microsystems | Validation |



# REASONS TO CHOOSE A STEM MAJOR

## Impact on Society

- North Korea successfully conducted a three-stage rocket test - Dec 2012
- North Korea successfully conducted underground nuclear test – Feb 2013
- North Korea threats of pre-emptive nuclear strikes against the US and South Korea – Dec 2012 – Mar 2013

*A U.S. Air Force "nuclear capable" B-2 stealth bomber flew near Osan U.S. Air Base, south of Seoul, on Thursday in a display of force aimed at deterring North Korean threats of attacks on the U.S. and South Korea. March 27, 2013 YONHAP/ASSOCIATED PRESS*

# TOP REASONS TO CHOOSE A STEM MAJOR

## Fun!

**“Do what you love. When you love your work, you become the best worker in the world” – Uri Geller.**


Sandia conducts comprehensive system testing to ensure nuclear weapon safety and reliability.


Thu Oct 19 2006 10:27:16.986 996 S96 utc S

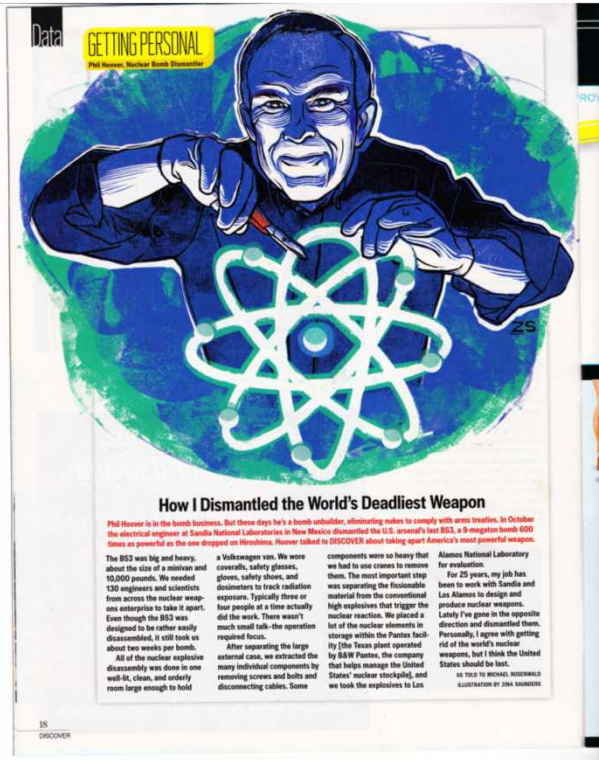
# REASONS TO CHOOSE A STEM MAJOR

## Challenge

In the ever-changing world of STEM, no two days will be exactly the same.

*B53 Nuclear Bomb Dismantled in 2011*

*Discover Magazine article*



Data

GETTING PERSONAL

Phil Hoover, Nuclear Bomb Dismantler

**How I Dismantled the World's Deadliest Weapon**

Phil Hoover is in the bomb business. But these days he's a bomb unbuilder, eliminating nukes to comply with arms treaties. In October the electrical engineer at Sandia National Laboratories in New Mexico dismantled the U.S. arsenal's last B53, a 9-megaton bomb 600 times as powerful as the one dropped on Hiroshima. Hoover talked to DISCOVER about taking apart America's most powerful weapon.

The B53 was big and heavy, about the size of a minivan and 10,000 pounds. We needed 130 engineers and scientists from across the nuclear weapons enterprise to take it apart. Even though the B53 was designed to be rather easily disassembled, it still took us about two weeks per bomb.

All of the nuclear explosive disassembly was done in one well-lit, clean, and orderly room large enough to hold a Volkswagen van. We wore coveralls, safety glasses, gloves, safety shoes, and dosimeters to track radiation exposure. Typically three or four people at a time actually did the work. There wasn't much small talk—the operation required focus.

After separating the large external case, we extracted the many individual components by removing screws and bolts and disconnecting cables. Some components were so heavy that we had to use cranes to remove them. The most important step was separating the fissionable material from the conventional high explosives that trigger the nuclear reaction. We placed a lot of the nuclear elements in storage within the Pantex facility [the Texas plant operated by B&W Pantex, the company that helps manage the United States' nuclear stockpile], and we took the explosives to Los Alamos National Laboratory for evaluation.

For 25 years, my job has been to work with Sandia and Los Alamos to design and produce nuclear weapons. Lately I've gone in the opposite direction and dismantled them. Personally, I agree with getting rid of the world's nuclear weapons, but I think the United States should be last.

AS TOLD TO MICHAEL ROSENWALD

ILLUSTRATION BY ZINA SAUNDERS

18 DISCOVER

# REASONS TO CHOOSE A STEM MAJOR

## Self and Career Satisfaction

"I feel sorry for the person who can't get genuinely excited about his/her work. Not only will he/she never be satisfied, but he/she will never achieve anything worthwhile" – Walter Chrysler.

Best Jobs of 2014 (CareerCast.com)

| | | |
|---|---|---|
| 1 | **Mathematician** | $101,000 |
| 2 | **University Professor** | $69,000 |
| 3 | **Statistician** | $76,000 |
| 4 | **Actuary** | $94,000 |
| 5 | Audiologist | $70,000 |
| 6 | Dental Hygientist | $71,000 |
| 7 | **Software Engineer** | $94,000 |
| 8 | **Computer Systems Analyst** | $80,000 |
| 9 | Occupational Therapist | $76,000 |
| 10 | Speech Pathologist | $70,000 |
| 11 | Dietitian | $56,000 |
| 12 | **Biomedical Engineer** | $87,000 |
| 13 | Human Resources Manager | $100,000 |
| 14 | Optometrist | $98,000 |
| 15 | Physical Therapist | $80,000 |
| 16 | Finacial Planner | $68,000 |
| 17 | Medical Laboratory Technician | $48,000 |
| 18 | Economist | $92,000 |
| 19 | **Computer Systems Administration** | $73,000 |
| 20 | **Petroleum Engineer** | $131,000 |

Ranking based on Working Environment, Income, Employment Outlook, and Stress

**Bold** = STEM Career

# REASONS TO CHOOSE A STEM MAJOR

## Experiences

STEM fields offer more opportunities and experiences than other majors


NATO Nuclear Policy Group - 2009

# Motivation Matters!

Tim Overton | Lorinda Nelson | Tami VanDeburgh | Kelly Gregg | Ray Lynn Myer

## BHS Class of '76 Has Five Honor Students

Tim Overton, Lorinda Nelson, Tami VanDeburgh, Kelly Gregg, and Ray Lynn Myer are the Honor Students of the 1976 Beaver high school graduating class.

Tim Overton, son of Mr. Alfred Overton, is president of the Student Council and served as vice-president last year. He has been in the Oklahoma Honor Society each year, was Citizen-of-the-Month twice and last year was selected as the Beaver high school Citizen-of-the-Year.

Tim has been active in band and golf, was in the junior and senior plays, and has represented his school on the

School Students".

Lorinda Nelson is the daughter of Mr. and Mrs. Kenneth Nelson. During her four years at Beaver High School, she has been active in vocal music, 4-H, FHA, and has been in the Oklahoma Honor Society each year. She is president of the senior class, was secretary for the vocal group for two years and served as vocal accompanist for two years. She was elected FHA Sweetheart this year and was a candidate for Vocal Queen her sophomore year. She also served as 4-H secretary and game leader for two years. In her busy schedule she has found

Who Among American High School Students" and the "Society of Distinguished American High School Students". Next fall, she plans to major in business at Oklahoma Panhandle State University.

Tami VanDeburgh is the daughter of Mr. and Mrs. Scott VanDeburgh of Elmwood. Active membership in the First Christian Church of Beaver and its Youth Group has influenced Tami's decision to attend the Dallas Christian College, Dallas, Texas, to major in music. She is accompanist for the Boy's Glee Club and has

have included one year in the FHA, participation in the state and district music contests resulting in three first place awards, a year on the school paper staff, parts in the junior and senior plays, and work in the School Service program. She has been in the Oklahoma Honor Society and will be in "Who's Who Among American High School Students."

Kelly Lin Gregg is the daughter of Mr. and Mrs. Irtle Joe Gregg. She enjoys her work as a nurse's aide at the Beaver County Memorial Hospital and has enrolled in a pre-medical course at Oklahoma Panhandle

1974-1975. Kelly was honored a a queen candidate for FF during her freshman year served as a Student Counc Representative during he sophomore year, and was member of the Pep Club fo three years.

Ray Myer, the son of Mrs Lorene Gray, has combined hi work at Beaver High Scho with a technical program at th Liberal Area Vocationa Technical School. He has thre credits in Auto mechanics an three credits in Draftin Technology. He is planning continue his education Northern Oklahoma Colleg Tonkawa, majoring in Draftin

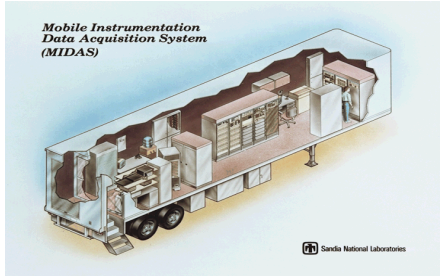
Motivation is required in order to do anything, but that power can only come from within you. Goals can typically provide a direction for your motivation and help bring you success in a STEM major. It is important to have an end in sight.

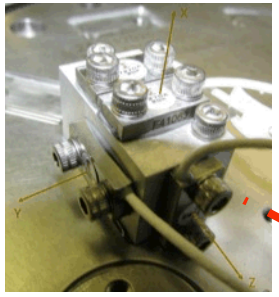
You're an essential piece….without you, the puzzle is incomplete!


# Backups

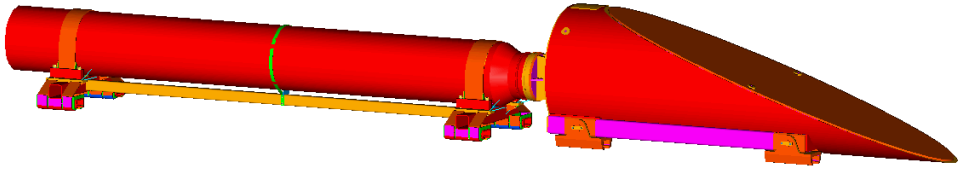
# Test Objectives and Configuration

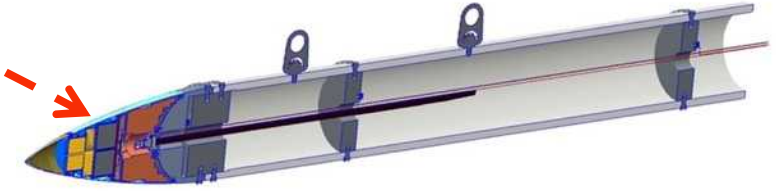
- Test Setup
  - Five Reverse Ballistic Tests
  - DAQ-MIDAS (IMP1-3)
  - DAQ-MIU (IMP4-5)



- To demonstrate B61-12 impact sensor functionality
- To gather evidence to validate the Solid Mechanics System Model (SMSM) predictions for the amount of crush-up of the nose, the acceleration-time history at various locations within the NBSA and to correlate impact sensor response to the impact environment
- To gain an understanding of uncertainty in the SMSM results
- To allow adequate time to modify the design if test results indicate that the design will not meet B61-12 Ground Burst fuzing requirements

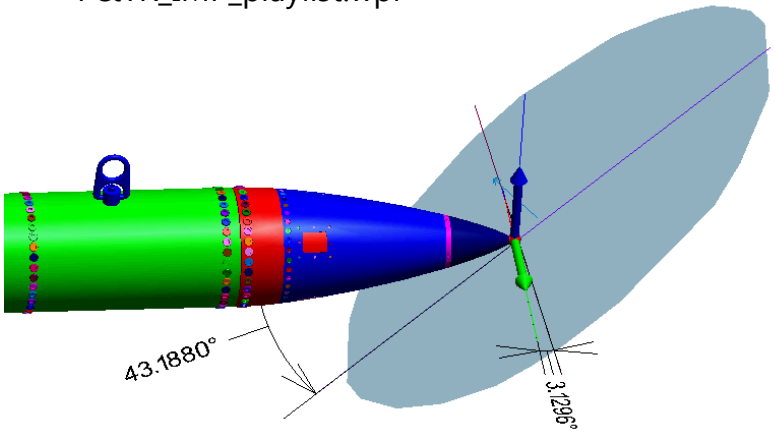




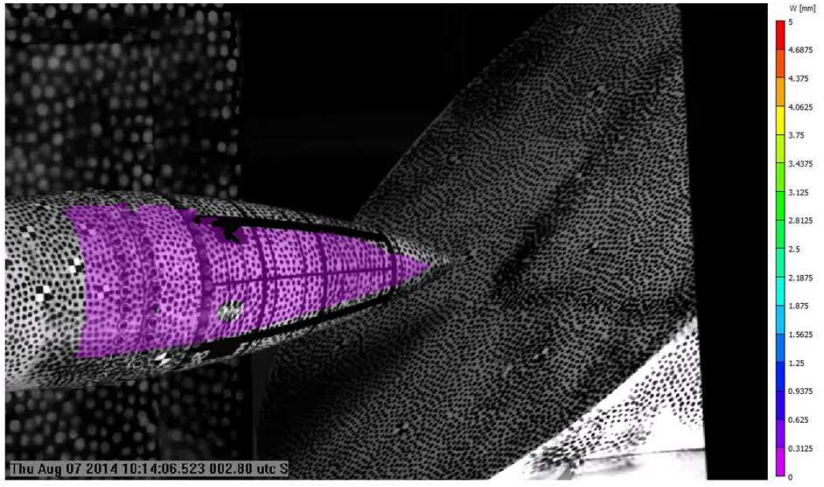
# SST61NE-IMP4

IMP4 Test, 7 August 2014

P&TR_IMP_playlist.wpl




IMP4 – Impact Angles




IMP4 – Deformation Mapping via DIC

# Physical Layout


1. High-speed Camera
2. Radiography
3. Sled Track
4. Test Item
5. Instrumentation Cables
6. Test Stand