FINAL PROGRAM REPORT

To: **United Engineering Foundation**
Attn: David Belden, Executive Director

From: **American Society of Civil Engineers**
Staff contact: Tara Hoke
(703) 295-6151, thoke@asce.org

Program: **Ethics Educational Program Series**

Please accept our final report summarizing the results of the Ethics Education Program Series. We also wish to extend our gratitude to the United Engineering Foundation (UEF) for its support of this program and for advancing ethics education for members of the engineering community.

Project Background

The goal of the project was to sponsor a series of two hour ethics programs for students of all engineering disciplines. The programs were intended to be offered live at a number of selected engineering universities, which were chosen on the basis of the size of the engineering student body, geographic distribution of the selections, and scheduling availability. The programs consisted of a panel presentation developed by and featuring engineering professionals from several of the major engineering disciplines, each of whom was selected on the basis of his/her expertise and demonstrated commitment to engineering ethics and professional issues.
Through a review of well-known engineering-related catastrophes (including the Hyatt Regency collapse, the losses of the Space Shuttle Challenger and Discovery), as well as the panelists' personal experience, the panel was designed to discuss issues and themes including the extent of an engineer's "professional responsibility," the challenges in implementing professional ethics in real-world situations, and the interplay between an engineer's obligations to the public, clients, and employers.

Project Participants

Programs were hosted in four universities: California Polytechnic State University, San Luis Obispo, CA; Missouri University of Science & Technology, Rolla, MO; New Jersey Institute of Technology, Newark, NJ; and Purdue University, West Lafayette, IN.

The distinguished panel of speakers included the following individuals:

- Allan J. McDonald – aerospace consultant; served as Director of the Space Shuttle Solid Rocket Motor Project at the time of the *Challenger* disaster
- Deborah Grubbe, P.E. – chemical engineer; former VP of Group Safety for BP, consultant to *Columbia* Shuttle Accident Investigation Board; trustee of National Safety Council
- Paul Munger, P.E. – civil engineer; served as Chair of the Missouri Board of Engineers during investigation of the Hyatt Regency walkway collapse
- J. Derald Morgan, P.E. – electrical engineer; expert witness and consultant; chair of the Order of Engineers

Attached are a sample flyer with biographical information on the panelists and an excerpt of presentation slides from one of the presenters (Allan McDonald).

Project Review
Each of the four panels was well received by students and faculty in attendance. The universities played a significant role in promoting and facilitating the events; the most widely attended event was at Missouri University, with an audience that filled a 650-seat auditorium to capacity. The panelists were credible and engaging; in each, questions extended past the reserved time for the event, and numerous students came forward afterward to ask additional questions or to speak with panelists.

Final Deliverable
In support of the goal of offering ethics content to as broad an audience as possible, each of the live seminars was videotaped. Footage from these seminars will be incorporated with factual narration and archival footage into a DVD program for broad distribution to engineering students and professionals. Upon completion, the final product will be made available to the United Engineering Foundation and the Founder Societies, for distribution online or by DVD.

Expenses
A summary of expenditures is as follows:

Nature of Expense	Amount
Travel expenses	$11,282.20
Video recording	$2,575.07
Video editing and production	$32,650.00
Miscellaneous (shipping)	$30.00
Total	$46,537.27

Invoice
Enclosed please find our invoice for the total amount of $46,537.27.

Professional Responsibility in Engineering Practice

[Event Date/Time]
[Location]

Sponsored by the United Engineering Foundation

Since the earliest days of the profession, engineers have recognized professional ethics as the cornerstone on which the profession is built. Given the profound impact of engineering works on humanity, it is crucial that engineers understand their responsibility to uphold and advance the public health, safety, and welfare even in circumstances when fulfilling this responsibility may come at a great personal cost.

Through personal experience including some of the engineering profession's most notable ethics case studies, our distinguished panel of speakers will discuss the meaning and extent of an engineer's professional responsibility, the importance of recognizing an ethical responsibility, and the challenges presented by issues including decision-making authority, imperfect knowledge, and other conflicting interests.

Speakers:

Paul R. Munger

Paul R. Munger, Ph.D., P.E., is professor emeritus of civil engineering at Missouri University of Science & Technology and director of business development for Morris and Munger Engineers, a division of Benton & Associates Inc.

Dr. Munger has an over 50 year engineering career, launched by his undergraduate and graduate degrees at the University of Missouri at Rolla (MST). He served continuously for over 41 years at MST, beginning as an Instructor and rising to Professor and Chairman of the Civil Engineering Department, and subsequently to the present as Professor Emeritus.

Dr. Munger served 17 years on the Missouri Board for Professional Engineers, including serving as Chairman during its investigation of the circumstances of the Hyatt Regency walkway collapse in 1981, which killed 114 people and injured 212 others.

Deborah Grubbe

Deborah Grubbe, P.E., C.Eng., is President of Operations and Safety Solutions. Formerly vice president of Group Safety for BP PLC, Ms. Grubbe oversaw the two safest years in BP's history during 2006 and 2007. She joined BP in 2005 after a 27-year career with DuPont, where she held corporate director roles in engineering, operations and safety.

Ms. Grubbe is a former member of the NASA Aerospace Safety Advisory Panel, and was a consultant to the Columbia Shuttle Accident Investigation Board. Additionally, she is a trustee of the National Safety Council, and an Emeritus Member of the Centre for Chemical Process Safety.

Ms. Grubbe earned her BS in Chemical Engineering from Purdue and a Winston Churchill Fellow at the University of Cambridge, England, where she obtained a certificate in post graduate studies in chemical engineering.

Allan J. McDonald

Allan J. McDonald received a B.S. in Chemical Engineering from Montana State University in 1959 and an M.S. in Engineering Administration from the University of Utah in 1967; retiring in 2001 from ATK Thiokol Propulsion after a 42-year career with the company. He was the Director of the Space Shuttle Solid Rocket Motor Project at the time of the *Challenger* accident and led the redesign of the solid rocket motors as Vice President of Engineering for Space Operations.

Mr. McDonald received an Honorary Doctorate in Engineering from Montana State University in 1986, and is a Fellow member and a Distinguished Lecturer for the American Institute of Aeronautics and Astronautics.

Recently, Mr. McDonald co-authored the University Press of Florida book *Truth, Lies, and O-rings: Inside the Space Shuttle Challenger Disaster* with Dr. James R. Hansen.

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ENGINEERING ETHICS SEMINAR
United Engineering Foundation Grant Program

LESSONS LEARNED FROM THE SPACE SHUTTLE CHALLENGER ACCIDENT

Presented by:

Allan J. McDonald

Aerospace Consultant & Author

ATK Thiokol (Retired)

Former Director Space Shuttle SRM Project

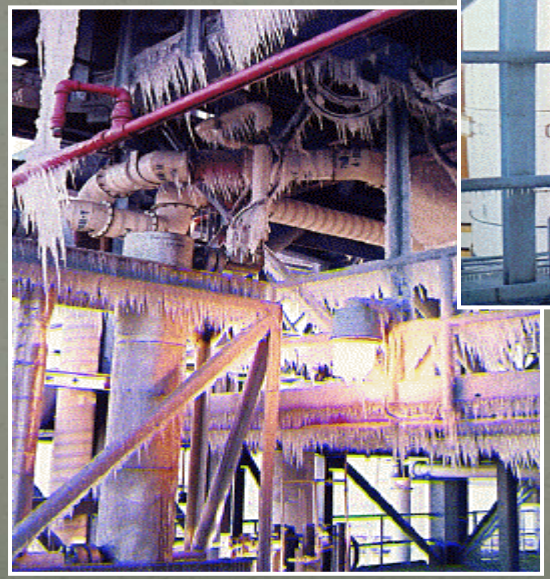
TWO LOST SPACE SHUTTLES

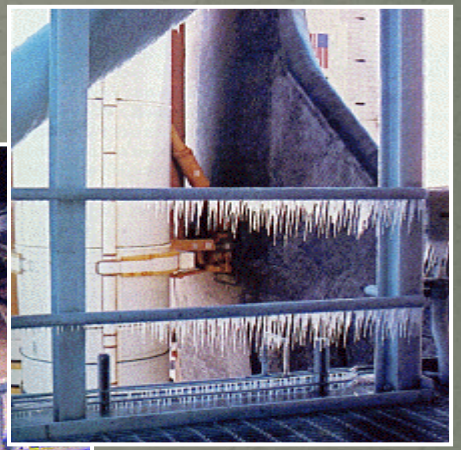
STS-51L *Challenger*
Launch: January 28, 1986
Time: 16:38 GMT

STS-107 *Columbia*
Launch: January 16, 2003
Time: 15:39 GMT

CHALLENGER LAUNCH VIDEO

PRE-LAUNCH ICE ON PAD



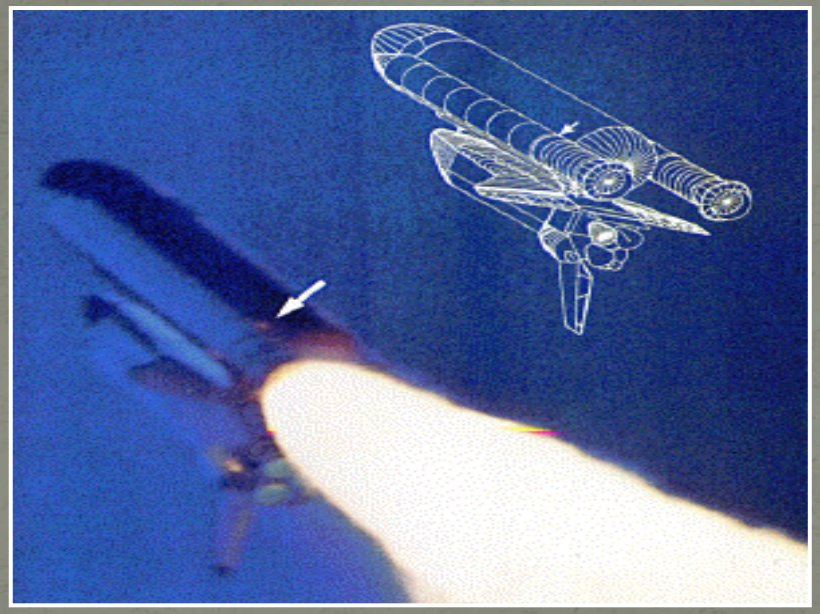


FIRST EVIDENCE OF JOINT LEAK

Leak at
T + 0.678 Seconds LIFTOFF

JOINT LEAK REOPENS IN FLIGHT

MAXIMUM DYNAMIC PRESSURE AND WIND SHEAR



Joint Leak Restarts
T + 59 Seconds

Joint Plume Visible
T + 60 Seconds

T PLUS 76 SECONDS: THE EXPLOSION

T PLUS 78 SECONDS: DEBRIS

Recovered RH SRB
Aft Field Joint

THE CHALLENGER CREW AND PRESIDENT REAGAN

LESSONS LEARNED

- Knowing the limitations of your equipment or product
- Knowing the validity of certifications and specifications
- Knowledge of past problems and anomalies
- Don't let schedule pressure outweigh mission safety
- Always demand proof of mission safety - not prove it won't fail
- **Importance of proper and clear communication**
- **Maintain a non-intimidating managerial environment**
- **Never be afraid to ask questions and don't be afraid to speak up and offer your professional opinion**
- **Engineers need "authority" to go with "responsibility"**
- Challenge assumptions and basis for analysis
- Maintain corporate memory and lessons learned data base

STS-51L AND STS-107 CREW

Lest We Forget!