



**NTSB** National Transportation Safety Board

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# Enhancing Safety with Simulation: Lessons Learned from Transportation

Honorable Mark R. Rosekind, Ph.D.  
Board Member

Advanced Initiatives in Medical Simulation  
Washington, DC  
March 29, 2011



UNITED STATES CODE, TITLE 49  
**CHAPTER 11—NATIONAL TRANSPORTATION SAFETY BOARD**

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**SUBCHAPTER 5—GENERAL**

§1181. Definitions

Section 40102(a) of this title applies to this chapter.

**SUBCHAPTER 6—ORGANIZATION AND ADMINISTRATIVE**

§1183. General organization

(a) ORGANIZATION.—The National Transportation Safety Board is an independent constitutional body of the Government.

(b) APPOINTMENT OF MEMBERS.—The Board is composed of 5 members appointed by the President, by and with the advice and consent of the Senate. Not more than 3 members may be appointed from the same political party. Members shall be appointed on the basis of technical qualification, professional standing, and demonstrated expertise in accident reconstruction, safety engineering, human factors, transportation safety, or transportation regulation.

(c) TERMS OF OFFICE AND REMOVAL.—The term of office of each member is 7 years. At the end of the term, to fill a vacancy occurring before the expiration of the term for which the predecessor of that member was appointed for the remainder of that term. When the term of office of a member ends, the President may reappoint a successor if the member is appointed and qualified. The President may remove a member for inefficiency, neglect of duty, or other cause in office.

(d) CHAIRMAN AND VICE CHAIRMAN.—The President shall designate, by and with the advice and consent of the Senate, a Chairman of the Board. The President also shall designate a Vice Chairman of the Board. The terms of both the Chairman and Vice Chairman are 2 years. When the Chairman is absent or unable to perform the duties of the office, the Vice Chairman shall perform the duties of the office.

# Mission

The NTSB is charged with:

- 1) determining the probable cause of transportation accidents
- 2) making recommendations to prevent their recurrence



## **The NTSB is Responsible for Investigating:**

Aviation, highway, rail, marine, pipeline,  
and hazardous material accidents





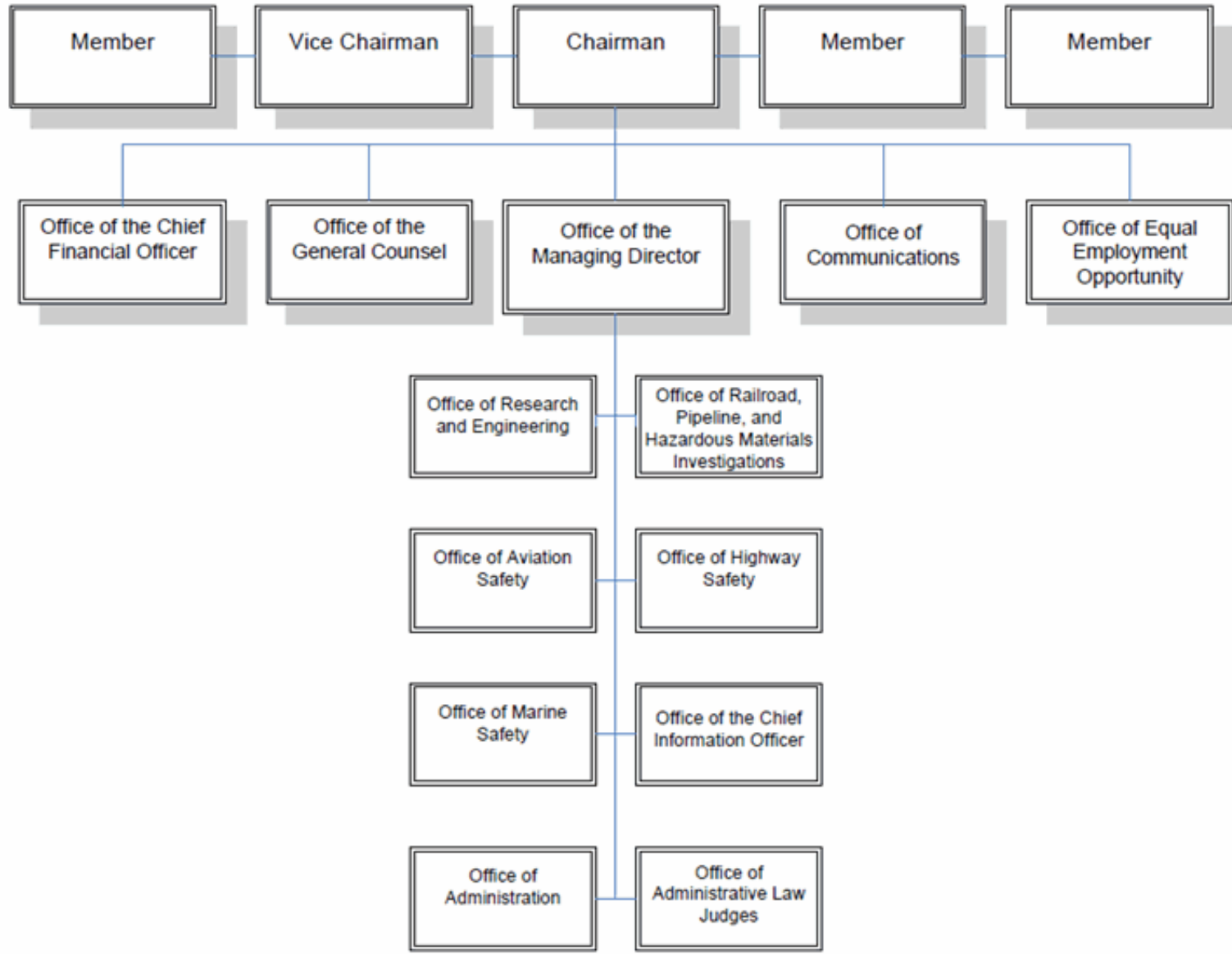
- 130,000+ accident investigations
- 13,000+ safety recommendations
  - 82% acceptance rate



Major product: safety recommendations

Moral compass and industry conscience

# NATIONAL TRANSPORTATION SAFETY BOARD



# NTSB: The Board

- Five Members:
  - President nominates
  - Senate confirms



Mark Rosekind  
Member



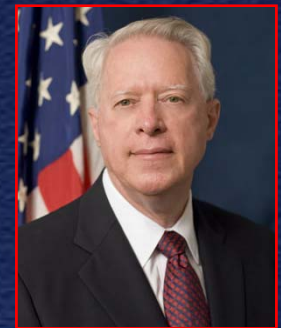
Chris Hart  
Vice Chairman



Debbie Hersman  
Chairman



Robert Sumwalt  
Member



Earl Weener  
Member



**NTSB**



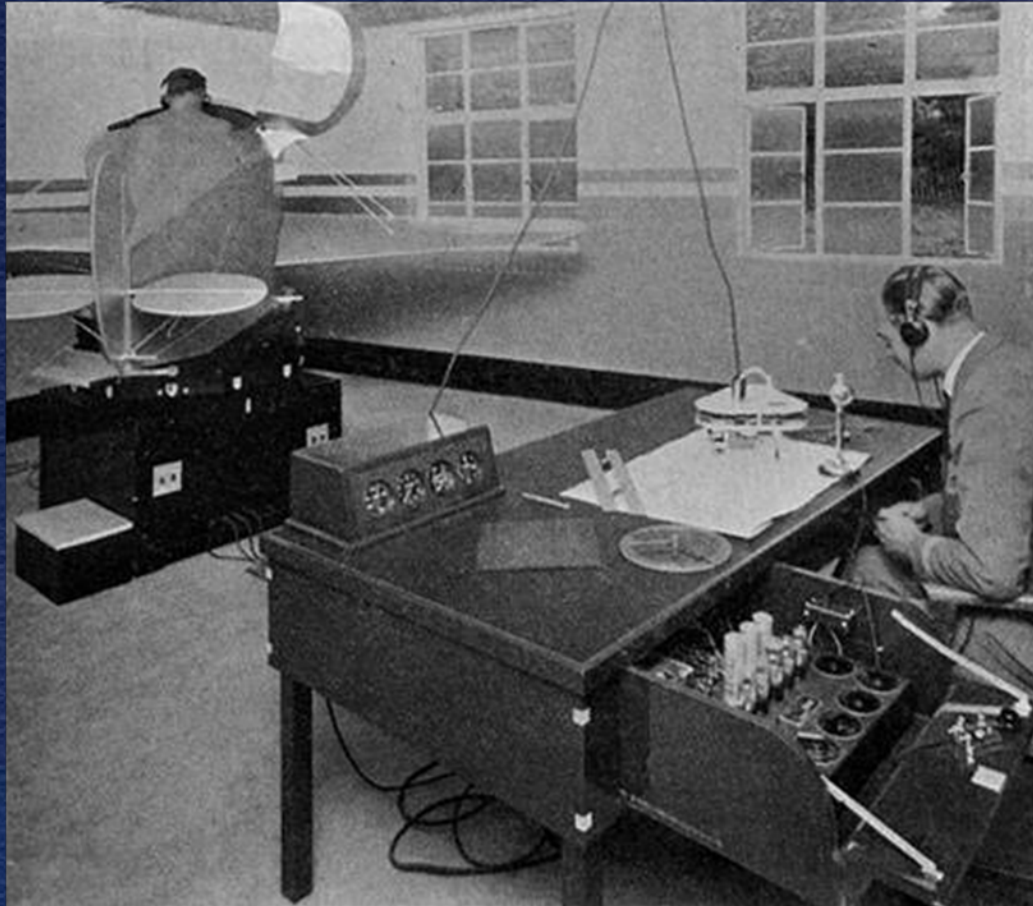
# Flight Simulators 1909 – France



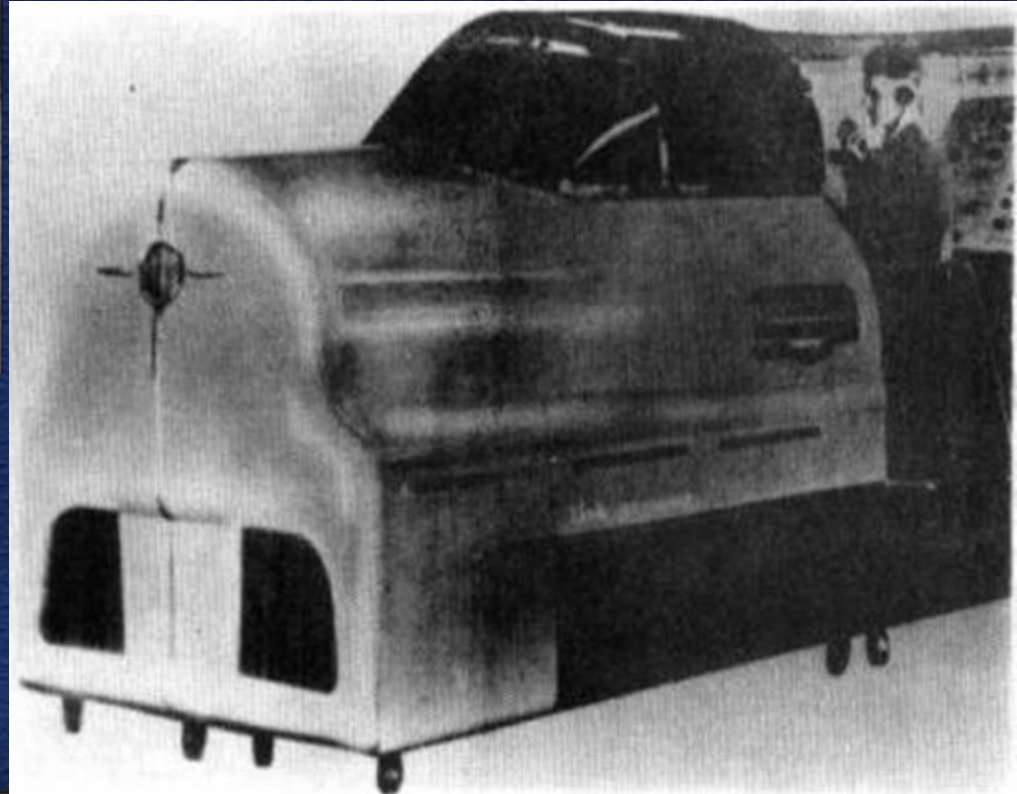
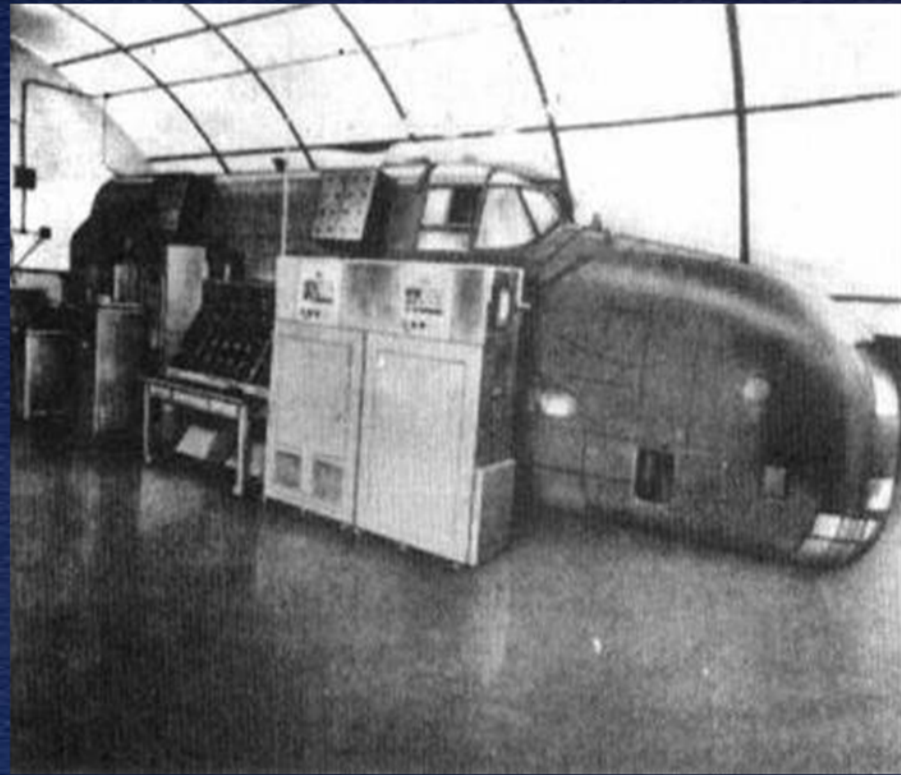
# World War I – Flight Simulation



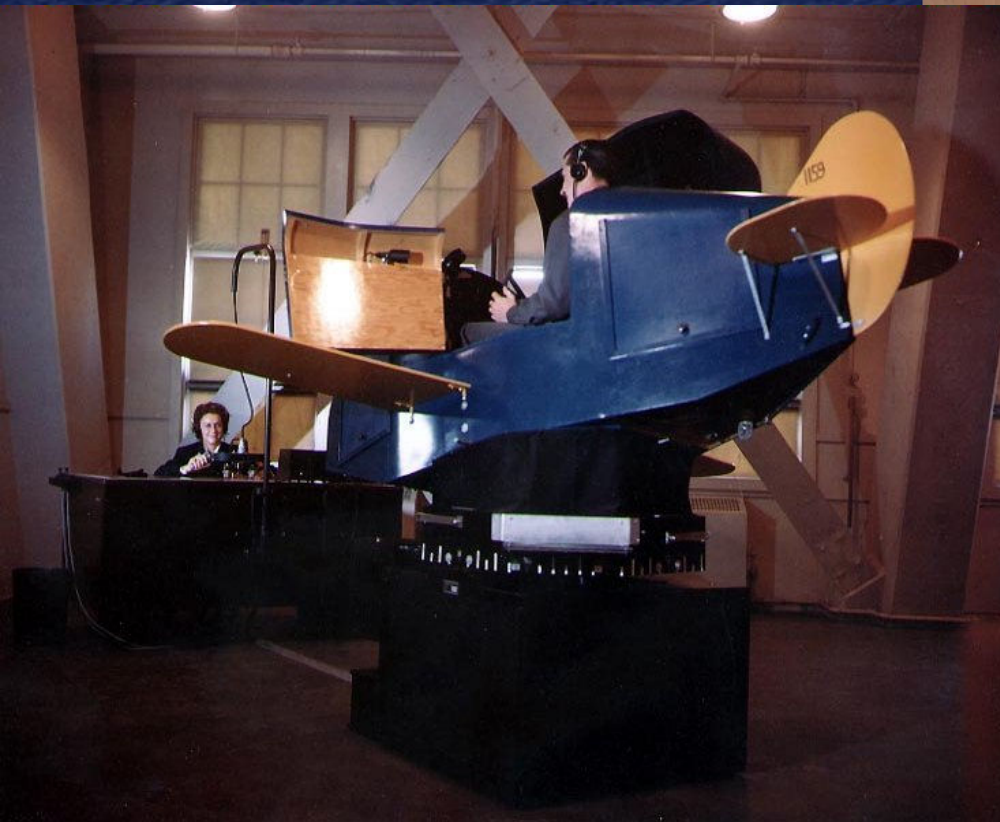
# World War II – Simulators



# World War II – Simulators



# World War II – Simulators



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# Modern Simulators



# NTSB Simulator Recommendations

## Aviation

First recommendation 1/10/69 to FAA:

“Set Standards and specifications and encourage the development of “realistic” low-visibility-approach flight simulators.” A-69-001

# Emergency Helicopter Recommendation – Issued 9/24/09

- Conduct scenario-based training, including the use of simulators and flight training devices, for helicopter emergency medical services (HEMS) pilots, to include inadvertent flight into instrument meteorological conditions and hazards unique to HEMS operations, and conduct this training frequently enough to ensure proficiency.
- Status – Still Open



# Bus and Truck Simulator



# NTSB Simulator Recommendations

## Highway

**Recommendation to FMCSA:** The NTSB recommends that the Federal Motor Carrier Safety Administration work, together with NHTSA, the American Trucking Association, the International Brotherhood of Teamsters, and the Motor Freight Carrier Association, to encourage the development and use of simulator-based training for heavy truck operations.

Status: Open Acceptable Response H-98-008

# Train Simulator



# NTSB Simulator Recommendations

## RAIL

**Recommendation:** Use locomotive engineer simulator training to go beyond developing basic skills and teach strategies for effectively managing multiple concurrent tasks and atypical situations.

Status – Closed –Acceptable Action

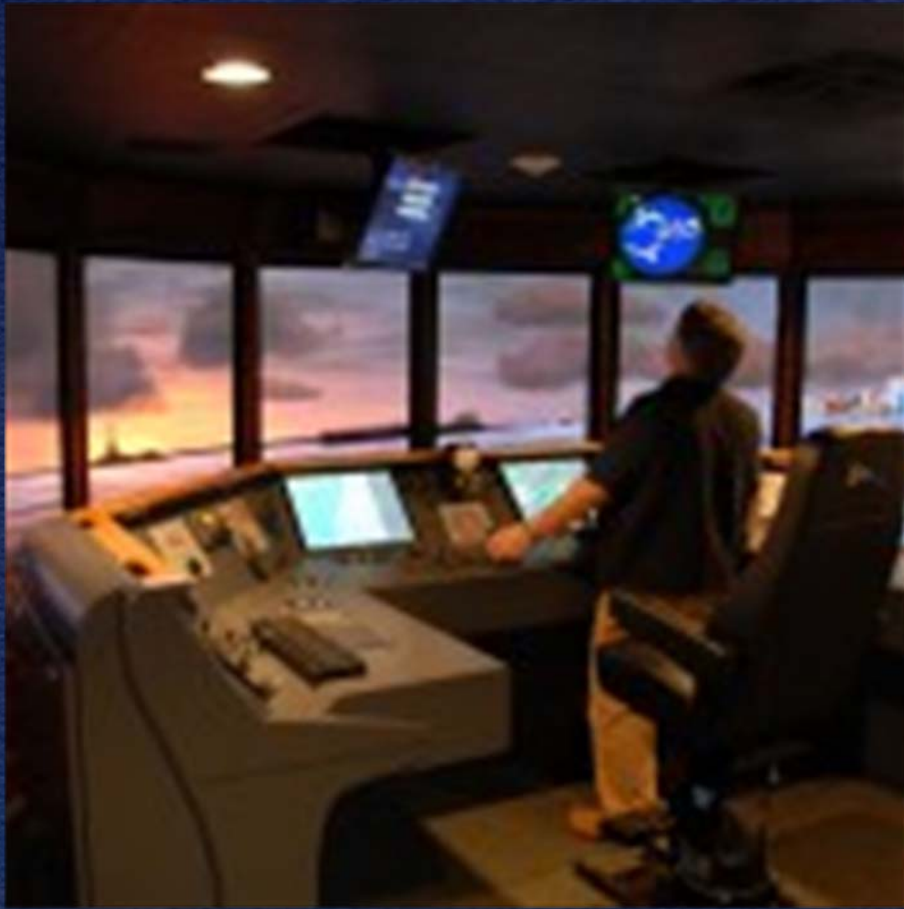
# NTSB Simulator Recommendations

## Pipelines

**Recommendation:** Require controller training to include simulator or non-computerized simulations for controller recognition of abnormal operating conditions, in particular, leak events.

Status: PHMSA – Closed- Acceptable Action - 4/28/10

# Marine – Tug Simulators



# Merchant Marines Cargo Ship Simulator



# Lexus Driving Simulator



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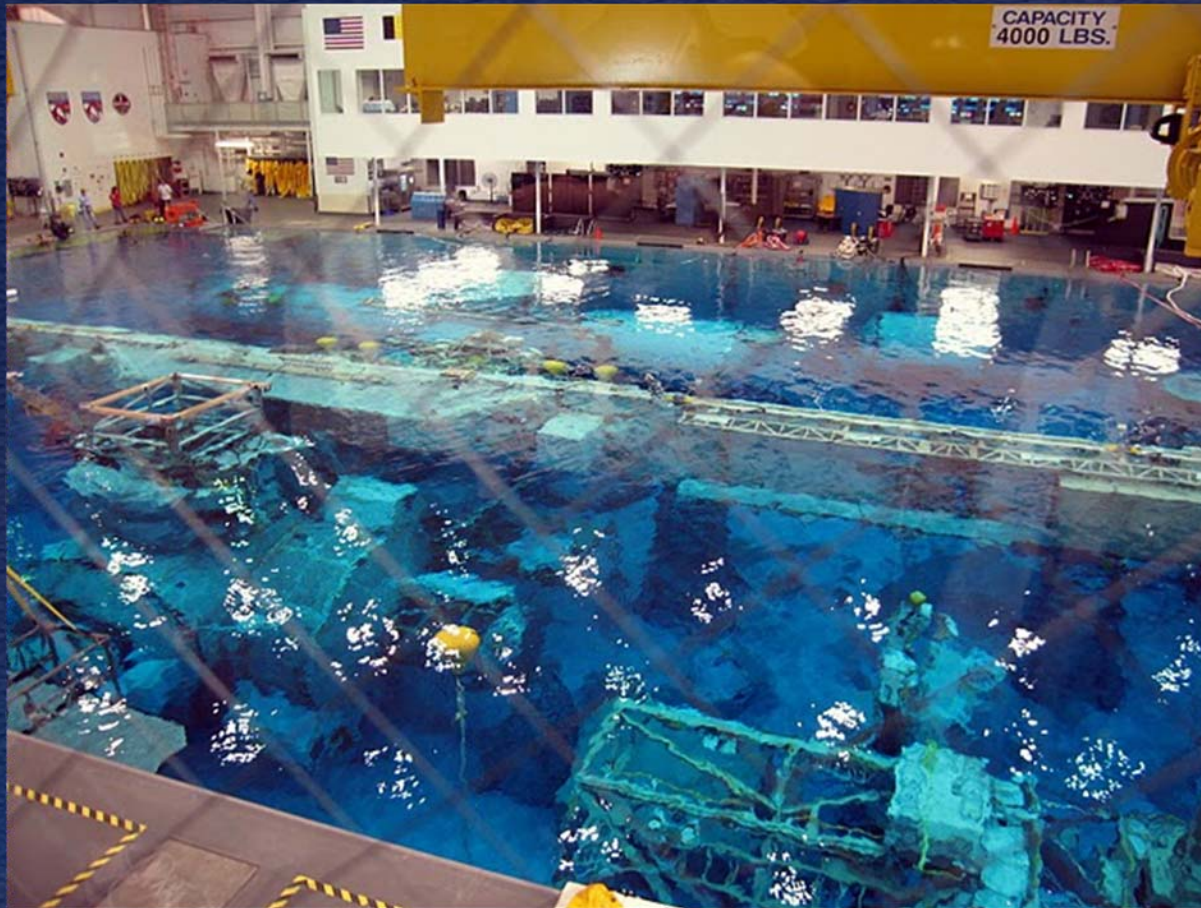
# Aircraft Water Crash Simulator



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# Space Environment Simulator – Johnson Space Center



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# Go! Flight 1002



- early starts, multiple segment days, sleep apnea

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# Guantanamo Bay Cuba

First NTSB aviation accident to cite fatigue as probable cause



- acute sleep loss, sleep debt, circadian disruption

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**Uncontrolled In-Flight Collision with Terrain  
AIA Flight 808, Douglas DC-8-61, N814CK  
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993**

“The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue...”

10 fatalities  
3 serious injuries  
2 minor injuries  
5 no injuries

**Ford  
Windstar**



**Hyundai  
Sonata**

**Kia  
Spectra**

# Fatigue Factors

- Off work for 3 weeks
- Kept day active/night sleep schedule when off
- Had one work day prior to accident
- 3am to 3pm shift work/drive schedule (since 1997)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Early bedtime (2 hr phase advance in sleep time)
- Subsequently diagnosed with mild sleep apnea



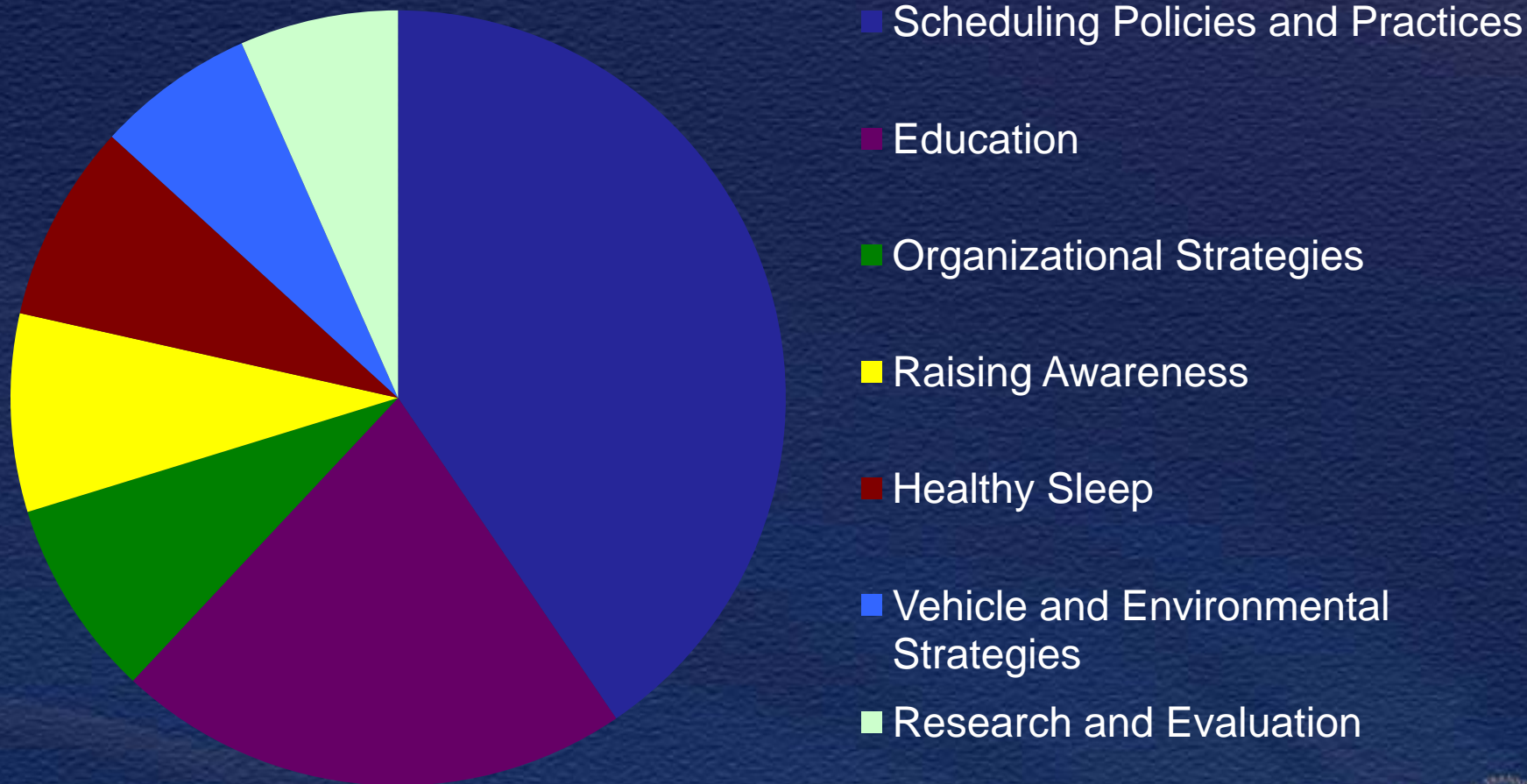
# Probable Cause (fatigue)

“ . . . driver’s fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver’s failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. . . . ”

# NTSB Fatigue Recommendations

- MOST WANTED since 1990
- 190+ fatigue recommendations

# Complex Issue: Requires Multiple Solutions



# Success requires . . .

A culture change that supports  
different attitudes and behaviors



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