Professional Practice and Occupational Health and Safety

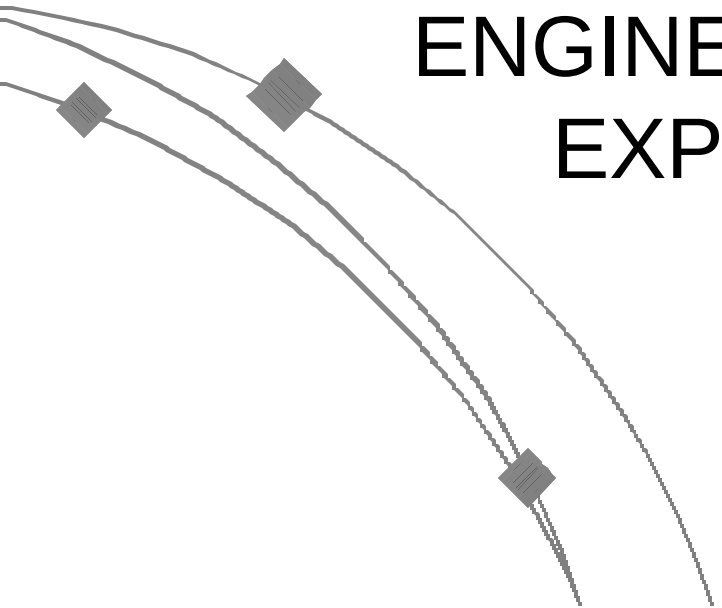
ENGINEERING AS SOCIAL EXPERIMENTATION

SAFTEY

Absolute safety ,in the sense of a degree of safety which satisfies all individuals or groups under all condition, is neither attainable nor affordable.

Professional Practice and Occupational Health

ENGINEERING AS SOCIAL EXPERIMENTATION



Engineering Sequence

- **Initiation of Task**

(Idea, specific request, or market demand)

- **Design**

Concept, goals, preliminary design.

Performance specifications

Preliminary analysis.

Detailed analysis; simulation/prototyping.

Specifications for materials and components.

Detailed shop drawing.

Engineering Sequence

- **Manufacture**

  Scheduling of tasks.Purchasing components and materials.Fabrication of parts.Assembly / construction.

  Quality control / testing.

- **Implementation**

  Advertising. Sales and financing.

  Operating and parts manuals

  Shipping and installation. Operator training.

  Provisions for safety measures and devices.

Engineering Sequence

- Use of the product.

Field services: maintenance, repairs, spare parts

Monitoring social and environmental effects.

Reporting findings to parties at possible risk.

- **Final Tasks**

Geriatric services: rebuilding, recycling.

Disposal of materials and wastes.

ENGINEERING TASKS / PROBLEMS

- Task

Conceptual design

- Problem

Blind to new concepts. Violation of patents or trade secrets. Product to be used illegally.

- Task

Goals; performance

- Problem

Unrealistic assumptions. Design

ENGINEERING TASKS / PROBLEMS

- Task

Specifications

- Problem

depends on unavailable or untested materials

- Task

Preliminary analysis

- Problem

Uneven: overly detailed in designer's area of expertise, marginal elsewhere.

ENGINEERING TASKS / PROBLEMS

- Task

Detailed analysis

- Problem

Uncritical use of handbook data and computer programs based on unidentified methodologies.

- Task

Simulation, prototyping

- Problem

Testing of prototype done only under most favor conditions or not completed.

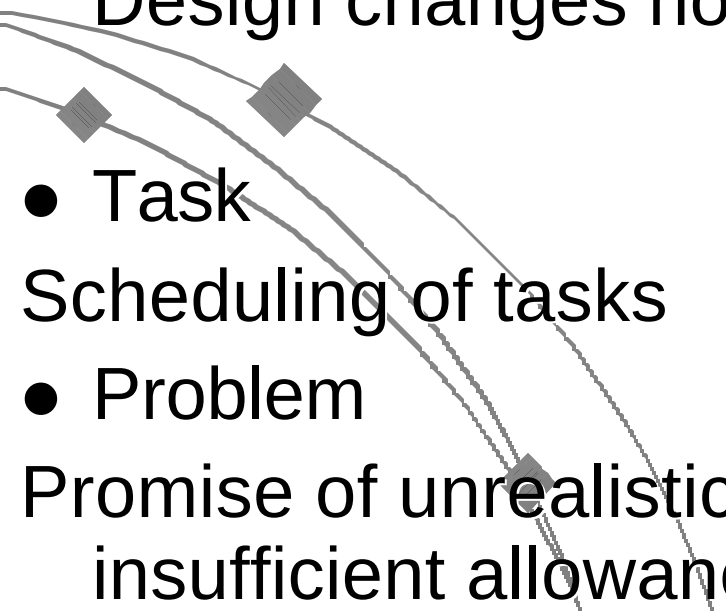
ENGINEERING TASKS / PROBLEMS

- Task

Design specifications

- Problem

Too tight for adjustments during manufacture and use. Design changes not carefully checked.



- Task

Scheduling of tasks

- Problem

Promise of unrealistic completion date based on insufficient allowance for unexpected events.

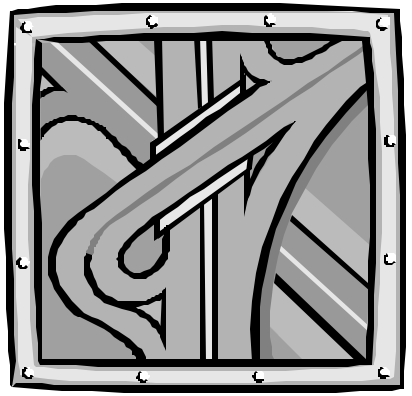
ENGINEERING TASKS / PROBLEMS

- Task

Purchasing

- Problem

Specifications written to favor one vendor. Bribes, kickbacks. Inadequate testing of purchased parts.



- Task

Fabrication of parts

- Problem

Variable quality of materials and workmanship. Bogus materials and components not detected

ENGINEERING TASKS / PROBLEMS

- Task

Assembly/construction

- Problem

Workplace safety. Disregard of repetitive-motion stress on workers. Poor control of toxic wastes.

- Task

Quality control/testing

- Problem

Not independent, but controlled by production

ENGINEERING TASKS / PROBLEMS

- Task

Advertising and sales

- Problem

False advertising (availability, quality). Product oversold beyond client's needs or means.

- Task

Shipping, installation, training

- Problem

Product too large to ship by land. Installation and training subcontracted out, inadequately supervised.

ENGINEERING TASKS / PROBLEMS

- Task

Safety measures and devices Use

- Problem

Reliance on overly complex, failure-prone safety devices. Lack of a simple “safety exit.” Used inappropriately or for illegal applications. Overloaded. Operations manuals not ready.

- Task

Maintenance, parts, repairs

- Problem

Inadequate supply of spare parts. Hesitation to recall the product when found to be faulty.

ENGINEERING TASKS / PROBLEMS

- Task

monitoring effects of product

- Problem

No formal procedure for following life cycle of product, its effects on society and environment.

- Task

Recycling/disposal

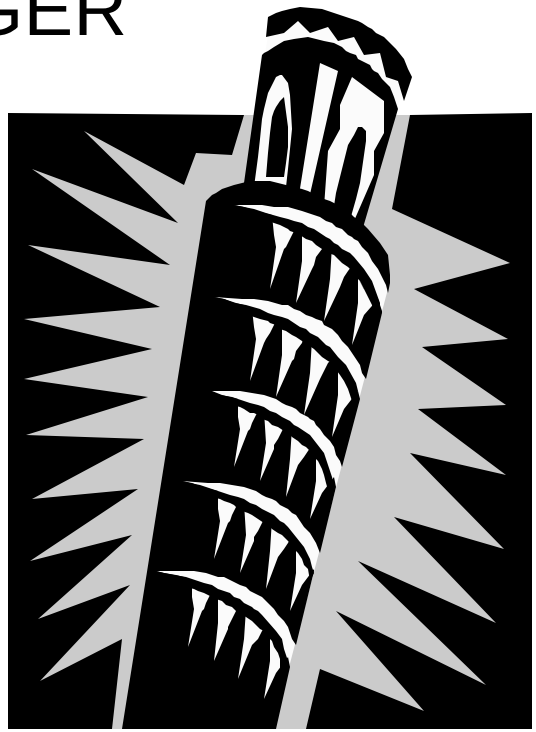
- Problem

Lack of attention to ultimate dismantling, disposal of product, public notification of hazards.

ENGINEERING AS SOCIAL EXPERIMENTATION

- ALL PRODUCT OF TECHNOLOGY PRESENTS SOME POTENTIAL DANGER

ENGINEERING IS AN INHERENTLY RISKY ACTIVITY



ENGINEERING AS SOCIAL EXPERIMENTATION

ENGINEERING IS AN INHERENTLY RISKY ACTIVITY

- TO UNDERSCORE THIS FACT AND EXPLORE THE ETHICAL IMPLICATIONS

  ENGINEERING SHOULD BE VIEWED AS AN EXPERIMENTAL PROCESS

  IT IS AN EXPERIMENT ON SOCIAL SCALE INVOLVING HUMAN SUBJECTS

SIMILARITIES TO STANDARD EXPERIMENTS VIEW ENGINEERING PROJECTS AS EXPERIMENTS

A- Any project is carried out in partial ignorance.

- UNCERTAITIES EXISTS IN

1. ABSTRACT MODEL USED FOR THE DESIGN
2. THE PRECISE CHARACTERISTICS OF THE MATERIALS
3. THE NATURE OF THE STRESSES THE FINISHED PRODUCT WILL ENCOUNTER

Disaster at Sea
EXXON VALDEZ
oil spill

TITANIC

Not a Romance or love story

But

An Engineering Disaster
An Engineering complacency


TITANIC
Haunting Image of technological complacency

TITANIC

"All the News That's Fit to Print."

The New York Times.

THE WEATHER.

TITANIC SINKS FOUR HOURS AFTER HITTING ICEBERG; 866 RESCUED BY CARPATHIA, PROBABLY 1250 PERISH; ISMAY SAFE, MRS. ASTOR MAYBE, NOTED NAMES MISSING

Col. Astor and Bride, Isidor Straus and Wife, and Maj. Butt Aboard.

"RULE OF SEA" FOLLOWED

PICKED UP AFTER 8 HOURS

FRANKLIN HOPEFUL ALL DAY

HEAD OF THE LINE ABOARD

Biggest Liner Plunges to the Bottom at 2:20 A.M.

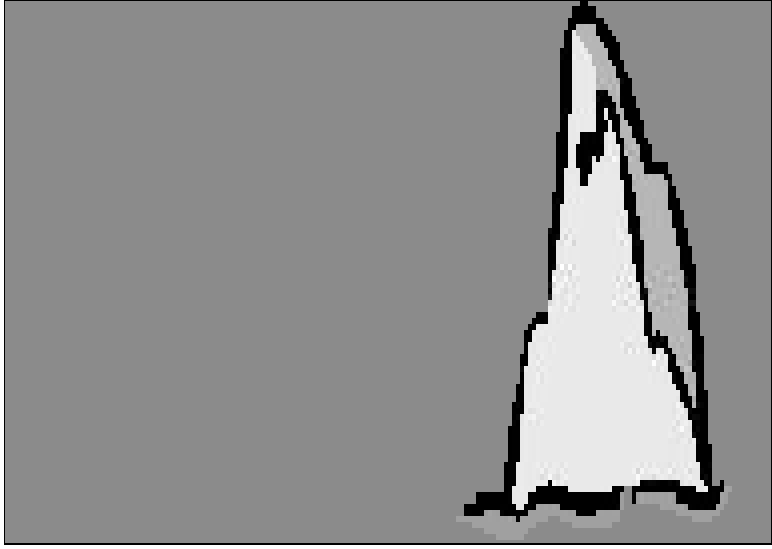
RESCUERS THERE TOO LATE

WOMEN AND CHILDREN FIRST

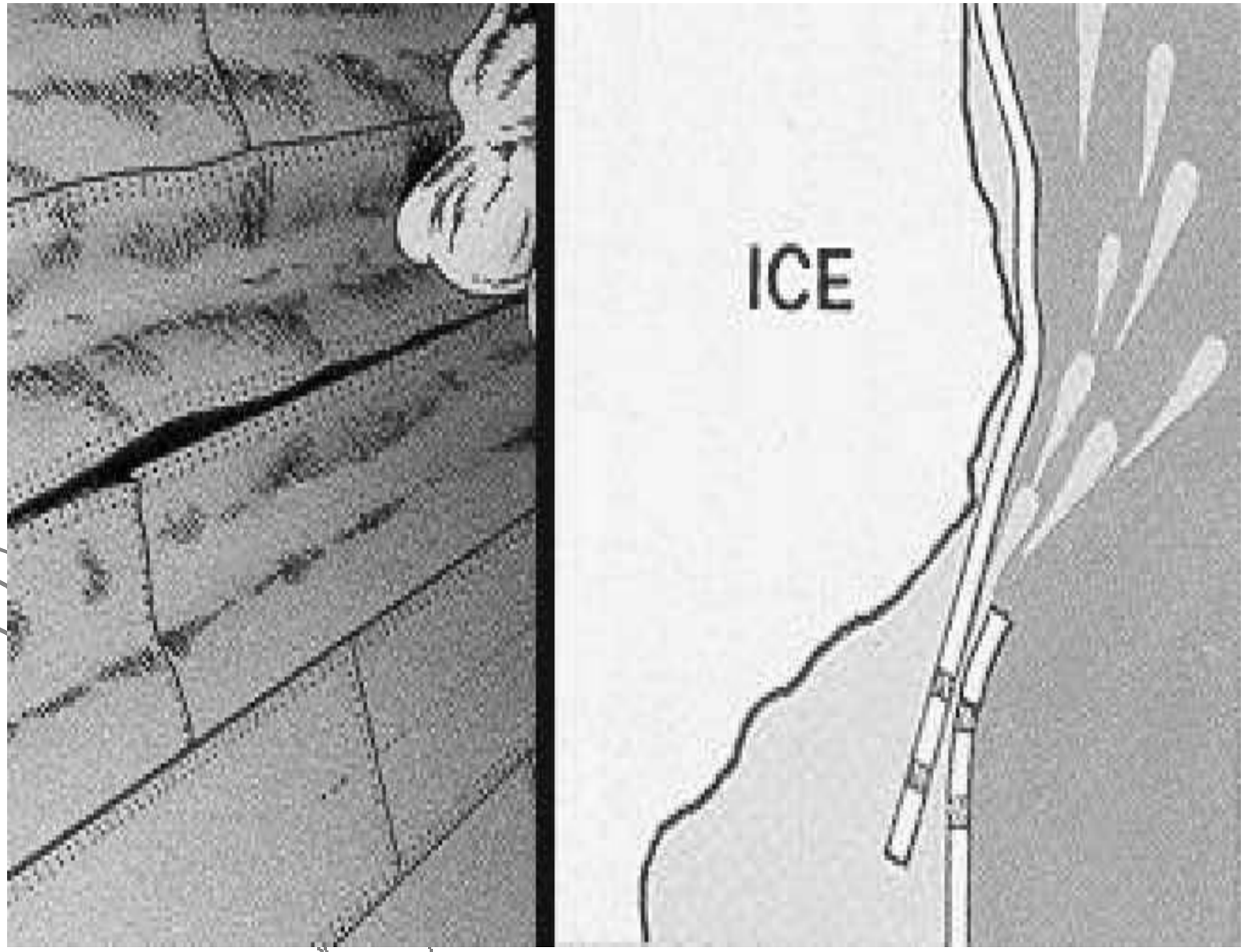
SEA SEARCH FOR SURVIVORS

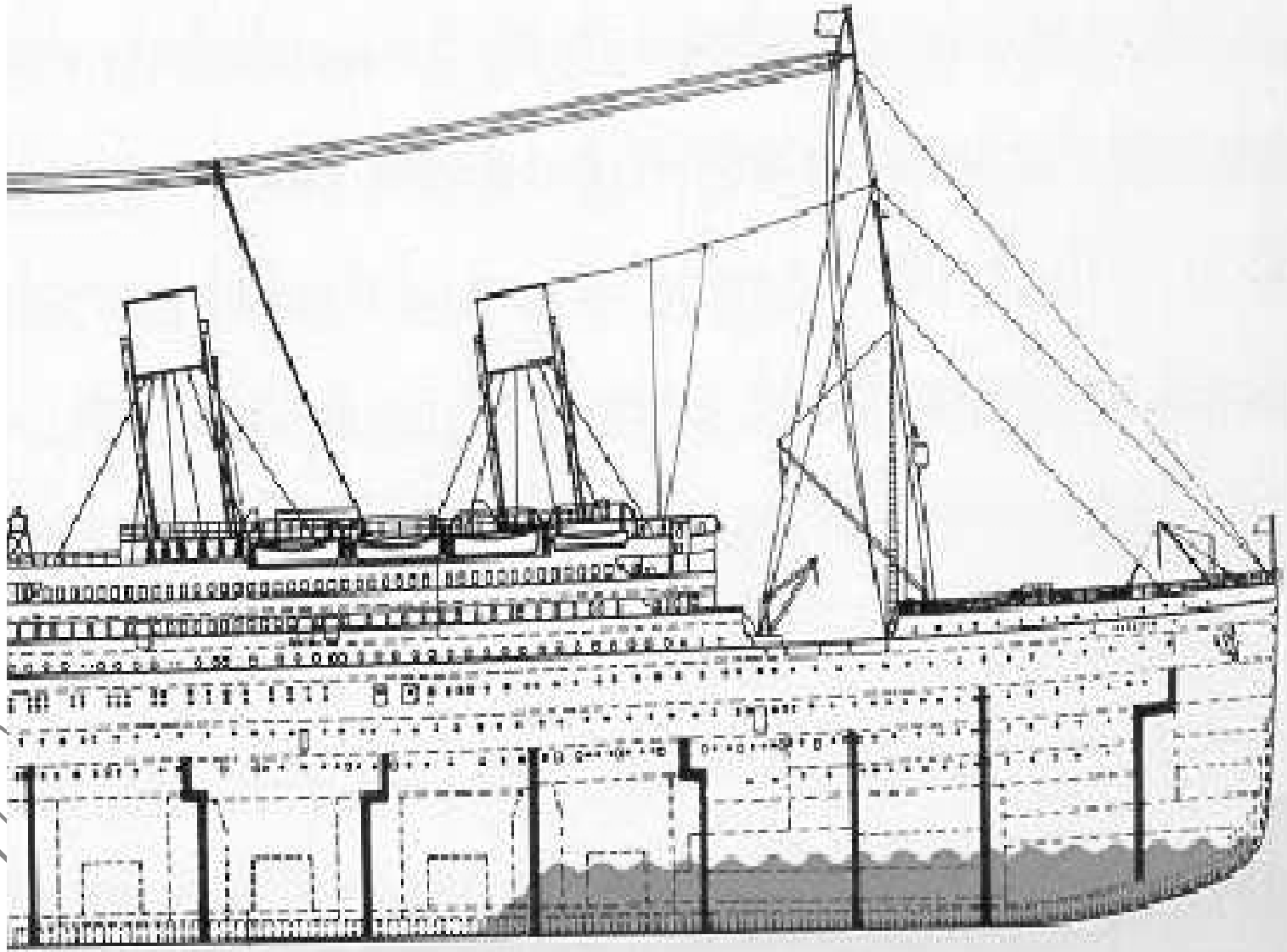
CLINGING DEAD THE NEWS

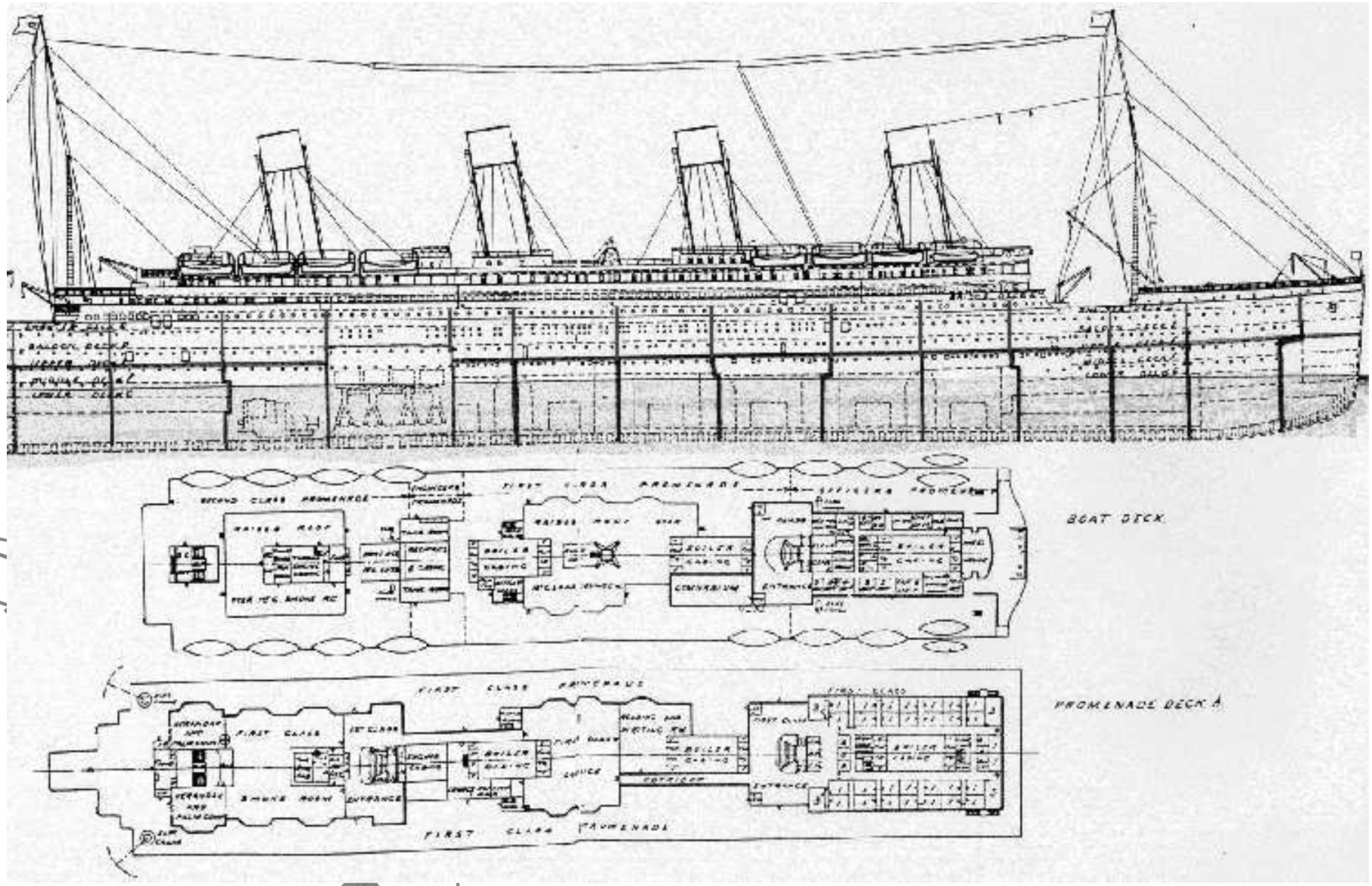
TITANIC



- Maiden voyage 1912
- Greatest engineering achievement (*it was proclaimed)*
- Length of two and half football fields
- Safe ship, 16 watertight compartments (floats with any four compartment flooded)


ICE




BOAT DECK
PROMENADE DECK A

Over Confident

- Life boat available for 825
- Total Capacity 3547

- Result **1522 Dead** out of 2227

- Not only short of lifeboats
- But poor design mechanism of lunching Lifeboats

Major Atlantic Passenger Liner Losses Before the Titanic

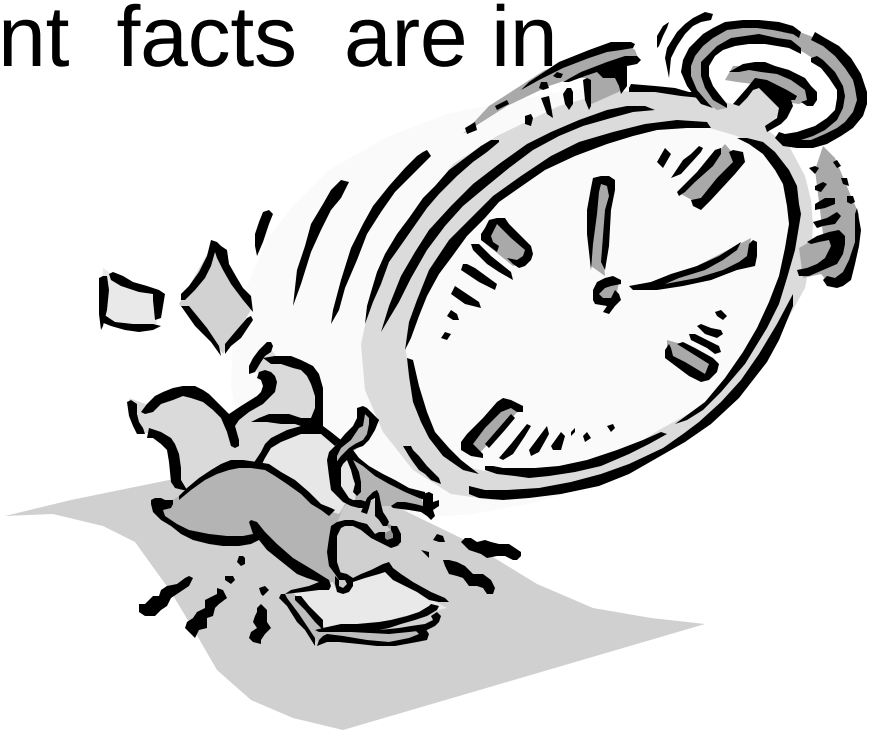
1854	Arctic	Collins	278
1856	Pacific	Collins	186
1857	Tempest	Anchor	150
1868	Hibernia	Anchor	66
1870	Cambria	Anchor	190
1873	Ismalia	Anchor	52
1873	Atlantic	White Star	546
1895	Elbe	North German Lloyd	303
1898	La Bourgogne	French	549
1904	Norge	United Steamship Co.	701
1907	Berlin	North German Lloyd	140
1909	Republic (&Florida)	White Star	4
			3165


"First Christmas holiday in years and
our iceberg gets hit by a bloody boat."

KOREAN AIRLINER

SIMILARITIES TO STANDARD EXPERIMENTS VIEW ENGINEERING PROJECTS AS EXPERIMENTS

Engineers do not have the luxury of waiting until all the relevant facts are in before commencing work



SIMILARITIES TO STANDARD EXPERIMENTS

One talent crucial to an engineer's success

The ability to accomplish task with only a partial knowledge of scientific laws about nature and society

SIMILARITIES TO STANDARD EXPERIMENTS

B- The final outcomes of engineering projects, like those of experiments,are generally uncertain.

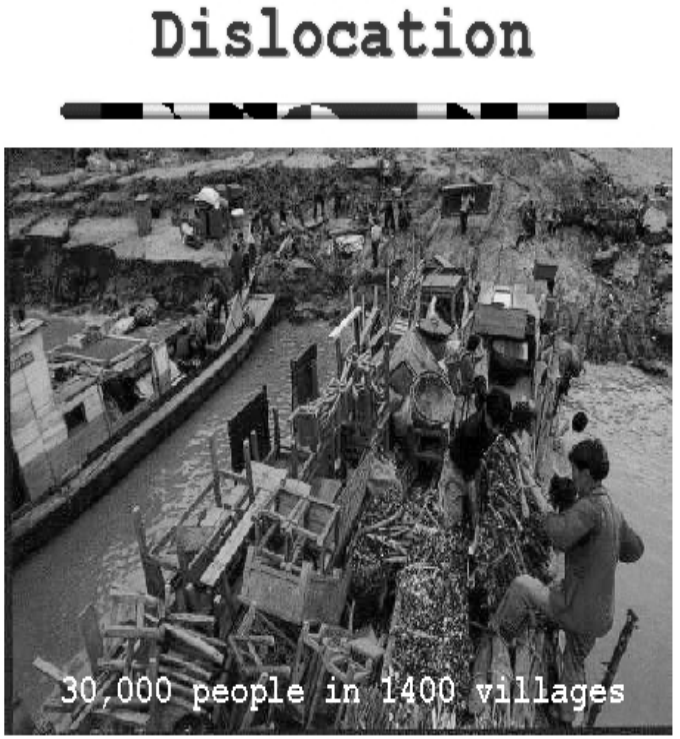
-Often in engineering it is not even known what, the possible outcome may be.

-Great risks may attend even seemingly benign project.

Error in engineering design Artificial Intelligence!!!! Vincennes

SIMILARITIES TO STANDARD EXPERIMENTS

- **A reservoir may do damage to a region's social fabric or to its ecosystem**



SIMILARITIES TO STANDARD EXPERIMENTS

- **An aqueduct may bring about a population explosion in a region where it is the only source of water, creating dependency and vulnerability without adequate safeguards**

SIMILARITIES TO STANDARD EXPERIMENTS

- **A medical scan radiation**
- **Fingerprint reader**
- **Hair dryer**

SIMILARITIES TO STANDARD EXPERIMENTS

Effective engineering relies upon knowledge gained about products both before and after they leave the factory

- **Ongoing success in engineering depends upon gaining new knowledge,just as does ongoing success in experimentation**
- **Monitoring is thus as essential to engineering as it is to experimentation in general.**
- **The ultimate test of a products efficiency, safety, cost effectiveness,environmental impact, and the real value lies in how well that product functions within society**

CHALLENGER DISASTER

- We do not seem to learn from our past experience

ENGINEERING AS EXPERIMENTATION

The normal design process

is **iterative**,

carried out on trial designs with modification being made on the basis of feedback information acquired from tests

ENGINEERING AS EXPERIMENTATION

- EXPERIMENTATION PLAYS AN ESSENTIAL ROLE IN THE DESIGN PROCESS

1. **PRELIMINARY TEST OR SIMULATION FOR ROUGH DESIGN**
2. **MATERIAL AND PROCESSES FORMAL EXPERIMENTATION REQUIRED FOR DETAIL DESIGN .**
3. **PRODUCTION STAGE FURTHER TESTS TILL FINAL PRODUCT**

LEARNING FROM THE PAST

It is expected that engineers would learn from:

1. Their own design and operating results

2. Those of other engineers

LEARNING FROM THE PAST

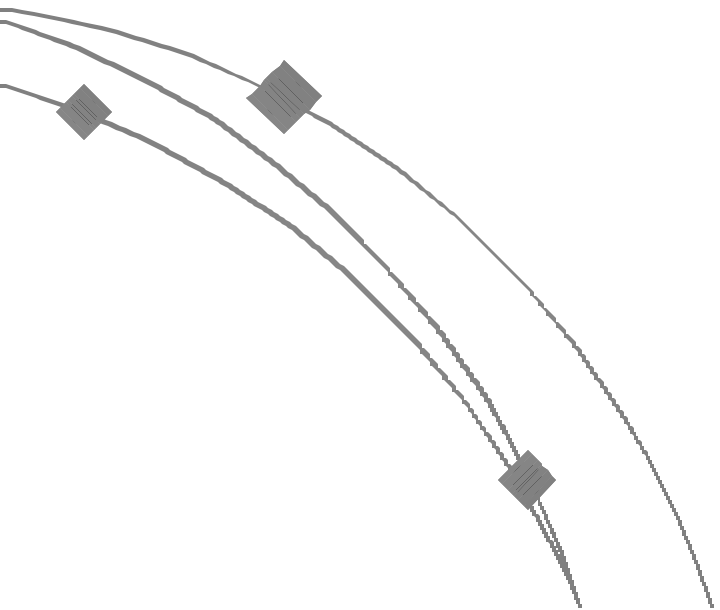
Unfortunately that is frequently not the case

1. Lack of established channels of communication
2. Misplaced pride in not asking for information
3. Embarrassment at failure
4. Plain neglect

History repeats itself

References

- This presentation has been put together by using other materials such as video, audio, text and presentations from various books and websites .
- All the reference are listed on the web ct.




THE END