Secrets of the Code

James R. Chiles
Author, Inviting Disaster

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Approach of *Inviting Disaster*

- Tell the Story, *After* the Headlines ...
- … Of Ordinary Error in Extraordinary Places
- Identify Patterns in 200 Years of Disasters, Precursors, and Close Calls
- Talk about Nice People
The “Nicest People” Principle

The Nicest People You Could Hope to Meet ...

... *Cause Terrible Accidents*
Subject Matter

• Complex, ever-changing, high-energy systems

• Where upsets can be fast, strange, and have irreversible consequences ... 

• ... so good decisions must be made quickly under adverse conditions
Looking for Signals in the Noise, aka ...

- Close Calls
- Near Misses
- Precursors
- Busts
The Taboo Subject

- “Mistake” is a bad word - “Failure” is worse
- But failures hold many lessons
- Experts in high-energy systems don’t accept mistakes - but they do expect them
“We made too many wrong mistakes.”

- Yogi Berra
“We made too many wrong mistakes.”

- Yogi Berra

... Can there be “right mistakes”?

Yes!
Outline of Talk

I. Patterns of Mistake, New and Old

II. Codes in Four Flavors

III. Secrets of the Codes
Old Mistakes
In the News

• Cutting Costs and Corners

• Grandfathering as a Loophole

• Operators complacent, unable to handle adverse conditions

• Equipment is insufficiently tested

• Sheer recklessness
New Mistakes

- Rogue components, Byzantine faults, and “emergent behavior” in highly automated systems
- Nuisance alarms
- Infrastructure parasitology
- Lessons not learned, but concealed
Trends Across Industries

• Automation on the rise; pressure for agility and lower costs

• Complex, tightly-coupled systems ... maintained (or built) on the fly

• Workforce turnover

• Tension over uniform standards to apply, vs. more flexible approach
II. Codes in Four Flavors

A) Consensus safety standards, enforced by government

B) Codes of law and honor

C) Secret codes and ciphers

D) Software programming
Boiler Code

- Incremental, evolving
- Based on formal committees, plus a social network
- Massachusetts law opened the door
- But Uniform Code difficult to finalize – opposition didn't end with ratification
Two Decades of Resistance, Part 1
Two Decades of Resistance, Part 2
B. Codes of Law and Honor

- Self-contained lists: “Do this or else”
- Began with Sumerians and Babylonians
- Criminal laws are called codes too
- On the fringe: the *Code Duello*
Wisdom of the Ancients (?)

- Ur-Nammu started it all
- Hammurabi's Building Code
- Appendix: Many curses for noncompliance
C. Codes and Ciphers

- **Means:** information -- intentionally concealed -- transferable to others

- **Codes:** Words and phrases given arbitrary meaning in a codebook

- **Ciphers:** Switching letters and numbers around

- Codebreakers depend greatly on legwork by others
Secret Codes: Fiction
Secret Codes: Reality
Cold Cases

"We are really good at what we do, but we could use some help with this one"
- FBI cryptology chief, Dan Olson
D. Software is a Code too

- Rock-solid programming is important, given widespread automation in industry and aerospace.

- Meanwhile the languages are changing, from Ada to C, C++, and Java.

- How traceable in ultra-critical settings?

- Will control programs be stable as systems age and sensors fail?
III. Secrets of the Codes
Secrets of Codemakers and Codebreakers

When it comes to standards and codes:

- Tap into user groups for emerging trends

- “Right Mistakes” are better than “Wrong Mistakes”
When it comes to laws:

Exceptions should bring elevated scrutiny, time limits, and public disclosure. Look for workable retrofits instead of grandfathering.
Secrets of Codemakers and Codebreakers

From the world of secret codes:

The best codebreaking techniques can't work without good observation and clear thinking ... so think analytically
Secrets of Codemakers and Codebreakers

From the world of computer programming:

Future software packages will be more capable but thorough testing is a major challenge. High levels of automation can bring rare but strange failure modes.
“What is Not Yet, May Be”
Comments are Welcome, via ...

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