



INVITING DISASTER

Secrets of the Code

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National Board
May 12, 2014

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





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“We made too many wrong mistakes.”

- Yogi Berra



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“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

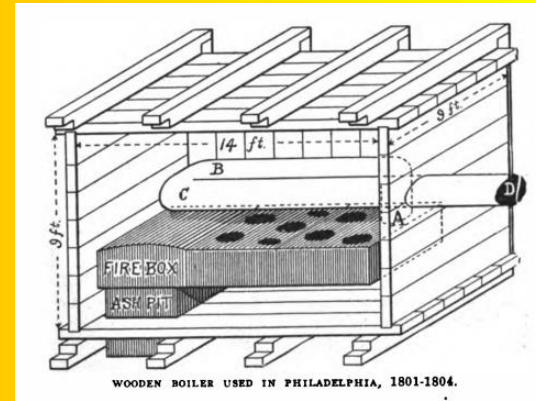
- Automation on the rise; pressure for agility and lower costs
- Complex, tightly-**coupled systems** ... maintained (or built) on the fly
- Workforce turnover
- Tension over uniform standards to apply, vs. more flexible approach

II. Codes in Four Flavors

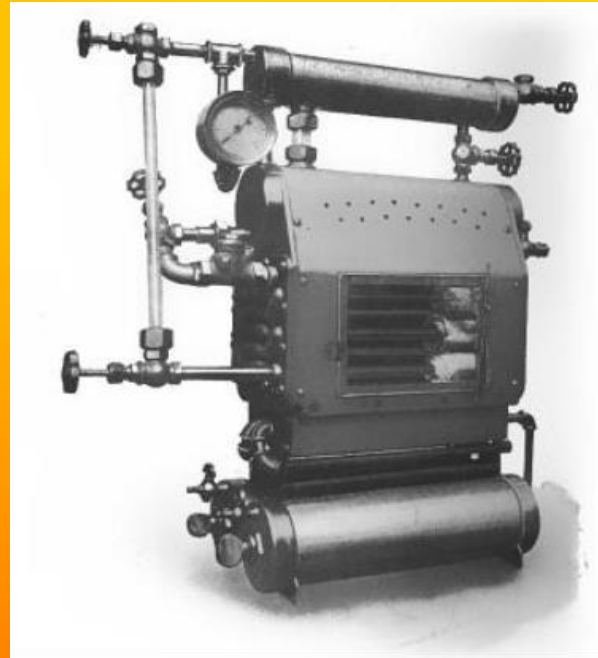
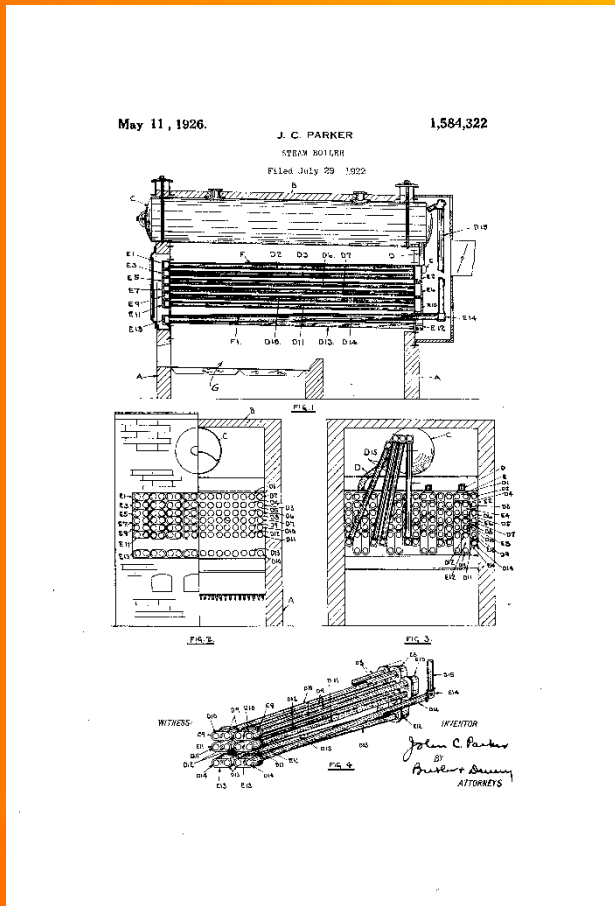
- A) Consensus safety standards, enforced by government
- B) Codes of law and honor
- C) Secret codes and ciphers
- D) Software programming

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

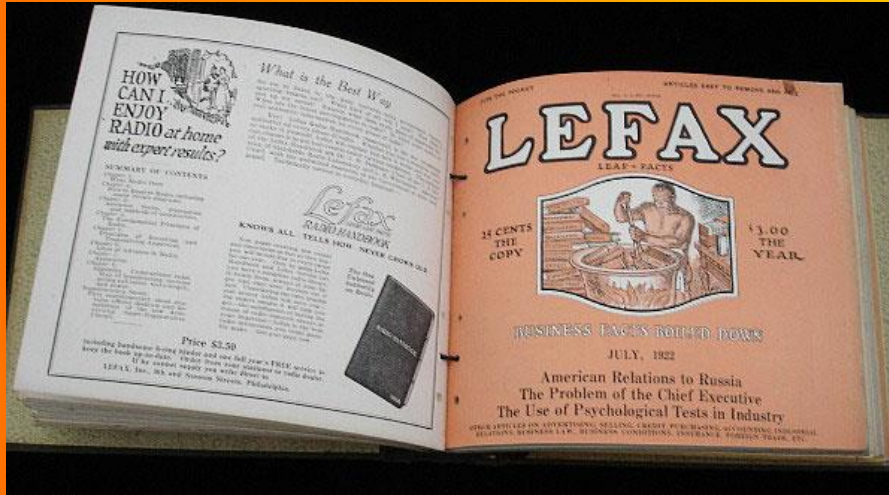


Two Decades of Resistance, Part 1



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Two Decades of Resistance, Part 2

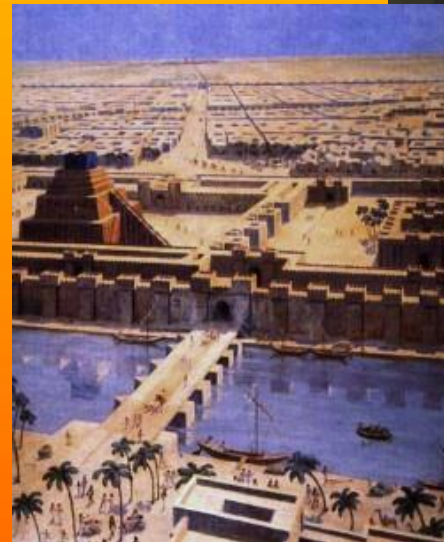


B. Codes of Law and Honor

- 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

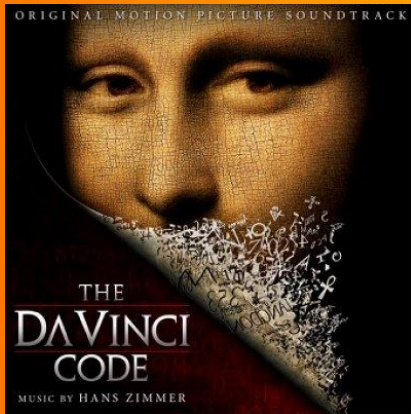


C. Codes and Ciphers

- 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

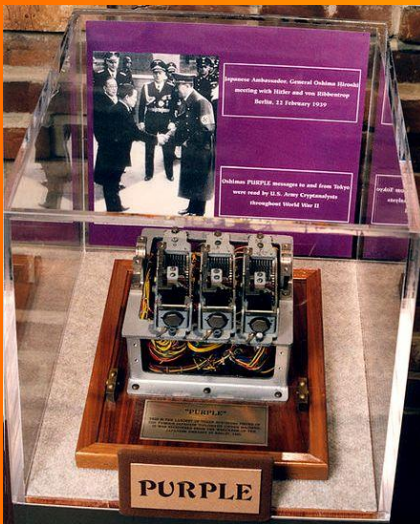
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Secret Codes: Fiction



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Secret Codes: Reality



Cold Cases

4 San Francisco Chronicle Sat., Aug. 2, 1969

Coded Clue in Murders

A man who claimed he shot and killed two Vallejo teen-agers last December and a young woman on July 4 threatened yesterday to kill 12 more this weekend.

The menacing message came in unsigned letters mailed to the editors of The Chronicle, the Vallejo Times-Herald and the San Francisco Examiner.

"Here is part of a cipher," the letter said in part. "In this cipher is my identity.

"If you do not print this cipher by the afternoon of Fry (Friday), I will go on a kill rampage Fry night.

PEOPLE

This code may conceal Vallejo killer's identity

N	X	⊕	S	∇	E	/	Δ	□	□	Z	7	A	P	□	B	V
9	Ξ	⊗	∅	∅	∅	F	□	Δ	∇	+	∅	Δ	A	Δ	B	
□	O	T	⊗	R	∇	∇	+	∅	∅	∅	∅	∅	∅	∅	∅	∅
V	Z	∇	∅	Y	K	E	∅	T	Y	A	Δ	□	□	L	∅	∅
H	I	F	B	X	Δ	⊕	X	A	D	∅	\	Δ	L	T	∅	∅
□	∇	∇	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Z	∅	J	T	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
V	E	X	∇	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅

NOTES

ALPTE GLSE - SE ERTE
 VLSE MTSE -CTSE -WSE -RTSE
 PLRTSE ONRSE WLD VCBE
 WLD XLCRCHSP NE WLD STS WCVL
 BULMTLTUNSE VCBE

(MUNSEARSTEN MUIARSE)
 KLSE-LRSTE-TRSE-TISE-MRSE-MRSE

(KREUSEEE NMRSE)
 NMRSECBKUSEPTEZATEWRCRSE
 36 MISE 74 SPRKSE 29KNOBOLE NTSRSE
 35GLE CIGSE WUNUTKE DRKSE PSESHLE
 651 MISE HTLSE WUTCTRS NMRSE
 99.848 2UNEPLSEVCSEADITSEASRSENBSE
 NREANSE PVISEWLDVCBE (3XBL)
 NMRSE NRSE IUNTRLCRCRSE NTSRCRONE
 KPVISE NCRSE MKSERBSEDEBEWVXLR
 NMRSE NMRSE NMRSE
 D-W-N-Y HIL XDLX 1/2 MURDER

"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”



Secrets of Codemakers and Codebreakers

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:**

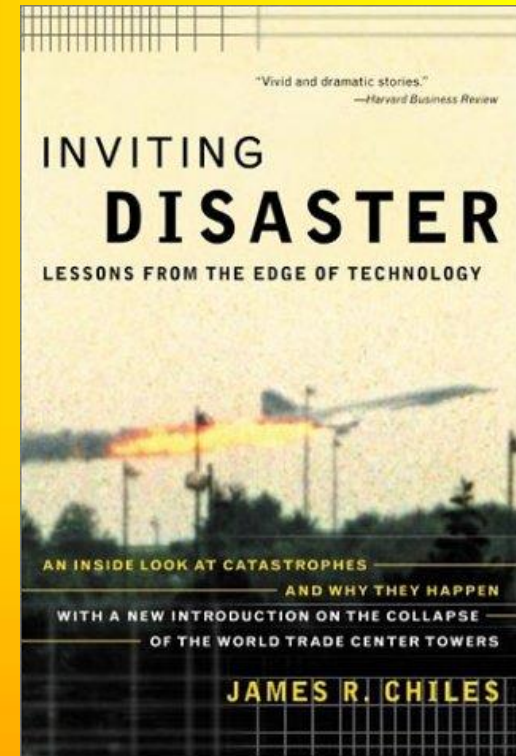
Future software packages will be more capable but thorough testing is a major challenge. High levels of automation can bring rare but strange failure modes

“What is Not Yet, May Be”



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