Surety – Principles and Opportunities

presented at the

Nuclear Implementation Project Workshop

"The Back-end: Healing the Achilles Heel of the Nuclear Renaissance?"

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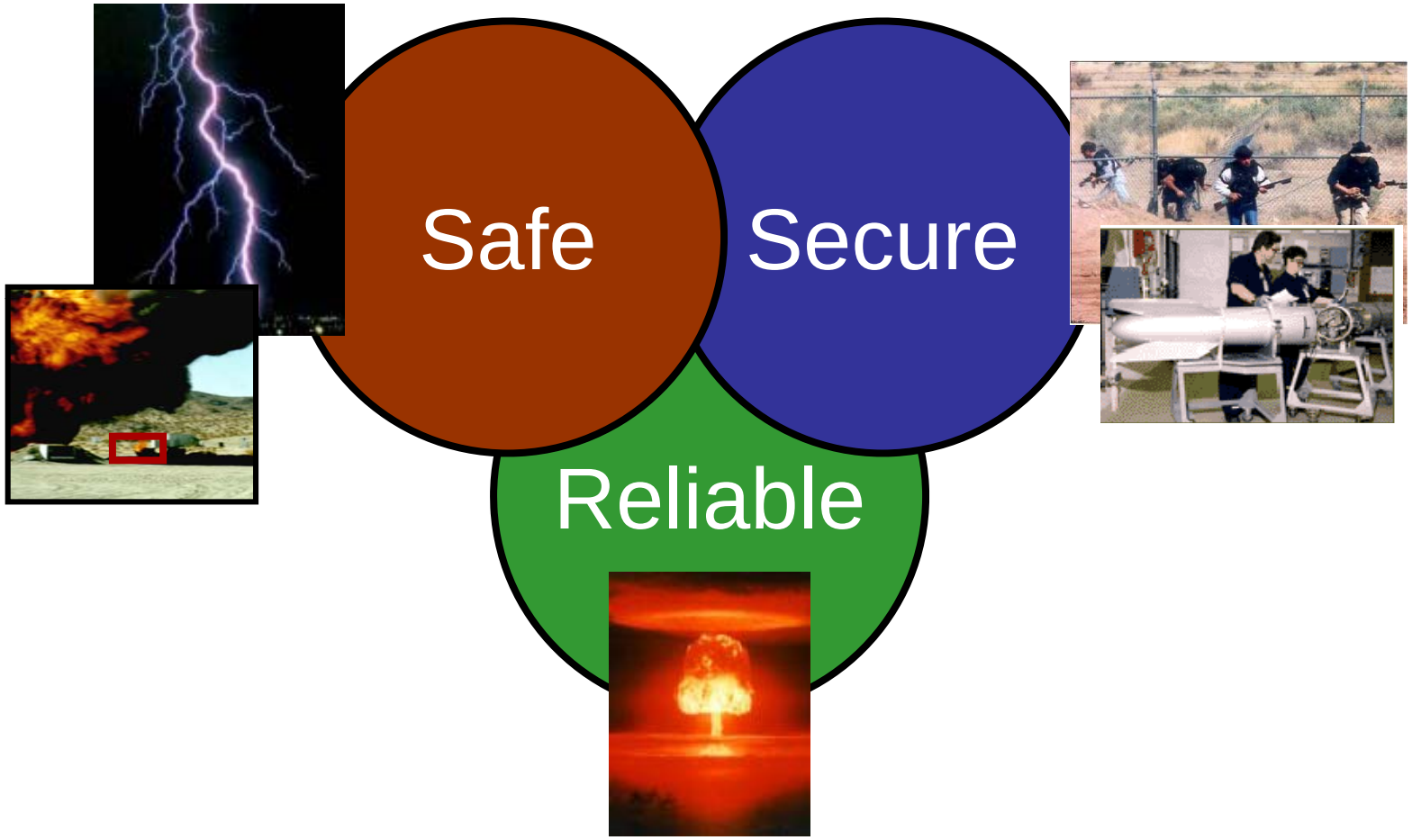
Outline

- What exactly is “surety” and where did it come from?

- How does this relate to nuclear materials in the broader context?

What Is Surety?



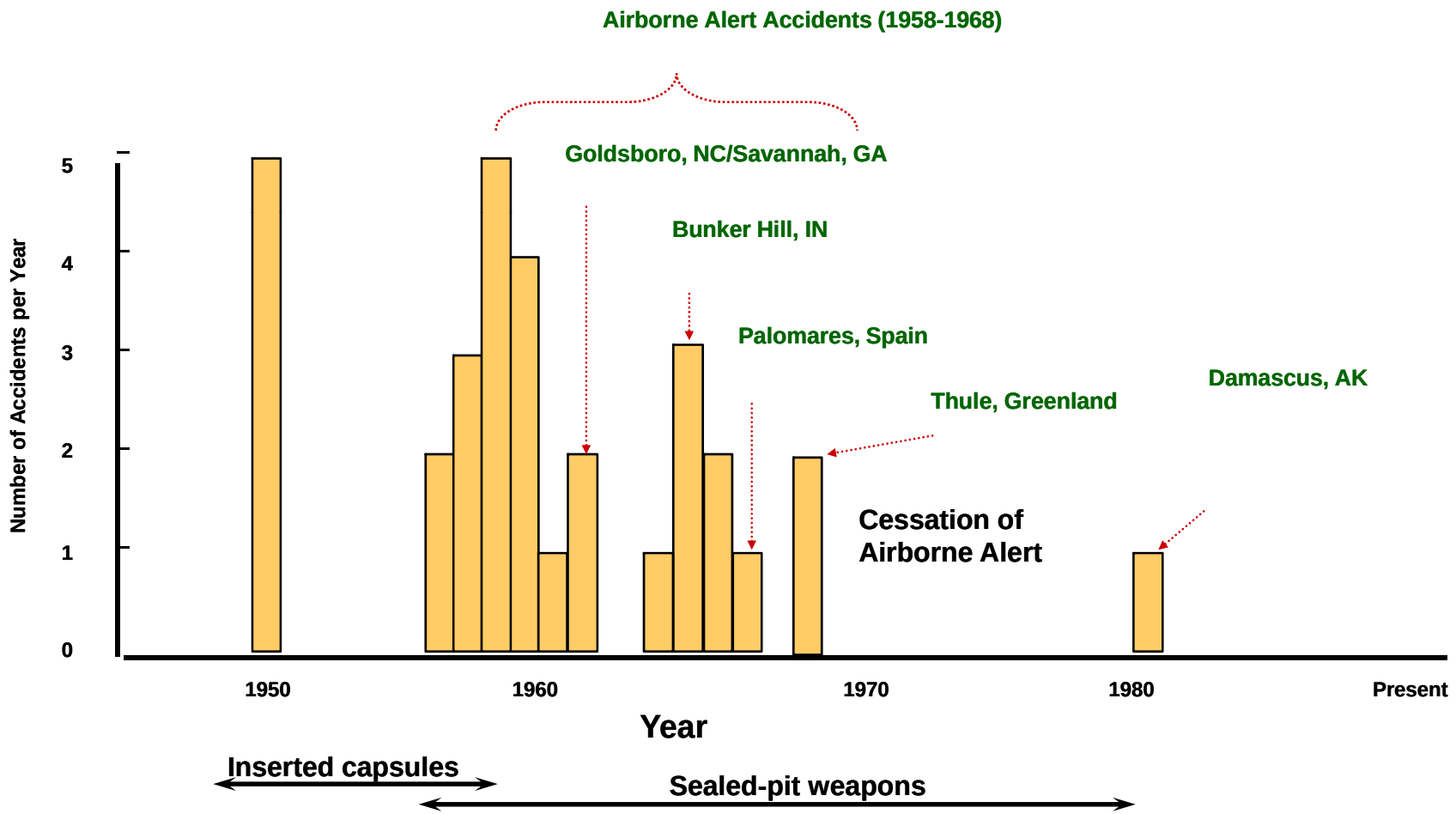
‘**Sure·ty**: a basis of confidence and/or security’

From Webster’s Dictionary

Selected Payoffs of Surety Applications

- Nuclear weapons safety and security
  - Development of Enhanced Nuclear Detonation Safety
  - In 32 accidents since 1945, there has been no nuclear-yield-producing detonation
- Protection of nuclear-stockpile assets at fixed sites
  - Pantex Site
  - Department of Defense locations
- Transportation of nuclear weapons and components
  - Office of Secure Transportation
  - More than one-million miles logged without serious accident or loss of a weapon or component
  - Systematic approach to identification and treatment of possible threats

Surety Thinking Was Spurred by Early Accidents



Surety Principles Work

Thule,
Greenland
(1968)

Minot, North Dakota (1980)

Damascus,
Arkansas
(1980)

Underlying Principles of Nuclear-Weapons Surety Have Broader Applicability

- Understand the whole problem – be fully risk and consequence informed
- Optimize the whole system – use a layered approach, including ***engineered controls and human factors***
- Adaptively evolve to meet threats and risks – continuously incorporate information from all pertinent sources
- Evaluate the total lifecycle – emphasize continuous improvement of engineered and human systems, via performance criteria

People Can Make Mistakes Anytime, Anywhere

The Washington Post

4 colonels relieved of command over nuclear-armed flight
More than 65 other officers are disciplined

By Walter Pincus, Washington Post | October 20, 2007

WASHINGTON - Four Air Force colonels have been relieved of their commands and more than 65 lower-ranking officers and airmen have been disciplined over a series of errors that led to a B-52 flight from North Dakota to Louisiana with six nuclear-armed cruise missiles that no one realized were under the wing.

"This was an unacceptable error that resulted in an unprecedented string of procedural failures," Major General Richard Y. Newton III, assistant deputy chief of staff for operations, said yesterday in reporting on a six-week Air Force inquiry.

"Our investigation found that there has been an erosion of adherence to weapons handling standards" at Minot Air Force Base in North Dakota, where the August flight began, and at Barksdale Air Force Base in Louisiana, Newton said.

Opportunities for use of surety principles in the “nuclear back end”

- How can use of surety principles benefit the nuclear “back end?”
  - Fully risk informed
  - Optimize the whole system
  - Evolve, adapting to changes in threats and risks
  - Continuously improve
- How do we define acceptable tradeoffs in terms of consequences?
- Are there economic barriers to adopting surety in the nuclear “back end?”
- Are existing tools/approaches adequate? Are additional tools/approaches needed?
  - Beyond PRA, QMU
- What are the potential international applications of surety to the nuclear “back end?”

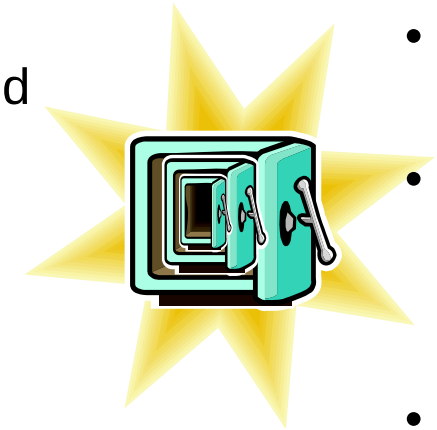
Improved performance in safety, security, and reliability – greater cost effectiveness

backups/outtakes

Today, Surety Principles Guide Implementation Throughout the Nuclear Weapons Enterprise

"4 I's" of Enhanced Nuclear Detonation Safety

- **Isolation** of critical components from unintended energy
- **Incompatibility** of incoming energy with detonation sources
- **Inoperability** caused by abnormal environments
- **Independence** of multiple subsystems, enabling stimuli



"SAFE" for integrated security & use control

- **S**tate always known and verifiable to be secure
- **A**ware of the situation, reliably, unambiguously, and uniquely leading to state change
- **F**orbids undesirable consequences certainly and irreversibly under abnormal or unauthorized conditions
- **E**nables when specifically authorized for access, change of custody or use