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The Problem of Redundancy Problem: Why More Nuclear Security Forces May Produce Less Nuclear Security (2004)

Scott D. Sagan

Introduction

Following the September 11, 2001 attacks, concerns arise about the possibility of successful terrorist attacks on nuclear-related facilities.

Successful terrorist attacks on nuclear facilities could:

- do lots of physical damage, and/or
- aid some rogue individual or terrorist organization in its production of dangerous weapons

In either case, the costs of a successful terrorist attack would be very high.

In response to these valid concerns, many advocate improving the security of these nuclear sites by adding more security forces.

Redundancy

Redundancy and Reliability: The Automobile Break Example

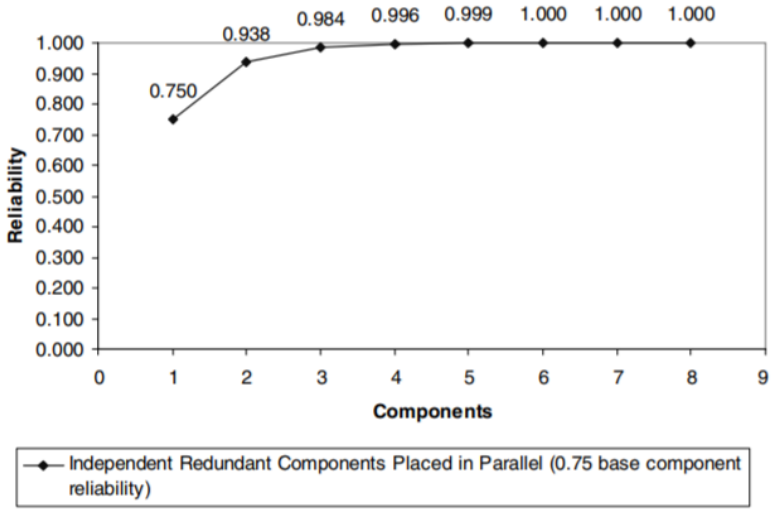

Fig. 1. The benefits of redundancy for reliability.

Application to Nuclear Security

Sagan's Big Question

Will more nuclear security forces provide improved nuclear security against terrorist threats?

Sagan is skeptical that redundancy in the context of nuclear security will always be effective in reducing the probability of successful terrorist threats.

He discusses three major ways in which redundancy may "backfire" and have a neutral or negative effect on nuclear security systems.

- Common-Mode Errors
- Social Shirking
- Overcompensation

Common-Mode Errors

"adding extra components can inadvertently create a catastrophic common-mode error (a fault that causes all the components to fail)" (937)

- Commercial Aircraft Engine Example

Application to Nuclear Security

- Insider Threat Problem

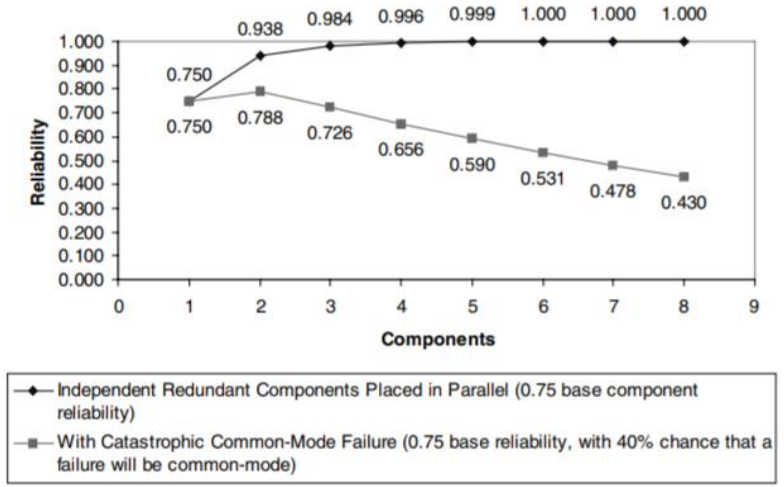

Fig. 2. Catastrophic common-mode errors.

Social Shirking

Sagan argues that "social shirking"/diffusion of responsibility may reduce the effectiveness of efforts to make systems more redundant and reliable.

Returning to the Automobile Example: The problem of "social shirking" does not apply because breaking units are independent of one another and are not aware of the presence of other breaking units.

In the context of nuclear security, when real people are involved, this problem may apply.

"Unresponsive Bystander" Example

Application to Nuclear Security

- Military Example: Identification

Overcompensation

Perceived increases in security may cause individuals to engage in risky behaviors that mitigate the effectiveness of the attempts to increase security.

- "Baby-Proof" Cap Example
- Skiing Example

Sagan argues that the *Challenger* explosion is an example of overcompensation.

Big Ideas

Low probability events happen all the time.

Redundancy as a method of improving reliability/security may be either successful or unsuccessful depending on the circumstances. In other words, redundancy is not inherently helpful or problematic.

Costly actions taken with the intention of improving nuclear security may not improve security at all, and could even decrease the effectiveness of security.

Careful consideration of the three problems with redundancy is required when proposing security changes.

Criticisms

The article is somewhat lacking direct examples closely related to nuclear security, as well as thorough explanations of how

Sagan's theoretical framework for "social shirking" in the context of nuclear security could use more development. Much of his argument relies on evidence from situations which are arguably not comparable to nuclear security.

- "there is no reason to suspect that nuclear security personnel are immune to this all too human problem" (941)
- "Unresponsive Bystander" vs. Security Personnel