

# SDI: A Violation of Professional Responsibility

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## Roadmap

- SDI
- Professional Responsibility
- Conflicts of Interests
- Discussions between SDI & Parnas
- Advice
- Open Questions

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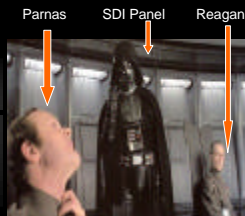
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## What is SDI?

- Strategic Defense Initiative.
- Star Wars Program
  - R&D on CS problems in space-based defense systems.
- Parnas served for 2 months
  - Daily paycheck of \$1000!!



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## More Details on SDI

- Free us from nuclear weapons...
  - Somehow make nuclear strategic missiles impotent and obsolete.
- The plan?
  - Network of satellites carrying sensors, weapons & computers to detect and intercept ICBM's.

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## Nature of Star Wars

- Emphasis on sensors & weapons
  - ... usually ignored the computer limitations associated with these.
    - Vast amounts of raw data to be processed.
    - Detect missile firings
    - Determine source of the attack
    - Compute attacking trajectories
    - Discriminate decoys from real targets
    - Aim & fire weapons.
- "Software is the glue that holds such systems together."

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## Limits on Software Technology

- Testing & correctness.
  - Hardware vs. Software
- "Testing can show the presence of bugs, never their absence." - Dijkstra.
- Unrealistic to expect a real program to work properly the first time it is really used.
  - Extensive use under *actual* operating conditions.

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## More SDI Difficulties

- Software based on assumptions about targets and decoy characteristics.
  - Could be exploited.
- High reliability requires redundancy in satellite communications
  - Unusually expensive
  - Quite vulnerable

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## SDI Reliability, is it even possible?

- Only *IF* failures of individual components are statistically independent.
  - Are they retarded? In a coordinated attack this is *NOT* the case.
- Overload a system...
  - Decoys consume resources.
  - Ignore or fail. --> Catastrophic.

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## SDI... yet more difficulties.

- Missile tracking
  - Transfers from one satellite to the next
    - Requires data passing.
  - Distributed Real-Time Database.
    - Impossible when network components are unreliable.
      - ... expect unreliability during a real battle.
    - Damaged stations.

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## Issue of Testing

- ⚡ Impossible.
  - ⚡ Would require “practice” nuclear wars?
  - ⚡ Partly damaged satellites?
- ⚡ Difference between this and other weapon systems:
  - ⚡ “No opportunity to modify the software during of after its first battle.”

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## Professional Responsibility

1. I am responsible for my own actions and cannot rely on any external authority to make decisions for me.
2. I cannot ignore ethical and moral issues. Determine whether task is beneficial to society.
3. I must make sure I am solving the real problem, not just some short-term satisfaction.

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## Initial Views

- ⚡ Similar posture to Einstein's:
  - ⚡ “To hold a ‘no arms’ policy would be to place the world at the mercy of its worst enemies.”
- ⚡ Neither arms race nor nuclear weapons are consistent with this view.

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## Someone say "Funds"?

### Conflict of interest?

- Parnas had a project within the U.S. Navy that could benefit from the SDI funding.
- The panel was actually full of these conflicts of interest.



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## The Panel Begins

- Presentations were done poorly.
  - Technical terms not defined.
  - Numbers generated without evidence.
  - Ignored the "big picture"
  - Everyone had a "pet" project.

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## Notion of Trustworthiness

- U.S.A?
  - No full trust, then arms race won't stop.
- U.S.S.R?
  - Assume its 'effective', improve its offensive forces.
- U.S.A?
  - Build more nuclear weapons in order to compensate.
- \*Creates a worse scenario than it was before\*

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## Parnas Questions the Panel

- No one disagreed.
- Continue the program.
- Advance the state of Computer Science.



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## Reaction...



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## SDI's "damage control"

- "100,000 errors and would still work properly."
  - ... yeah, which ones?
- "No fundamental law claiming it could not be done."
  - Issue is with trust, not building it.
- "Demanding perfection."
  - Just being able to trust it... that is, no *major* flaws.

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## 90% Distraction

- Three layers, each 90% effective, then the overall leakage would be  $< 1\%$ :
  - No basis whatsoever for the 90% figure.
  - Assumes performance of each layer is independent... (there are many links)
  - Statistically makes no sense
    - Only works for describing a random process.

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## “Loose Coordination” Distraction

- Eastport group report:
  - SDI could be trustworthy if each battle station functioned autonomously
    - Reduce communication between stations.
  - Some issues
    - No definition of terms.
    - No structure is described.
    - Plenty of contradictions.

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## Three claims from Eastport

- It decomposes the program into a set of smaller programs.
  - Each one can be built and tested.
- Battle stations would be autonomous.
  - Some degree of independence.
- Testing individual stations “possible”
  - Infer behavior of the whole system.

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## Assumptions by Eastport

1. Stations do not need data from other satellites.
2. These “smaller” station programs won’t run into the same previous problems.
3. Explicit communication between stations.
4. Collection of communicating systems differs from a single system.

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## FALSE

1. Data from other satellites HAS to be used.
2. Impossible to test in actual operating conditions... thus *still* no trust.
3. Weapons might affect sensors.
  - a) Isolation is not the same as a grid test.
4. Distributed systems are harder than centralized systems.

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## Questions from Parnas

- ⚡ Why fund SDI?
  - ⚡ Panel is trivializing problems such that:
    - ⚡ Projects seem doable.
    - ⚡ Funds keep coming in.
  - ⚡ SDI is creating a false sense of security
    - ⚡ Society has no clue of what is going on.
    - ⚡ SDI professionals know this.

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## Questions from Parnas

- What should be the role of academic institutions?
  - Professor tenure?
    - Speak freely.
  - Institutional pressures.
    - Fund us or die.

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## Should SDI be pursued?

- State the following very clear:
  - An effective shield is unlikely, and a trustworthy one impossible.
- Do not use SDI as an excuse to fund technological advances in Computer Science.

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## Episode VII, Bush Strikes Back

- Funding in the U.S.A. in 2007
  - +1.8%
  - \$137 billion.
  - \$54.8 billion does not go into weapons & STS
    - 3.3%
    - 3rd year decrease.
  - Pentagon
    - \$74.1 billions
    - \$63 billion for weapons.



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## Open Questions

- After 9/11 funding has been significantly diverted to weapons & defense research.
- As graduate students desperately seeking funds, would you take anything that came in? Assume its unrealistic, over-hyped, likely to fail.

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## Open Questions

- “Customer does not know what he actually wants... we do.”
- Obviously this happens in industry... but
  - We are in a bind.
  - Need contracts and payments
  - Customers don't always like to be treated as if they don't know what they are talking about.
  - Superiors don't care about customers.

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