

A Deterrence Stability Framework for the Evaluation of New Technologies



PONI 2019 Summer Conference
July 9-10, 2019
Sandia National Laboratories in
Albuquerque, NM

PRESENTED BY

Steven Horowitz (6835)

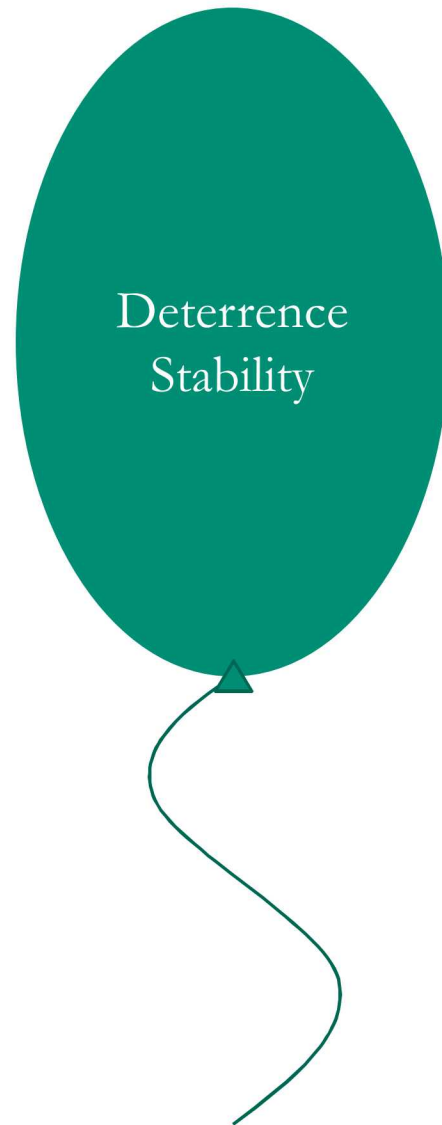
With mentoring assistance from Eric
Wallace (6833)



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

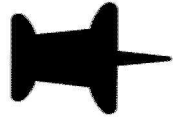
Outline

- International Situation
- Definitions, Scope, & Assumptions
- Framework
- Impact
- Applications



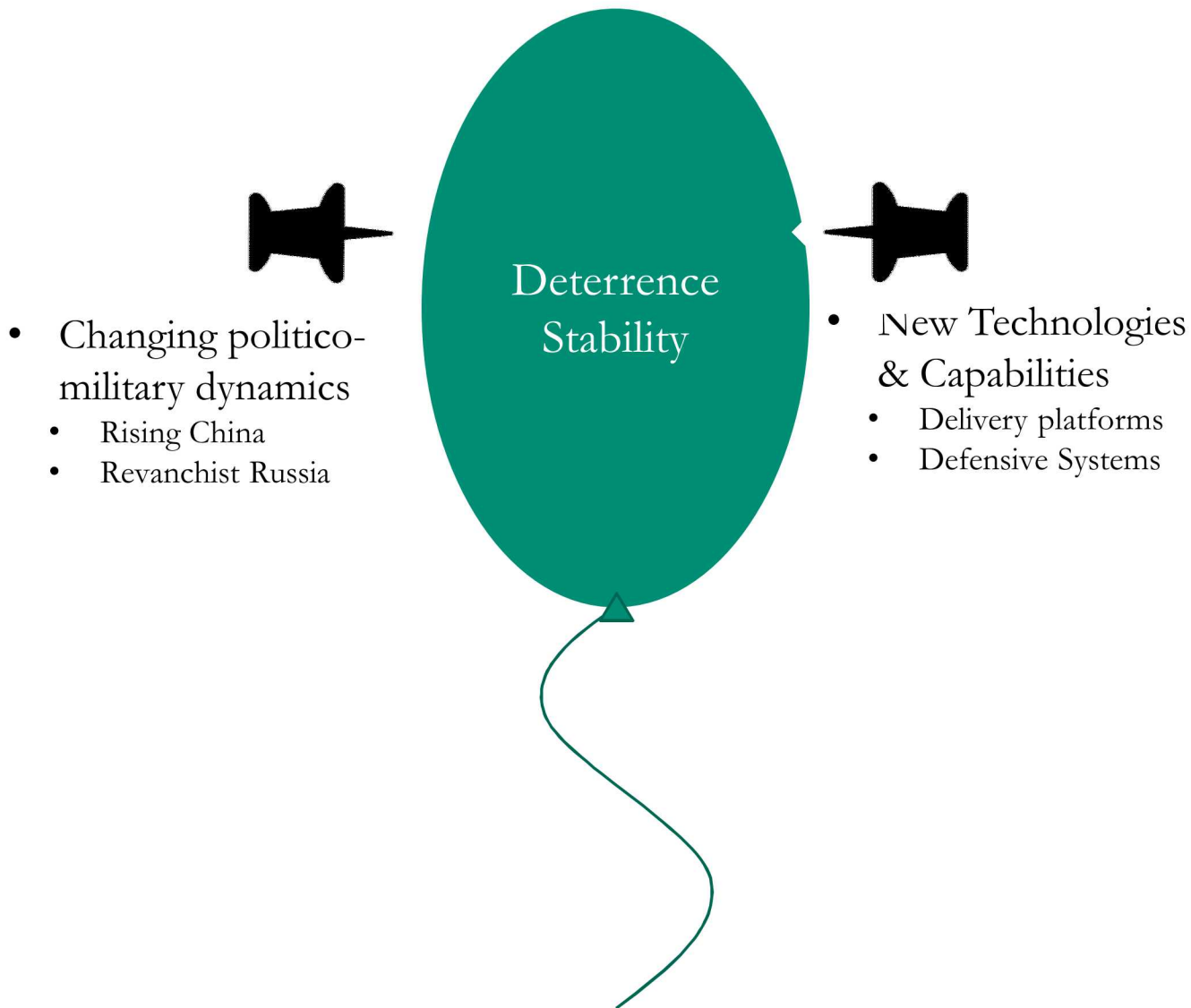
International Situation

- Changing politico-military dynamics
 - Rising China
 - Revanchist Russia



Deterrence
Stability





Scope, Assumptions, & Definitions

- Not including political dynamics between states. We simply assume State A desires or feels compelled to attack State B
 - What does State B need given State A's capabilities?
- Two-Player System: *Central* Deterrence rather than *Extended*
- Both states possess nuclear weapons, i.e. no preventative war
- Mutual vulnerability (i.e. no perfect missile defense)

Shifting Factors in “Strategic” Deterrence Stability

Long-Term

Short-Term

Shifting Factors in “Strategic” Deterrence Stability

Long-Term

Military Balance, Politics (Foreign & Domestic), Economics, Social & Cultural Change

Arms Control

Arms Race/
Security
Dilemma

Alliances

Technology
Offense/
Defense
Balance

Short-
Term

Crisis
Stability

First-Strike
Stability from
Strategic Force
Structure

Imperfect
Information:
Emotions,
Ambiguous
Information,
Misperception

Shifting Factors in “Strategic” Deterrence Stability

Long-Term

Military Balance, Politics (Foreign & Domestic), Economics, Social & Cultural Change

Arms Control

Arms Race/
Security
Dilemma

Alliances

Technology
Offense/
Defense
Balance

Short-
Term

Crisis
Stability

First-Strike
Stability from
Strategic Force
Structure

Imperfect
Information:
Emotions,
Ambiguous
Information,
Misperception

Building a Framework: What Matters?



Building a Framework: What Matters?

- Posture and Doctrine
 - Force readiness level, deployment, leadership/command locations, etc.
 - Day-to-Day vs. Elevated
 - Second Strike vs. Launch Under Attack (LUA)

Building a Framework: What Matters?

- Posture and Doctrine
 - Force readiness level, deployment, leadership/command locations, etc.
 - Day-to-Day vs. Elevated
 - Second Strike vs. Launch Under Attack (LUA)
- Strategic Force Structure should be molded with above inputs

Building a Framework: What Matters?

- Posture and Doctrine
 - Force readiness level, deployment, leadership/command locations, etc.
 - Day-to-Day vs. Elevated
 - Second Strike vs. Launch Under Attack (LUA)
- Strategic Force Structure should be molded with above inputs
- Nuclear and Conventional Weapons with Strategic Effects & Delivery Platforms

Building a Framework: What Matters?

- Posture and Doctrine
 - Force readiness level, deployment, leadership/command locations, etc.
 - Day-to-Day vs. Elevated
 - Second Strike vs. Launch Under Attack (LUA)
- Strategic Force Structure should be molded with above inputs
- Nuclear and Conventional Weapons with Strategic Effects & Delivery Platforms
- Survivability

Building a Framework: What Matters?

- Posture and Doctrine
 - Force readiness level, deployment, leadership/command locations, etc.
 - Day-to-Day vs. Elevated
 - Second Strike vs. Launch Under Attack (LUA)
- Strategic Force Structure should be molded with above inputs
- Nuclear and Conventional Weapons with Strategic Effects & Delivery Platforms
- Survivability
- Command and Control



Relevant Features of Strategic Force Structure

State A: State to be Deterred

State B: The Deterring State

Relevant Features of Strategic Force Structure

State A: State to be Deterred

- Strategic Capabilities
- Command and Control
- Novel Weapon Capability[†]

[†]Could be a conventional weapon if it undermines concepts outlined here

State B: The Deterring State

- Survivability of Strategic Forces[‡]
- Command and Control
- Missile Defense

[‡]May also include Novel Weapon

Relevant Features of Strategic Force Structure

State A: State to be Deterred

- Strategic Capabilities
 - Delivery Systems & Warheads
 - Triad
 - First and/or Second Strike
 - Diversity & Flexibility
- Command and Control
- Novel Weapon Capability[†]
 - Speed
 - Accuracy
 - Numbers
 - Maneuverability
 - Penetration
 - Counter-Defensive Measures

[†]Could be a conventional weapon if it undermines concepts outlined here

State B: The Deterring State

- Survivability of Strategic Forces[‡]
 - Hardening
 - Concealment and Mobility
 - Diversity & Flexibility
 - Second Strike vs LUA
- Command and Control
 - Early Warning
 - Survivability
- Missile Defense

[‡]May also include Novel Weapon

Impact



= Novel Strategic System Property
Undermines Element



	Novel Strategic System Properties					
Element of a State's Deterrent Posture	↑ Speed	↑ Accuracy	↑ Maneuverability	↑ Penetration	↑ Number	↑ Counter-Defensive Measures
Hardening						
Concealment & Mobility						
Redundancy/ Diversity						
Second Strike						
LUA						
Early Warning						
C&C Survivability						
Missile Defense						

Impact

 = Novel Strategic System Property
Undermines Element

	Novel Strategic System Properties					
Element of a State's Deterrent Posture	↑ Speed	↑ Accuracy	↑ Maneuverability	↑ Penetration	↑ Number	↑ Counter-Defensive Measures
Hardening						
Concealment & Mobility						
Redundancy/ Diversity						
Second Strike						
LUA						
Early Warning						
C&C Survivability						
Missile Defense						

Test Case: Multiple Independently-Targetable Re-Entry Vehicles (MIRVs) with Penetration Aids

 = Novel Strategic System Property
Undermines Element



	Novel Strategic System Properties					
Element of a State's Deterrent Posture	↑ Speed	↑ Accuracy	↑ Maneuverability	↑ Penetration	↑ Number	↑ Counter-Defensive Measures
Hardening						
Concealment & Mobility						
Redundancy/ Diversity						
Second Strike						
LUA						
Early Warning						
C&C Survivability						
Missile Defense						

Applications - Future Direction

- New Capabilities
- India – Pakistan Standoff
- U.S. – Russia
- Central Deterrence vs. Extended Deterrence
- Other building blocks of “Strategic” Deterrence Stability
 - Arms control, psychology, etc.

Works Consulted

- Defense Intelligence Agency's 2019 "China Military Power" report, DIA-02-1706-085. https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf.
- U.S. 2018 Nuclear Posture Review. Office of the Secretary of Defense.
- Keir A. Lieber and Daryl G. Press, "The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence," *International Security* Vol. 41, No. 4 (Spring 2017), pp. 9-49.
- Paul J. Bracken, *The Command and Control of Nuclear Forces* (Yale University, 1983).
- *The Spread of Nuclear Weapons: An Enduring Debate*, ed. Roby Harrington (New York: W. W. Norton & Company, Inc. 2013).
- Glenn A. Kent and David E. Thaler, *First-Strike Stability: A Methodology for Evaluating Strategic Forces* (Santa Monica, CA: RAND Corporation, 1989).
- *On Limited Nuclear War in the 21st Century*, eds. Jeffrey A. Larson and Kerry M. Kartchner (Stanford: Stanford University Press, 2014).
- *Strategic Stability: Contending Interpretations*, eds. Elbridge A. Colby and Michael S. Gerson (Strategic Studies Institute and U.S. Army War College Press, February 2013).
- James M. Acton, "Chapter 4: Reclaiming Strategic Stability," in *Strategic Stability: Contending Interpretations*, eds. Elbridge A. Colby and Michael S. Gerson (Strategic Studies Institute and U.S. Army War College Press, February 2013), pp. 117-146.



Special Thanks To SNL Staff:

- Eric Wallace
- Geoffrey Forden
- Amir Mohagheghi
- Michael Gregson



Thank You!

