

Qualitative Considerations of Nuclear Forces for Future Arms Control Negotiations

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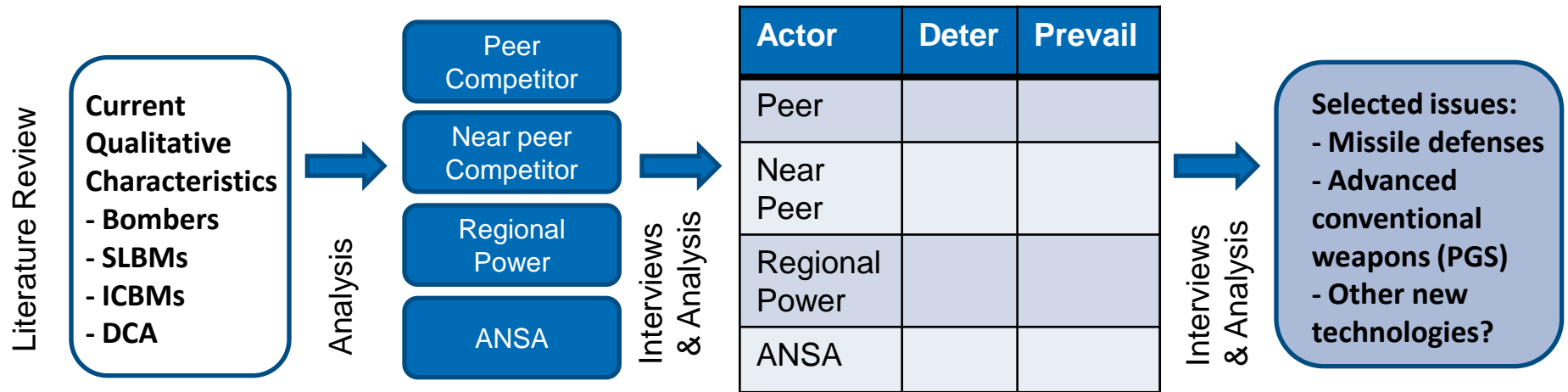
Study Overview

- Study Questions:
 - What qualitative characteristics of current U.S. nuclear forces are most critical to the nuclear mission, and how might they change in importance at lower numbers?
 - What are the implications for future arms control negotiations?
- Study Goal:
 - Provide considerations regarding equities, aspects of force structure, or specific characteristics of nuclear forces that should be protected within future discussions regarding nuclear force reductions.

“Maintain stability with major nuclear powers, deter potential adversaries, and reassure our partners and allies.”

-2010 Nuclear Posture Review

Study Methodology



Task 1A. Identify and define important qualitative characteristics of current nuclear forces:

Task 1B. Determine which qualitative characteristics are most important with regard to categories of geopolitical actors.

Task 2. As numbers decline

- How might relative values of characteristics change?
- Identify degraded characteristics
- Identify gaps between desired & remaining characteristics

Task 3. How might characteristics be affected by changes or improvements in U.S. military capabilities that complement or supplement nuclear forces?

Interviews

- OSD/Policy
- Office of the Joint Chiefs of Staff
- US European Command
- US Pacific Command
- US Strategic Command
- Air Force Global Strike Command
- Air Force Nuclear Weapons Center
- Air Force Strategic Deterrence & Nuclear Integration
- Defense Threat Reduction Agency
- Lawrence Livermore National Laboratory
- Naval Postgraduate School
- National Defense University
- Dartmouth College
- Duke University
- Georgetown University
- Stanford University
- Center for Strategic & International Studies
- Federation of American Scientists
- Institute for Defense Analysis
- National Institute for Public Policy

Qualitative Characteristics

Foundational Characteristics - Identified by the study team as essential to fielding a viable nuclear force, without which the ability to deploy a nuclear force would be unpredictable, dangerous, and of limited strategic utility

- Reliability
- Sustainability
- Safety/Security/Surety
- Command and Control

Variable Characteristics - Identified by the study team for analysis of relative importance

- Ability to Defeat Defenses
- Accuracy
- Ability to Reconstitute
- Promptness
- Ability to Retarget
- Survivability
- Ability to Signal
- Variety of Yield Options

Characteristics Matrix

Actors	Deter Adversaries and Assure Allies		
	Tier 1 (most important)	Tier 2	Tier 3 (least important)
ANSAs	Accuracy Promptness Variety of Yield Options	Ability to Retarget Ability to Signal	Ability to Defeat Defenses Ability to Reconstitute Survivability
Regional	Ability to Defeat Defenses Accuracy Promptness	Ability to Retarget Ability to Signal Variety of Yield Options	Ability to Reconstitute Survivability
Near-Peer	Ability to Defeat Defenses Ability to Reconstitute Ability to Signal	Accuracy Promptness Survivability	Ability to Retarget Variety of Yield Options
Peer	Ability to Defeat Defenses Ability to Reconstitute Survivability	Ability to Signal Accuracy Promptness	Ability to Retarget Variety of Yield Options

Characteristics Matrix

Actors	Prevail Across Spectrum of Conflict		
	Tier 1 (most important)	Tier 2	Tier 3 (least important)
ANSAs	Ability to Retarget Accuracy Variety of Yield Options	Promptness Ability to Defeat Defenses	Ability to Reconstitute Ability to Signal Survivability
Regional	Accuracy Promptness Variety of Yield Options	Ability to Defeat Defenses Ability to Retarget Ability to Signal	Ability to Reconstitute Survivability
Near-Peer	Ability to Defeat Defenses Accuracy Promptness	Ability to Retarget Ability to Signal Variety of Yield Options	Ability to Reconstitute Survivability
Peer	Ability to Defeat Defenses Promptness Survivability	Ability to Retarget Ability to Signal Accuracy	Ability to Reconstitute Variety of Yield Options

At Lower Numbers

Many challenges identified:

- Preserving a small triad while maintaining desirable nuclear-related career paths
 - Much concern over bomber and missile legs
- Fewer people thinking strategically about nuclear weapons, potential scenarios for use and related force requirements
- Desire to modernize weapons, delivery systems and the complex while discussion of nuclear weapons is politically unpopular
- Danger of loss of allies' confidence
 - Due to perceptions about both capability and resolve

At Lower Numbers

Tensions within the community:

- Difficult to choose the most important qualitative characteristics of a reduced Cold War arsenal facing 21st century challenges
- Having a “usable” arsenal of low yield weapons versus high-kilotonnage weapons (“City-busters aren’t believable anymore”)
- No consensus on which characteristics are the most important so it is difficult to assess which leg could be lost in any movement toward a dyad

Bottom line:

- Without making careful strategic choices the US may end up with the systems that last the longest—and their inherent characteristics—rather than those best suited to deter, defend and assure in an evolving security environment

Qualitative Characteristics

Foundational Characteristics

- **Reliability** - The physical properties of the warheads and the mechanical properties of the delivery platforms perform as expected and effectively fulfill an assigned mission to destroy a given target
- **Safety/Security/Surety** - Materiel, personnel, and procedures that contribute to the safe and effective control of nuclear weapons, thus preventing nuclear accidents, incidents, loss, or degradation in performance
- **Sustainability** - The ability of a nuclear weapons complex to supply new warheads and delivery vehicles in response to force requirements and successfully maintain and/or overhaul existing warheads and delivery vehicles. Relevant factors include supply of fissile materials, mechanisms to test reliability of warheads and delivery vehicles, and infrastructure to design and build nuclear warheads and delivery vehicles to meet evolving mission requirements
- **Command and Control** - The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of missions assigned to nuclear forces. Requires communication between authorities and forces to be reliable and secure

Qualitative Characteristics

Variable Characteristics

- **Ability to Defeat Defenses** – The ability to penetrate active defenses and overcome passive defenses
- **Ability to Reconstitute** – The ability to reconstitute a larger and/or more diverse force via upload or regeneration of forces in reaction to operational or geopolitical change
- **Ability to Retarget** – The ability to change the desired point of warhead impact after the delivery vehicle is in flight
- **Ability to Signal** – System(s) provide the capability to visibly communicate intent through the escalation or re-deployment of forces for transparency and predictability
- **Accuracy** – The ability to deliver a strike sufficiently precise for the assigned mission; precision often measured as circular error probability (CEP)
- **Promptness** – The ability to rapidly deliver destructive effects upon a target following the decision to engage or attack
- **Survivability** – The ability of nuclear forces to absorb a first strike from an adversary and deliver a response
- **Variety of Yield Options** – The ability to deploy warheads of varying yields across the nuclear force, whether by adjusting yield of individual warheads or fielding delivery vehicles capable of carrying and delivering a range of warheads of different yields

Actors

Peer Competitor

- Nuclear forces are equivalent or greater to US
- Variety of fixed and mobile delivery systems, of which a large number can strike the US from its own territory with long-range systems
- Robust command-and-control system
- Can hold a range of US targets at risk in any contingency or conflict

Near Peer Competitor

- Nuclear forces are smaller than US, but can still strike the US from its own territory with long-range systems
- Variety of delivery systems with indigenous and independent infrastructure that is not dependent on third states for materials or engineering
- Degrading or destroying command-and-control would pose challenge to US
- Can damage US, but cannot hold its national survival at risk

Actors

Regional Power

- Nuclear forces are not at parity with US and cannot achieve in the short term
- Limited nuclear forces in which any long range nuclear systems is inaccurate, small in number, and not mobile
- Unsophisticated command-and-control system
- Can hold US allies and partners at risk in any contingency or conflict

Armed Non-State Actors

- Armed group that is separate and autonomous from any state government but may receive support in the form of arms, money, and resources from one or many
- Capable of mounting sophisticated military operations, but lack industrial and manufacturing base required to construct a nuclear weapon
- Acquisition of nuclear material or weapons possible via theft or the black market, but unlikely to acquire more than one or a small handful of weapons
- ANSA in possession of nuclear weapons would initiate planning for nuclear operation, but its use might not occur for weeks or months