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Pathways to Disaster: How Might a Nuclear War Start?

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Little real data on the dangers of nuclear war

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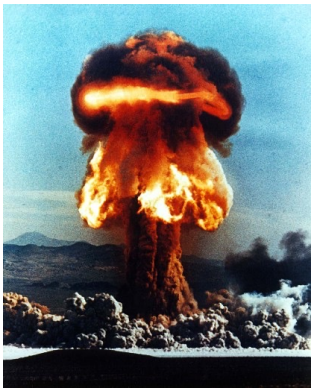
- Many assume the fearsome power of nuclear weapons will prevent anyone from using them
  - Risk of nuclear war vanishingly small
- But crises of the nuclear age – and wars of the pre-nuclear age -- suggest events can spin out of control
- What data or analysis could help us understand the most important dangers and how to reduce them?



Source: DOE

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Scenario 1: A Russian attack, and further threats against, Ukraine

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- Imagine:
  - Ukrainian forces strike deep into lands Russia has annexed (just what Putin has warned he would "certainly use all weapons available to us" to prevent); Russian forces reeling
  - U.S. intelligence receives information that Putin is considering – but has not yet decided on – using nuclear weapons to reverse the momentum:
    - Use 1-5 nuclear weapons on military targets, few civilian casualties
    - Then threaten to destroy Kharkiv, then other cities, unless Ukraine agrees to Russia's terms
- Attack purpose: coercion in offensive war
- Escalation risk: uncertain (use against non-nuclear-weapon state – but with the West heavily concerned)

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Scenario 2: Conflict on the Korean peninsula

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- Imagine:
  - A major North Korean provocation – e.g., shelling an island again
  - South Korea insists on striking back harder, to reestablish deterrence
  - North Korea uses ~6 conventional missiles against a U.S. airbase
  - ROK, U.S., begin an air campaign to destroy the DPRK's missiles
  - DPRK faces "use them or lose them" pressures – and an air campaign they might mistake for a prelude to invasion
- Purpose of possible use: defensive, regime survival
- Escalation risk: high

Source: Reuters

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Scenario 3: Escalation in South Asia

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- Imagine:
  - Major terrorist attack in India – India blames Pakistani group
  - India launches air strikes in response
  - Pakistan replies with air strikes
  - India launches limited conventional invasion
  - Pakistani forces with short-range nuclear missiles about to be overrun – do commanders fire?
- Purpose of potential use: avoiding defeat, avoiding deisure of nuclear weapons
- Escalation risk: high

Source: Wikimedia Commons

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Scenario 4: "Entanglement" in a U.S.-China conflict over Taiwan

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- Imagine:
  - China launches blockade of Taiwan
  - U.S. sends ships to supply the island and get supplies
  - China attacks the U.S. ships – 1000s killed
  - U.S. responds against Chinese ships
  - China begins attacking all U.S. naval forces in the region with ballistic and hypersonic missiles
  - U.S. attacks missile bases – also bases for nuclear missiles
  - China perceives the United States is trying to destroy its nuclear deterrent

Source: PopSci

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Scenario 4: "Entanglement" in a U.S.-China conflict over Taiwan (II)

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- In that circumstance, does China use some nuclear weapons – to damage U.S. forces and deter further U.S. attacks?
- Potential use purpose: "use them or lose them," deter attacks
- Escalation risk: medium

Source: US Navy via ReutersW

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All such conflicts likely to be complex, multi-domain affairs -- possibly multi-player

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- Future conflicts likely to involve many domains – land, air, sea, space, cyber
  - "Integrated," "multi-domain" deterrence still poorly understood
  - Will asymmetric responses – e.g., conventional strikes in response to devasting cyber – increase escalation risks?
  - A lesson of past crises: fog of crisis, misperception, events no leader intended…
- In multi-polar nuclear world, will others join in, or stay out?

Source: CSIS

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How might deliberate leadership decisions to use nuclear weapons happen?

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- Leaders might reach for the nuclear button when they believed they or their country would be <u>better off</u> after nuclear use
  - Use against a non-nuclear state without a nuclear ally
  - Use against a state whose forces were so vulnerable the leader believed a damage-limiting strike was possible
  - Use believing that the adversary would be deterred from a devastating response (e.g., "escalate to deescalate")

Source: USAF

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Categories of incentives for leaders to use nuclear weapons first

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- Preemptive – leader believes an attack is coming, strikes first
- Preventive – leader believes adversary is getting dangerous capabilities, strikes to prevent that
- Defensive – leader believes nuclear use is needed to protect the survival of the state/regime, or another vital interest (such as an important ally)
- Offensive – leader believes nuclear use will help secure an offensive victory
- Coercive – leader believes nuclear use will force an adversary to take a a desired action
- Force protective – leader faces "use them or lose them" pressure

Actions in each category have been planned or considered in the nuclear age…

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Beyond deliberate leadership decisions…

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- Unauthorized use
  - Field commanders might believe use was essential
  - Authority or capability might be pre-delegated to them
- False alarm
  - Deliberate decision, but mistake
- Escalation from accident
  - E.g., accidental detonation, accidental launch
  - More likely to lead to escalation if occurs in a major crisis or conflict – and more likely to occur then (Sagan, "Limits of Safety")

Source: Reuters xxx put in right picture

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A story to highlight the risks: Cuban Missile Crisis, sub B59

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- Unbeknownst to the U.S. Navy enforcing the "quarantine," Soviet *Foxtrot* subs were carrying nuclear weapons
- U.S. Navy began dropping "signalling" depth charges to force them to the surface
- On Sub B59, officers thought war had begun
  - No ability to communicate to Moscow
  - Temperature >>100 degrees, men passing out from lack of oxygen…
  - Captain ordered nuclear torpedo prepared for launch – Captain Vasili Arkhipov stopped it

Source: Olga Arkhipova

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Using pathway analysis to structure our thinking…

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One plausible pathway:

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Using pathway analysis to structure our thinking… (II)

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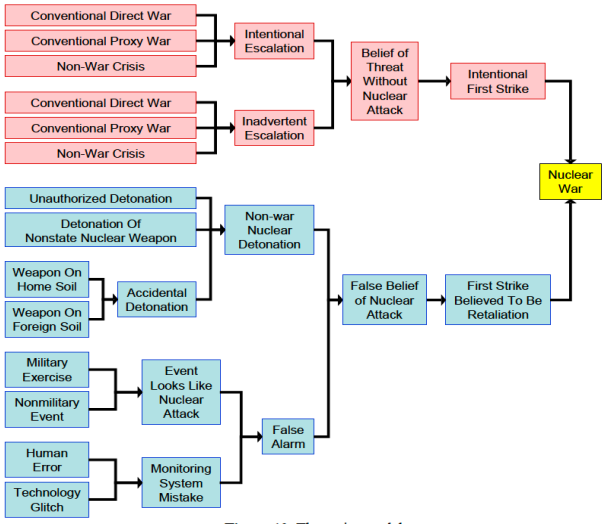

Seth D. Baum, Robert de Neufville, and Anthony Barrett, "A Model for the Probability of Nuclear War," Global Catastrophic Risk Institute, 2018

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We have very little data…

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"General, I have fought just as many nuclear wars as you have."

-- Alain Enthoven

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Some data could be collected, analyzed

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- Frequency of militarized crises between nuclear-armed powers, and between them and non-nuclear-armed powers
- Frequency, given militarized crisis, of escalation to conflict
- Key items without much real-world data:
  - Probability, given conflict between nuclear-armed powers, of escalation to nuclear use
  - Probability, given an initially limited use of nuclear weapons, of escalation to major strategic nuclear conflict
  - Probability, given conflict between nuclear-armed and non-nuclear-armed powers, of nuclear-armed power using nuclear weapons

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"Data for deterrence" – some sources

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- "Near-miss" data – past incidents
  - What factors made incident more or less dangerous? How have those factors changed, how might they change in the future?
  - What policies might address these factors?
- "Synthetic data" – war games
  - Many important games classified, some unclassified
- Non-nuclear historical data
  - Past failures of deterrence – causes
  - Past escalation to high levels of violence – causes
  - Risks, benefits, of multipolar vs. bipolar orders
  - Need to be very careful in considering how these non-nuclear analogies apply with nuclear weapons in the picture

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Another source of insight: Psychology and decision science

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- Psychology and decision science have advanced substantially in recent decades, and can surely offer some insight
  - What factors likely to be present during a crisis or conflict would increase or decrease the danger of rash gambles?
  - How will speed of decisions, torrent of information, suggestions from AI systems, other elements of the modern decision environment, affect the decisions that might be made – including at conflict levels well below "pushing the button"?
- Example: Loss aversion
  - Military leaders sometimes take desperate gambles to avoid a defeat
  - But how would "loss of country" aversion play into decisions?
- Can we design experiments that realistically capture key elements of the likely decision environment, or not?

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In short: we'll never really know, but there is potential to make some progress

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- Combination of all these methods can help build understanding of where the greatest dangers lie, how they might be reduced
- Pathway analysis and applied history, in combination, are likely the most important contributions
- But need to take insights and use them to better inform explorations of the implications of changing technologies and changing geopolitics

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Nuclear dangers are changing…

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- Geopolitics:
  - Radically increased U.S.-Russian and U.S.-Chinese hostility
  - Dramatic worsening from the war in Ukraine
  - Substantially increased Chinese power – including nuclear forces
  - Increased doubts over U.S. leadership, constancy → increased allied anxiety
  - Weakened arms control regime, uncertain future prospects
  - Dramatic expansions of North Korean nuclear, missile capabilities
  - Expanded Iranian nuclear bomb material production capacity
- Technology:
  - Missile defense, precision conventional, cyber, counter-space, hypersonics, artificial intelligence, disinformation, weapons autonomy…

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Russia's war on Ukraine has upended much of the international order

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- A UNSC member – charged with ensuring international peace and security – is waging large-scale aggressive war
  - Russia using nuclear threats to protect its offensive war
  - Weakened conventional forces likely to increase Russia's nuclear reliance
- A state that gave up the nuclear weapons on its soil in return for security assurances is being torn apart
- Impacts on security, food, energy are reverberating around the world

Source: Reuters

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But -- good news about nuclear weapons

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- No nuclear attacks for 77 years – remarkable success
  - In war games, few reach for the nuclear button
- ~80% of the world's nuclear weapons have been dismantled
- <5% of world's states have nuclear weapons – same as 35 years ago
  - No net increase in 3.5 turbulent decades – amazing success
- >50% of the states that started nuclear weapons programs gave them up
  - Efforts to prevent proliferation succeed more often than they fail
- >50% of the states that once had potential nuclear bomb material on their soil have eliminated it
- Nuclear material around the world is far more secure than it was 25 years ago
  - Most egregious weaknesses fixed – but more to be done

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The importance of presidential judgment

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- Cuban Missile Crisis:
  - Initially, Kennedy's advisors called for air strikes followed by an invasion
  - Kennedy pushed back, asking for another option
  - The recommended course might well have led to nuclear war
- Kennedy: Key lesson was always to offer the adversary a face-saving way to back down
- The world relies on sober judgment by the leaders of nuclear states

Source: JFK Library

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Backup slides if needed…

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Cuban Missile Crisis: The tale of sub B-59

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- Diesel sub, designed for northern waters, not the Caribbean
  - >110° on board – carbon dioxide high, sailors passing out
- Sub armed with a nuclear torpedo – physical capability to fire
  - U.S. Navy did not know it was nuclear-armed
- U.S. Navy using "practice depth charges" to force it to the surface
  - Those on sub believed war had begun, they were under attack
- Captain reportedly ordered nuclear torpedo prepared for firing – but then surfaces for air
- US aircraft fired tracer rounds, dropped flash explosives – captain paniced, ordered sub to submerge, prepare to fire
- *USS Cony* signals apology – and another captain aboard happens to see the signal because people got stuck going below

The fog of crisis can lead to disaster

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Questions we'd like data to help answer

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- What are the most dangerous pathways by which a nuclear war might start? What could we do to reduce their dangers?
- What characteristics of nuclear forces and policies (alert rates, command approaches, policies on when and how nuclear weapons would be used…) can provide deterrence with minimum risk of nuclear war?
- How can nuclear deterrence be "extended" to allies while maintaining minimum risk of nuclear use?
- What actions, done for deterrence or defense, might actually PROVOKE an adversary to use nuclear weapons?
- How will changing technologies, geopolitics, and a more multipolar world affect the various potential pathways to nuclear war?

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Another story highlighting the risks: 1961 Berlin Crisis, 1st Strike Plan

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- Khrushchev threatened to seize West Berlin
- Berlin could not be defended with conventional weapons alone
- If nuclear weapons were used, it seemed likely to escalate to strategic nuclear war – and the U.S. would be much less damaged if it struck first
- Carl Kaysen and Henry Rowen drafted a plan for a nuclear first strike – could destroy most Soviet nuclear forces with a limited strike, try to deter any retaliation
  - Discussed with Kennedy, JCS
  - "Fair probability" of a "substantial measure of success"

Sources: MIT, New York Times

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First-use threats are not just an abstract issue – U.S. has used repeatedly

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U.S. Nuclear Threats, 1945-2019	
1945: Hiroshima and Nagasaki	1969-70: Deterring Soviet attack on China
1948: Nuclear bombers to UK over Berlin	1969-72: Threats to North Vietnam
1950: Threat to respond to China in Korea	1971: Threats in Indian-Pakistani war
1953: Threat to force deal in Korea	1973: Nuclear alert in Arab-Israeli war
1954: Offer to French for Dien Bien Phu	1976: Threats to DPRK over fatal incident
1954-55: Threats to Chinese over Quemoy	1980: "Carter Doctrine" incl. nuclear threat
1956: Threat to deter Soviet action in Suez	1980: Threat to deter Soviet move into Iran
1958: Preparation to protect Kuwait oil	1981: Reagan reaffirms ME nuclear threat
1958-59: Threats over Berlin crisis	1991: Threats to Iraq
1961-62: Threats over Berlin crisis	1994: Threat to N. Korea
1962: Cuban missile crisis	1996: Public threat to Libya over CW
1968: Discussion of using for Khe Sanh	2017: "Fire and fury" threats to DPRK

Source: Ellsberg, *The Doomsday Machine*

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A first cut: 2 dangerous pathways

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- In a moment of intense crisis or conflict:
  - False alarm or major accident suggests nuclear war already underway
  - Conflict creates pressures to escalate to nuclear use
- The danger of escalation to nuclear use is higher if:
  - Leaders believe nuclear war is nearly inevitable
  - Leaders believe their country would be better off if they struck first
  - Leaders believe survival/sovereignty of their country (or their alliance system) is at stake in the conflict (even without nuclear use)
  - Leaders believe nuclear use could be controlled, all-out war avoided
  - Many fingers are potentially on the button
  - The conflict creates "use them or lose them" pressures
  - Decisions are made under extreme stress, with little time, with confusing (or wrong) information, by an individual or very small group

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