Background Data:
Nuclear Weapons, Missiles, and the Cuban Crisis
Randy H. Katz
CS Division, EECS Dept.
University of California, Berkeley
Spring 2005

The Atomic Bomb

• "The A-bomb ended the war, but radar won it."
• Aug. 1945: Single bomb destroys an entire city
  - Little Boy
    • Uranium bomb dropped on Hiroshima
      • 8900 lbs, 16 Ktons TNT
    - Fat Man
      • Plutonium bomb dropped on Nagasaki
      • 10300 lbs, 21 Ktons TNT

Offensive and Defensive Responses

• Longer Range, Faster, Higher Flying Bombers to deliver the bombs
  - March 1946: Strategic Air Command formed
  - B-52 first flies in 1954
• Bigger Hydrogen (Fusion vs. Fission) Bombs
  - Aug. 1949: First Soviet Atomic Bomb
  - Nov. 1952: First US H-bomb test (10 Mtons)
  - Nov. 1955: Soviet Union explodes their first H-Bomb
• OTH Radars and Defensive Lines
  - 1957-9: DEW (Distant Early Warning) Line
• Anti-Aircraft Missiles to intercept bombers
  - 1944: Design of Nike Ajax system

Ballistic Missiles:
Germany's V-2 Rocket

• Over 1000 fired at London towards end of WW 2
• Could destroy a city back—but very inaccurate
• 2700 killed, 6500 injured
• Psychological effect: Essentially no warning and no defense other than to destroy the launching sites
• What if you marry a nuclear warhead to a rocket?

Ballistic Missiles:
How to Intercept?

• Most vulnerable during boost phase
• Hard to intercept during terminal phase: "bullet hitting a bullet!"
• Also consider effects of nuclear air burst caused by interception—must be 20 mi up or more

Boost Phase
200 mi up
15000 mph
300 s

Midcourse Phase
800 mi up
20 minutes

Terminal Phase
5 minutes
Weird Logic of Nuclear Deterrence

- Massive Retaliation: Invade a little country, and we will destroy you—only works as a deterrent if the other guy has no nuclear weapons.
- Mutually Assured Destruction (MAD): "Whoever shoots first, dies second.
  - Sufficient counterforce that in matter what the aggressor does—
    even if he destroys a considerable number of the defender's missiles—
    it will still be able to simply threaten him with a first strike.
- U.S. No first use policy.

Strategic Triad/Flexible Response:
- Ground-based Missiles (ICBMs): arrive in 20-30 minutes
- Strategic Bombers: time to target 12 hours
- Nuclear Submarine (SLBMs): can lay in wait for days or even
  months while being submersed invisible and know that their home
  country has been destroyed.

Cuban Missile Crisis

- Cold War: Great power politics in Asia, Middle East, Africa, Latin America
  - Communist insurgencies and Soviet-leaning governments in N.
    Korea, N. Vietnam, Cuba.
  - E.g., U.S. response: CIA-supported Bay of Pigs invasion of Cuba
    (1961).
- Soviet fears of U.S. "Massive Retaliation"—How to reach
  parity with the Americans when USSR is so technologically
  far behind?
  - Soviet missiles of the time could only reach European cities
    from their launching sites.
  - U.S. deploys medium range missiles in Turkey in a highly
    provocative move (April 1962)—Soviets now fear a first strike!
- Soviet response: deploy own missiles into Cuba (September
  1962).

Soviet-Cuban Friendship

- Castro declares his country "Communist" after the
  Bay of Pigs
- Seeks protection from U.S. aggression
  through support of Soviet Union.

Cuban Missile Crisis

- Medium range missiles could reach Dallas or DC in 5
  minutes.
- Longer range missiles could reach virtually any major
  U.S. city.
- Soviets restores the MAD equation.
- U.S. what if their missiles could
  "decapitate" our ability to strike back?
  Mitigates MAD.

Land Based Missiles of the Cuban Missile Crisis

- U-2 Reconnaissance Plane
- Reconnaissance Photo
Thirteen Days

The Missile Game