

# The Atomic Bomb



Nuclear test at Bikini Atoll, Micronesia, July 25, 1946 as part of Operation Crossroads

1

## Manhattan Project

- Under direction of:
  - General Leslie Groves (right)
  - J. Robert Oppenheimer (scientific director of Los Alamos) (left)
- Involved nearly 130,000 people
- \$2 billion (\$30+ billion now)



2

- Some key aspects/events
- *Modern Marvels: The Manhattan Project* documentary
- June 1942: initiation of project
- First explosion (in secret)
  - July 16, 1945: Alamogordo, New Mexico
    - Trinity (“the gadget”): implosion-design plutonium device
- Two bombs dropped
  - August 6, 1945: Hiroshima
    - Little Boy (gun-type uranium-based device)
  - August 9, 1945: Nagasaki
    - Fat Man (implosion-design plutonium device)
- release of Smyth Report
- 1949: GAC report on hydrogen bomb



3

- theoretical insights
  - nuclear physics
  - feasibility of controlled fission / chain reaction
    - question of release of energy
- engineering
  - separation of isotopes
    - uranium-235 from uranium-238
    - gaseous diffusion vs. electromagnetic
    - plutonium model
  - trigger for bomb
    - gun model
    - implosion model
- materials
- organization
- industrial facilities
- secrecy

4

- Organizational innovations
  - federal government in science
    - how was this different?
  - massive funding
  - international collaboration
    - between 3 nations (U.S., UK, Canada)
    - how else?
      - significant contribution of immigrant scientists
  - networked science
    - multiple sites (Hanford, Oakridge, Los Alamos, U of Chicago, Columbia, UC-Berkeley, etc.)
    - growth of the “National Laboratories”
  - regulation of knowledge
    - massive secrecy
      - security clearances, disappearance of literature from public domain
  - multiple approaches simultaneously explored
    - Two types of bomb developed
      - Gun-type fission weapon
        - » Used uranium-235
      - Implosion-type fission weapon
        - » Used a plutonium core
        - » Uranium irradiated and transmuted into plutonium
        - » Plutonium then chemically separated from the uranium
    - uranium separation (U-235 from U-238)
      - multiple approaches to separation
        - » gaseous diffusion, electromagnetic separation, thermal diffusion

5



6

- First explosion (in secret)
  - July 16, 1945: Alamogordo, New Mexico
    - Trinity ("the gadget"): implosion-design plutonium device
- Two bombs dropped
  - August 6, 1945: Hiroshima
    - Little Boy (gun-type uranium-based device)
  - August 9, 1945: Nagasaki
    - Fat Man (implosion-design plutonium device)

