DIY Nukeproofing: A New Dig at "Data-Mining"

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DEF CON 23

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DIY Nukeproofing: Outline

- Why technologies like SILEX / AVLIS / MLIS are democratizing nuclear proliferation (FUD)
- Identifying risk and requirements to mitigate it
- Getting “shovel-ready”
- Taking “data-mining” very literally

Atomic Dominoes: Baryons to Bombs

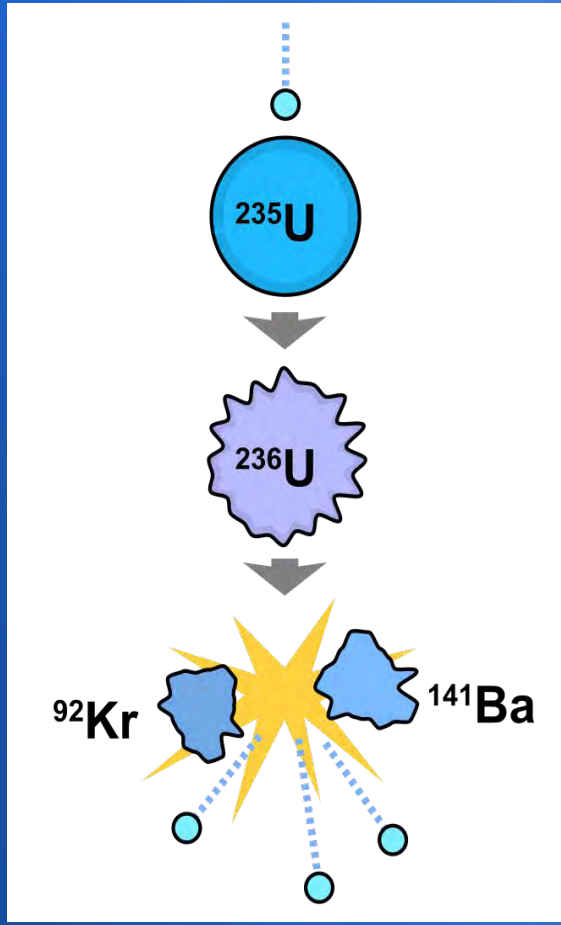
- Neutron discovered in 1932
- Fissile nuclei split when hit!
- **...and give off more neutrons**

such radiation

much explosion

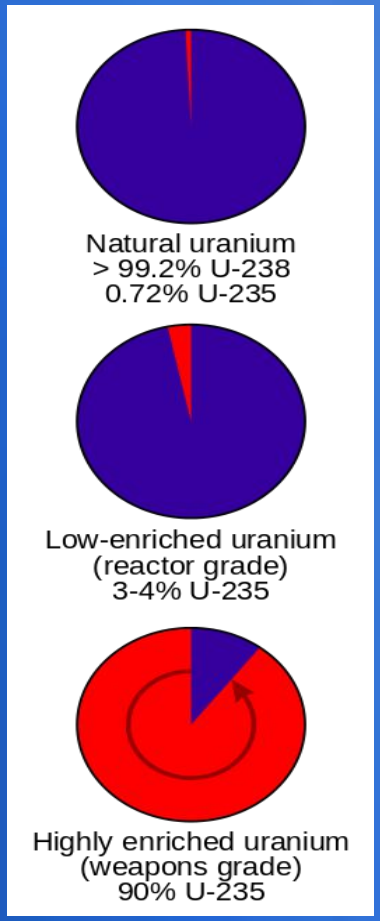
very fission product

wow



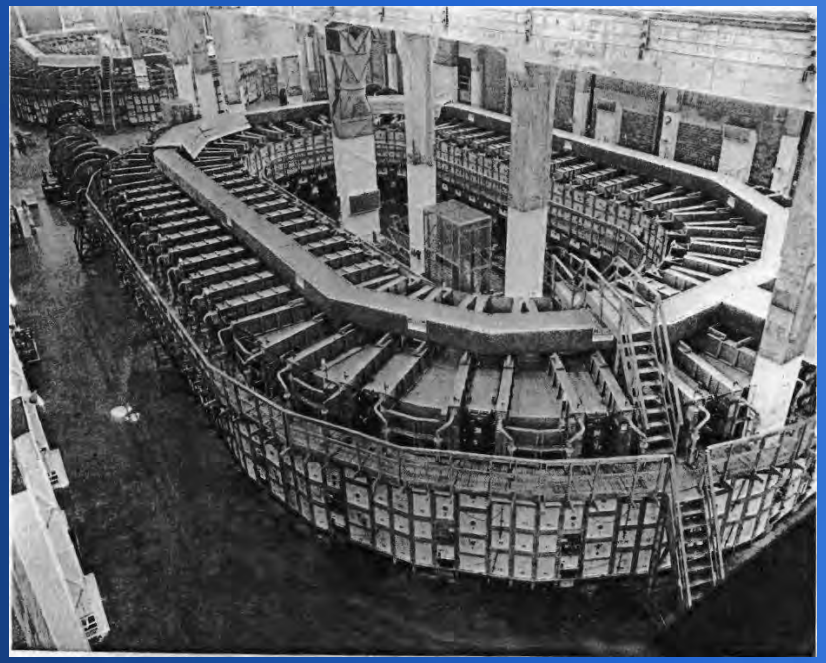
Pitchblende and the Manhattan Project

- Fissile material is not naturally occurring
- *...but pitchblende is, with up to 20% U*
- *Enter $26B of inflation-adjusted defense research and development during World War II*



Separation Anxiety

- Mining and refining proved to be easy (sort of)
- *...enrichment, not so much.*



- 13,300,000kg of Silver and nothing to show for it

Centrifuges proved practical...

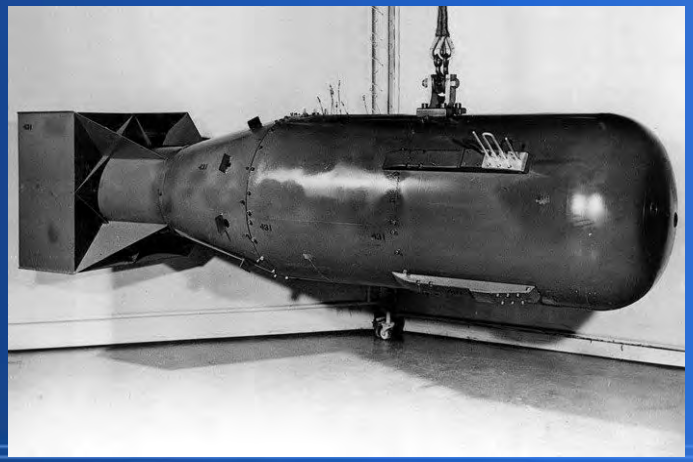
- Sort of, aside from needing 1,000s rotating near the speed of sound

- Has remained defacto standard for enrichment

It had some wicked deliverables...

- Plutonium implosion-type
- “Fat Man” 21kt, 14lbs Pu

- Uranium gun-type
- “Little Boy” 13kt 140lbs U



Little Boy's closest survivors...

- Eizo Nomura at 170m from ground zero in the basement of the Hiroshima Prefecture Fuel Rationing Union
- Akiko Takakura at 300m from ground zero in Bank of Hiroshima's Vault

Heating up the Cold War

- Teller-Ulam devices making use of ***tritium***
- Yields as high as 50MT (USSR)
- Lots of centrifuges spinning 24/7
- Ultimately we find a Nash Equilibrium...
- tl;dr MAD for Superpowers, why aren't all dead
- A whole lot of “hot” glass caverns left at the Nevada Test Site, data on blast protection

Loose Nukes

- Old bomb cores remain unaccounted for/lost
- Most thefts have been by small time criminals
- No recorded instances in bomb-size quantity
- Successfully smuggling strategy limited to submarines, tunnels, low flying drones
- Proliferation has *thus far* eluded non-state actors

Asymmetric Warfare: *The Mouse That Roared*

- Best Korea's Nuclear Necrocracy
- Skirting the lines of a “nation state”
- The smallest **known** nuclear program *to date*
- Kim Jong-Un's battle with Uric Acid
- ...poster-child of 21st century proliferation, “trickling down” to non-state actors

Laser Isotope Separation

- Ongoing clandestine development (AVLIS / MLIS / SILEX)
- Increasingly efficient processes
- Extremely compact by comparison
- Depreciates centrifuges
- **Greatly** reduces barrier of entry to proliferation
- Threat mounts with laser diode development

Systematic Decomposition of NUDET Protection

- Broad-spectrum radiation
- Blast over-pressure
- Seismic shock
- Fallout, decay products
- Secondary radioactivity
- Widespread conflagration
- *Potential* civil unrest

The Mineshaft Gap

- *The solution is below your feet... or can be*
- Civilian bunkers – newly popular in the '50s
- Switzerland – bunkers mandatory since '63
- Interest waned with stockpile reductions
- Resurgence after 9/11

Location, Location, Location

- Estimate nearby hazards/targets
- Use NukeMap for blast and radiation data
- Above the water table and/or in an aquiclude
- Avoid loose rock, sand, flood prone areas, etc
- Hard rock increases complexity, protection
- Clays offer high strength and plasticity

Determine Project Scope

- Primarily limited by time and money
- *Yes you can copy Cheyenne Mountain...*
- *...but not cheaply or quickly*
- For exercise and a hobby, keep it manual
- For speed, keep it under 2,000 ft^3 (56m^3)
- You can always *go deeper*...

Soil Stability

- *“I like my soil how I like my women, type A”*
- 4:1 benching without support
- Trench and tunnel support minimized
- Much easier to excavate than hard rock
- OSHA's “thumb test”
- **Extreme** care must be taken near karst, in sand

Don't forget to call 811

- Hitting a buried gas line will *probably* kill you
- Vacuum excavation for exposing utilities

Diggin', dig it up!

- Preferred excavation method varies
- Cut and cover is easier, compromises rock
- Shaft & Adit / Trench & Tunnel confined areas
- “Sortie rate” limits excavation, except hard rock
- Operating gas/diesel equipment underground

Excavation methods

- Think of it like a small mining operation
- Optimize Loading, Hauling, Dumping phases
- Type B&C soil require continuous support
- Fracturing type A soil: mattock, rotary hammer
- Fracturing soft rock: jackhammer
- Fracturing hard rock: hydraulic breaker hammer, blasting

Haulage

- In confined spaces, consider 5 gal buckets
- Wheelbarrows work well on shallow grades, can be winched uphill or vertically (headframe)
- Mini-loaders like the Toro Dingo fairly well work in long trenches with a shallow slope
- Continuous haulage systems are expensive

Headframes on Shafts

- Primarily used for mine shafts
- Well suited to replace a rental crane
- Ideal for operations with a small footprint
- Expect $400 total for ~500kg capacity DIY
- Ends up being the “limiting reagent” in sortie rate

Taking a Dump

- Disposing of spoil is usually expensive
- You can use craigslist and give it away
- Filling in nearby low lying areas is easier
- Keep in mind overall “sortie rate” in terms of tonnage efficiency

Temporary Support Systems

- Spot shoring is sufficient in hard soil/soft rock
- Large cracks and kettlebells are **extremely** dangerous, cracked dikes can be unstable
- On a small scale, wood falsework is practical
- Leveling jacks and schedule 40 pipe are great
- Remaining alert to ground deformation is critical

Permanent Support

- Glass fiber reinforced concrete
- 4” rebar spacing is ideal for NUDET protection
- Egg-shaped tunnels most collapse resistant
- Worst case scenario involves bedrock fracture
- Waterproofing is required below the water table!

Ventilation

- Breathing silicates **will** cause silicosis
- P100 respirator offers protection, taxing
- Wetting dust is an option, issues with humidity
- Tethered SCBAs are very effective
- If operating an engine, large blowers required
- Tape and LDPE sheeting is cheaper than ducts

Utilities

- Keeping a server online underground is easier
- Cooling generally not an issue in small scale
- Best to run waterproof conduit
- Battery operated sump pump for dewatering
- No substitute for a trash pump in a flood

Related Reading

- http://www.globalzero.org/files/gz_nuclear_weapons_cost_study.pdf
- http://thebulletin.org/silex-and-proliferation
- http://www.laserfocusworld.com/articles/print/volume-42/issue-8/world-news/laser-isotope-separation-fuel-enrichment-method-garners-ge-contract.html
- http://nuclearsecrecy.com/nukemap/
- http://www.smithsonianmag.com/science-nature/top-ten-cases-of-nuclear-thefts-gone-wrong-10854803/
- http://library.uoregon.edu/ec/e-asia/read/masonry.pdf
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