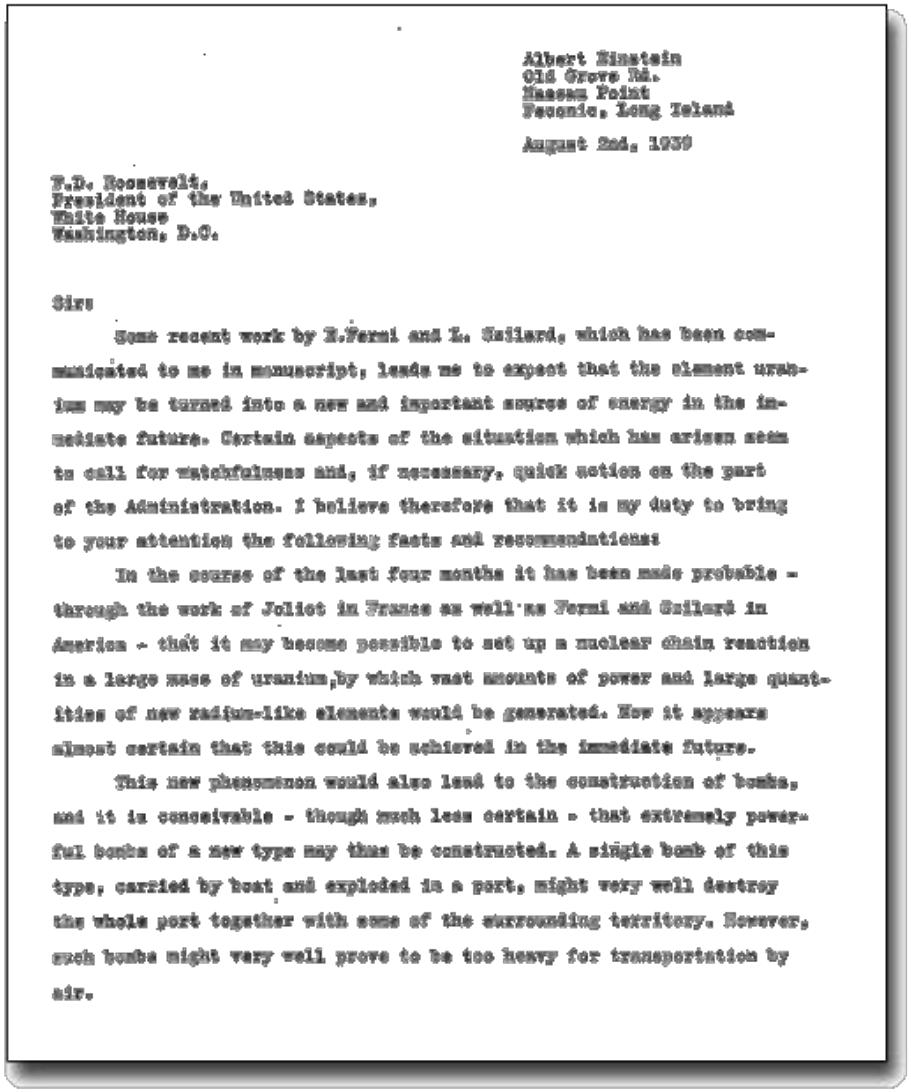
Oak Ridge: Still a Secret?

Vikings of the Smokies

October 16, 2022



Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd, 1939

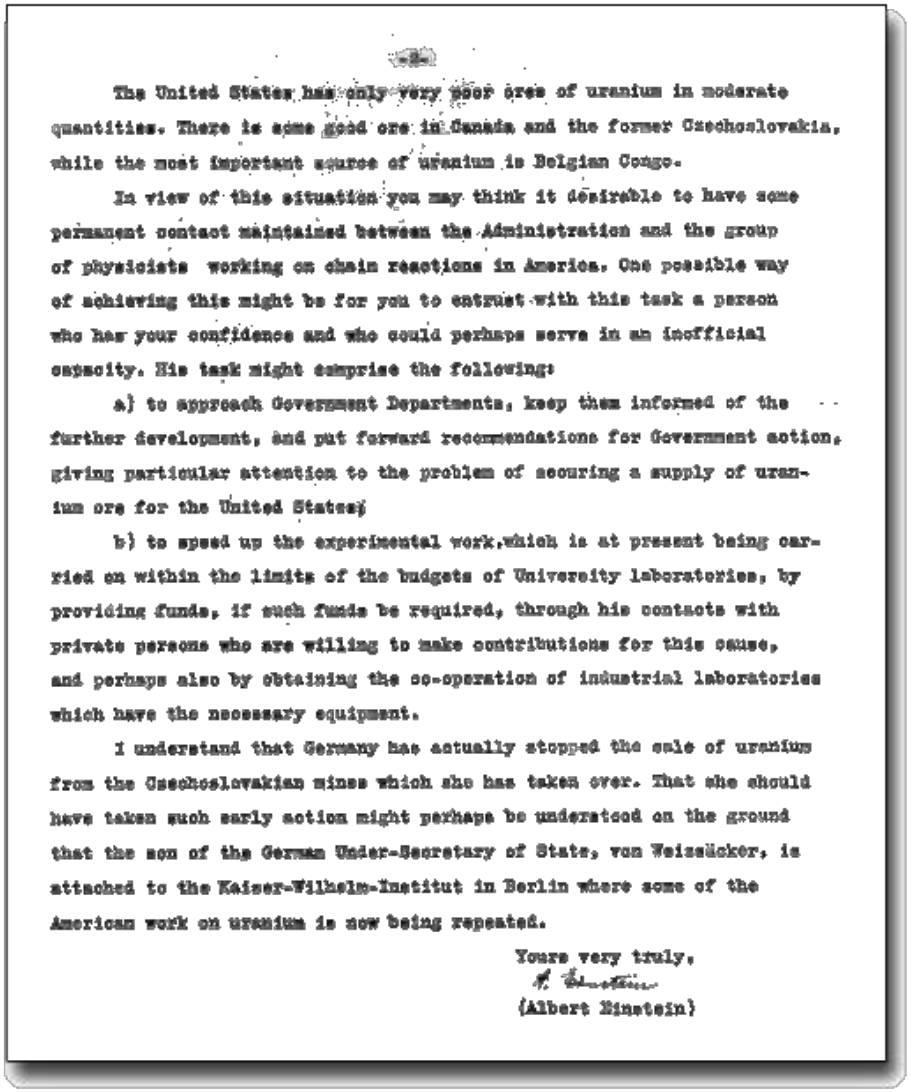
F.D. Roosevelt,
President of the United States,
White House
Washington, D.C.

Sir:

Some recent work by E.Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:

In the course of the last four months it has been made probable - through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction in a large mass of uranium,by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.



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The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source of uranium is Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an inofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States;

b) to speed up the experimental work,which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsäcker, is attached to the Kaiser-Wilhelm-Institut in Berlin where some of the American work on uranium is now being repeated.

Yours very truly,

(Albert Einstein)

Einstein's letter to President Roosevelt

August 2, 1939

Excerpts from Einstein Letter

- Some recent work by E. Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future.
- it may become possible to set up a nuclear chain reaction in a large mass of uranium by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.
- This phenomenon would also lead to the construction of bombs, and it is conceivable—though much less certain—that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.
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How Oak Ridge may have been chosen for the Manhattan Project

Senator Kenneth D. McKellar

While history books say the lay of the land and proximity to Norris Dam helped determine the location of Oak Ridge, what may be closer to the truth, is that when President Roosevelt asked Senator McKellar to help keep secret the funding required for the project, Senator McKellar is said to have replied, "Yes, Mr. President, I can do that for you… just where in Tennessee are you going to put that 'thang?'"

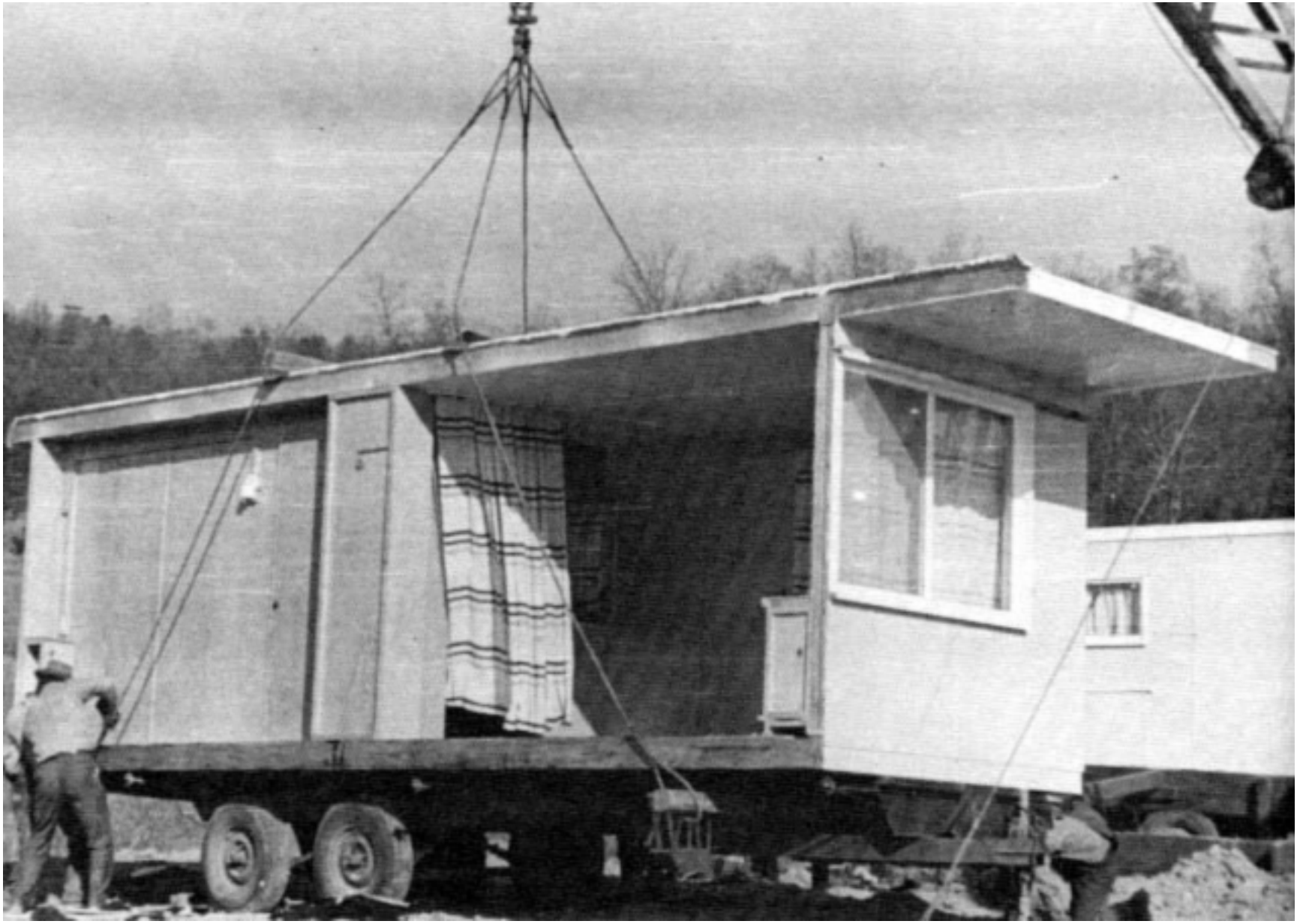
Manhattan Project

- Research and development project commenced in 1939 to produce atomic bomb
- Employed more than 130,000 people at its peak
- Cost ~$2B ($23B today) to build factories that produced fissile material
- Sites included Los Alamos, Hanford & Oak Ridge
- In 1942, U.S. government purchased 60,000 acres of farmland in Clinch River Valley for the development of a planned city supporting 75,000 residents…beginnings of Oak Ridge site

New Hope Community in 1942 (Entrance to Bear Creek Valley)

Tennessee Avenue in Oak Ridge

Highland View School and Flattops – Today's Children's Museum of Oak Ridge



Ninth largest bus system in the nation! 850 buses

Calutron (**Cal**ifornia **U**niversity Cyclo**TRON**)

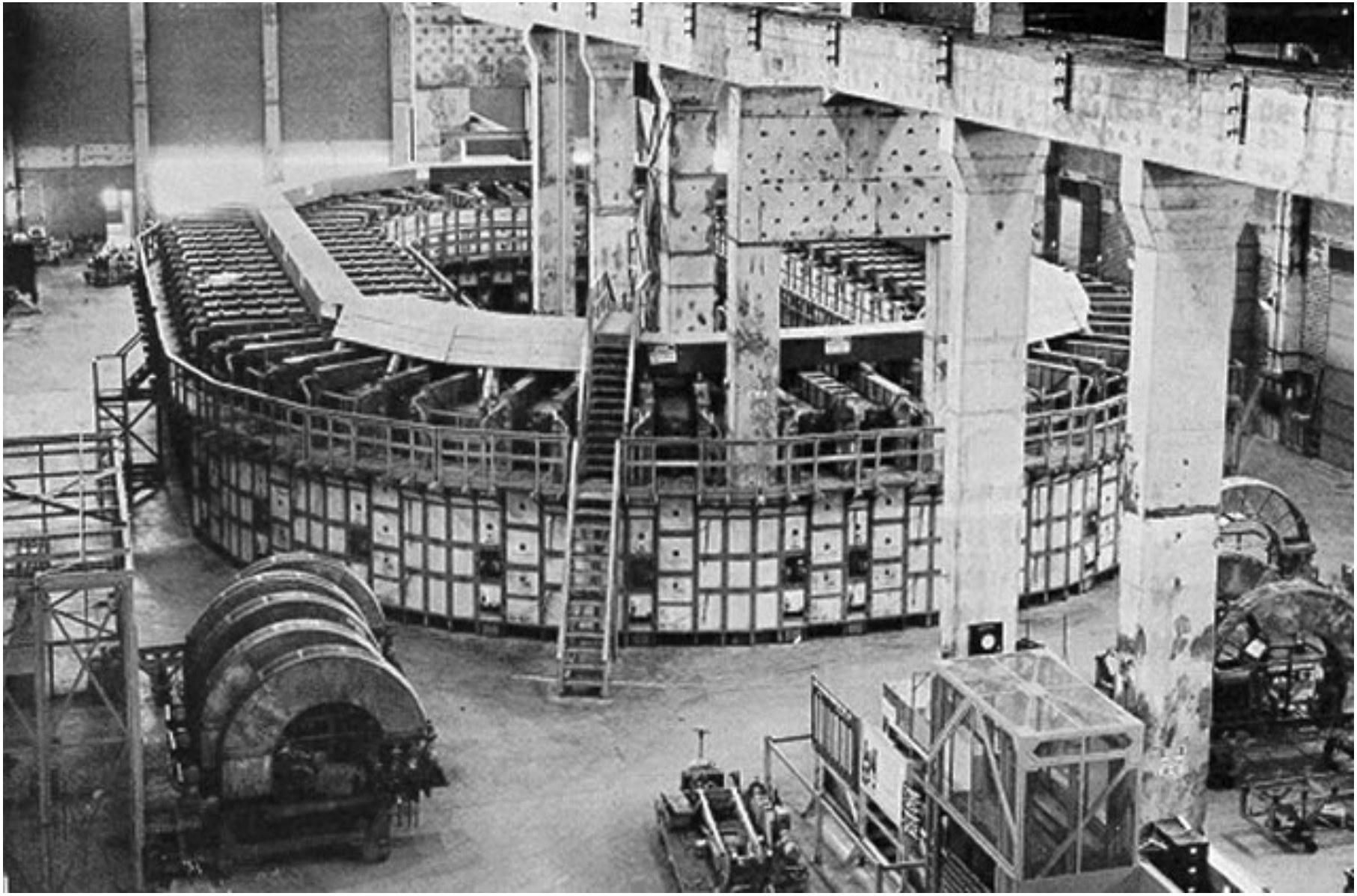
Ernest O. Lawrence

Invented by Nobel Laureate Ernest O. Lawrence, the Calutron was the giant mass spectrometer like equipment that separated the uranium used in Little Boy, the world's first atomic bomb used in warfare.

Note: Natural U is 99.3% U-238 and 0.7% U-235… nuclear fission requires U-235

Y-12: $480 million + 1,152 calutrons + ~4 million sq. ft. of floor space + 22,000 workers = 50 kg of U^{235}

Y-12 Electromagnetic Separation Plant - 1945



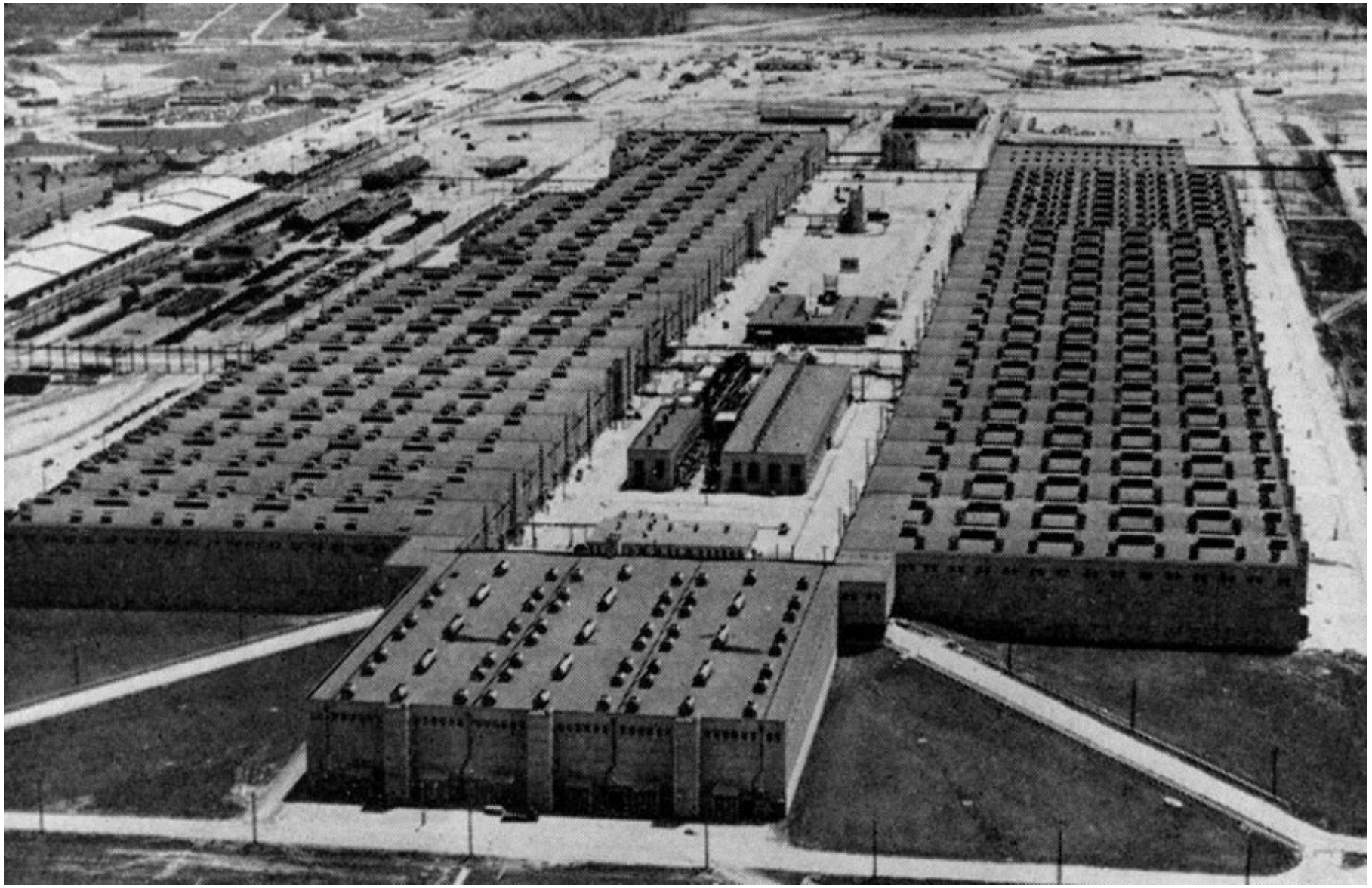
Alpha Calutrons stood 20 feet tall

14,700 tons of silver borrowed as electrical conductors because of a shortage of copper

Calutron Girls – hired by Tennessee Eastman Company right out of high school

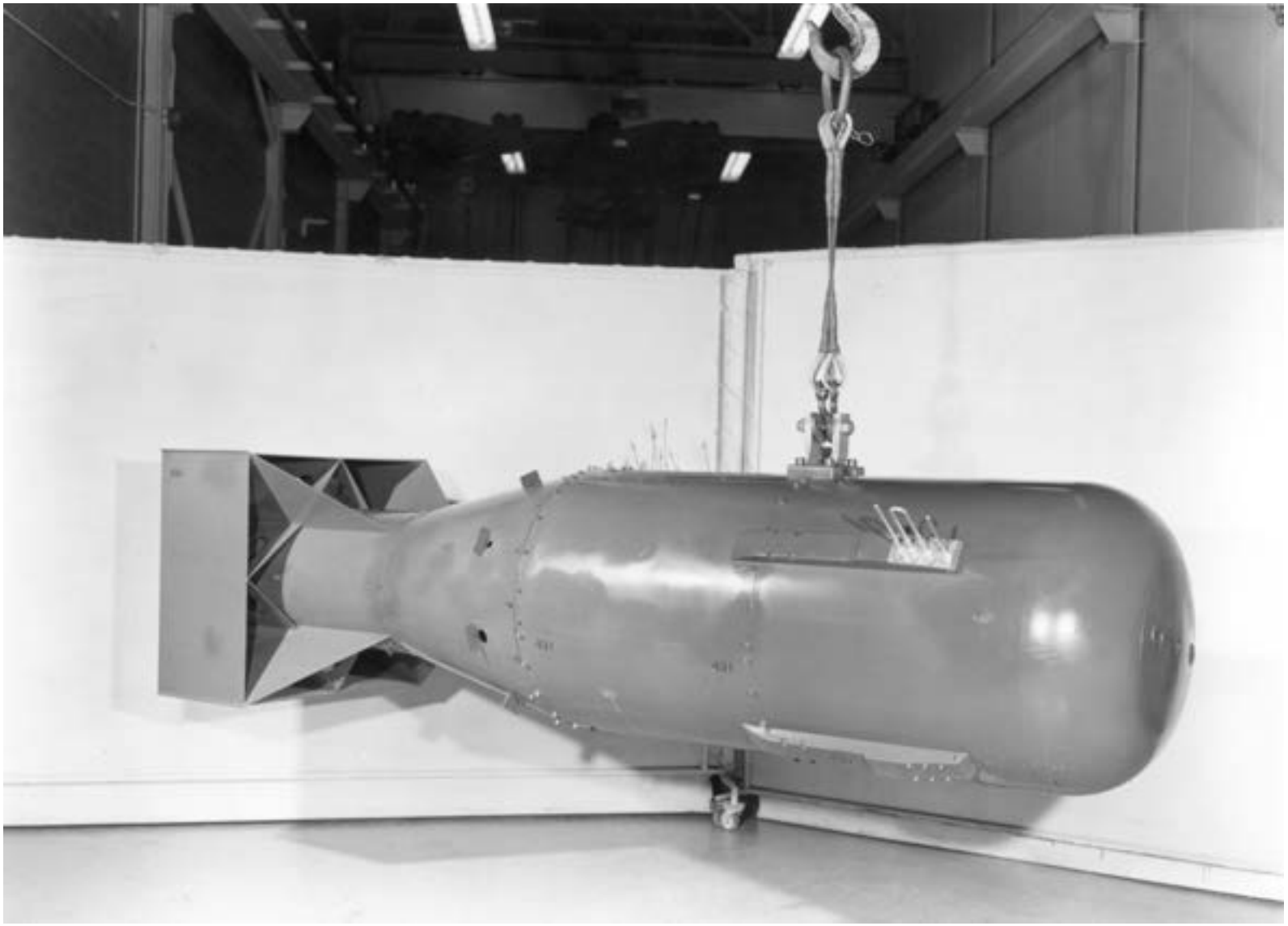
Ed Westcott's famous "Y-12 Shift Change" photo is a 20' by 50' mural at the Y-12 Cafeteria

Secrecy was important to the project



K-25 Gaseous Diffusion Plant – largest building in the world at the time - over 40 acres under one roof!

X-10 Graphite Reactor



Little Boy – world's first atomic bomb used in warfare – uranium came from Oak Ridge


WAR ENDS
EXTRA The Knoxville Journal EXTRA
TRUMAN REPORTS TO NATION

Post-War Oak Ridge

- Cold War next 40 years ensured Oak Ridge remained vital to US Defense mission (Y-12)
- Gaseous diffusion plants (K-25) produced U-235 for nuclear power & defense needs
- Oak Ridge National Laboratory (X-10) becomes Nation's leading scientific research center in many disciplines—nuclear reactor technology, medical isotopes, high-performance computing, materials, etc.

East Tennessee Technology Park

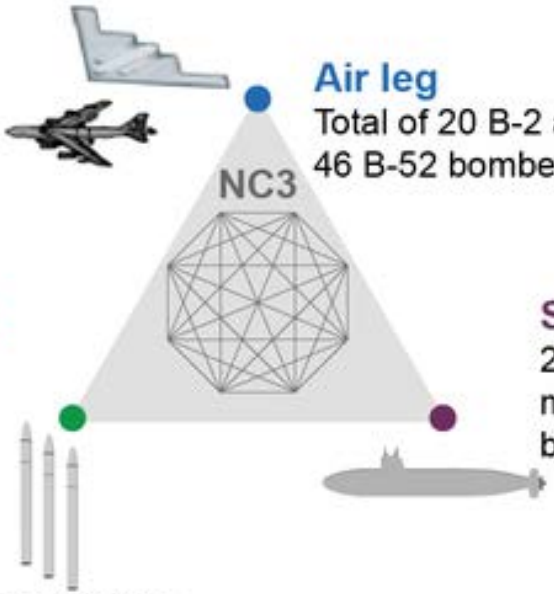
Y-12 National Security Complex


Oak Ridge National Laboratory

Today, Oak Ridge Federal Missions are Vital to U.S. Interests

- Y-12 National Security Complex
- Oak Ridge National Laboratory
- Oak Ridge Reservation Cleanup

Nuclear Deterrent Comprised of Sea, Land, and Air Legs—Nuclear Triad



NC3 = Nuclear Command, Control, and Communications

Source: GAO presentation of Department of Defense information. | GAO-21-210

Y-12 National Security Complex

- Y-12 is unique national asset in the manufacture, processing and storage of special materials vital to our national security—and contributes to the prevention of the spread of weapons of mass destruction
- More than 6,000 Tennesseans work at Y-12, including federal and contractor staff
- Y-12 has three primary national security missions:
  - Maintaining the U.S. nuclear stockpile
  - Reducing global threats
  - Fueling the U.S. Nuclear Navy

Maintain Safety and Security of the U.S. Nuclear Weapons Stockpile

- Production—manufacture of new components, which may be combined with recycled components into subassemblies
- Refurbishment—extends the lifetimes of systems in weapons stockpile; ensures their effectiveness
- Surveillance testing—determines how weapons in the active stockpile are aging
- Dismantlement—separating components of retired weapons and recovering nuclear materials

Reduce the global threat posed by nuclear proliferation and terrorism

- Y-12 secures vulnerable nuclear materials domestically and internationally—activities encompass detection, removal, and security of nuclear material
- Y-12 safely secures materials (from all over the world) and transports them to Y-12 for storage or disposition
- Y-12 works globally to ensure materials are appropriately protected through training of those charged with its protection

Provide feedstock to fuel the U.S. Nuclear Navy

- Y-12 provides highly enriched uranium (or feedstock) used in the fabrication of fuel for reactors in the Navy's nuclear-powered aircraft carriers and submarines (under agreement with NNSA's Naval Reactors Office)

Oak Ridge National Laboratory

- World-class research strengths:
  - High-performance computing
  - Neutron science
  - Advanced materials/manufacturing
  - Nuclear science and engineering
  - Isotopes
  - National security
- Annual budget ~$2.4 B with staff of 5,700

Oak Ridge National Laboratory Campus

World-Class User Facilities and Research

- Frontier is most powerful supercomputer in the world as of May 2022 (first exascale machine)
- Spallation Neutron Source: accelerator-based neutron source facility provides intense pulsed neutron beams for materials research
- High Flux Isotope Reactor: produces medical- and industry-grade isotopes (Ac-227 for treating cancer; Pu-238 for NASA space missions)

Oak Ridge Reservation Cleanup

- Environmental cleanup of DOE's Oak Ridge Reservation 3 main sites: Y-12, ORNL, and ETTP (former K-25 plant)
- UCOR cleanup mission:
  - Remedial actions at ETTP
  - Cleanup of excess facilities at ORNL and Y-12
  - Construction and operation of new on-site disposal facility, Environmental Management Disposal Facility (EMDF)

East Tennessee Technology Park...Reindustrialized Following Successful Environmental Cleanup

Cleanup nearly complete at one site, two to go

- 1st in the world to remove an enrichment complex
- Highly skilled and experienced workforce now focused on cleanup at ORNL and Y-12
- Working collaboratively with other DOE programs and contractors

Cleanup in Oak Ridge is driving economic opportunities—e.g., advance nuclear reactor technology

VISION: HERITAGE CENTER

Deliver prime industrial park space, historic landmarks, and conservation areas

VISION: ORNL

Deliver restored land to support redevelopment and modernization efforts

VISION: Y-12

Prepare land for beneficial reuse to advance defense and security missions