Is China Thermonuclear?

Analysis of things said and unsaid shows China at, if not already over the brink.

Analysis of Red China's fifth nuclear explosion indicates that she may be on the verge of producing a usable H-bomb, if she hasn't already done so. The U.S. Atomic Energy Commission knows, from analysis of debris, how close to membership in the thermonuclear club the December 27 blast carried the Chinese. But considering full disclosure to be "design information," AEC won't say.

Two phrases and a significant omission in the latest AEC statement, however, give important clues to the point which the Chinese program has reached. And it seems to be far along.

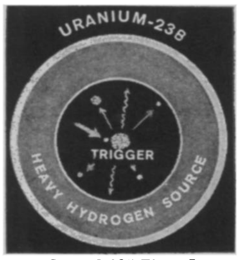
China has already gone through virtually all of the preliminaries to full thermonuclear status. Here's how it works:

• The first step in producing a hydrogen bomb is to develop a straight fission bomb, such as was dropped on Hiroshima. In a fission explosion, enough uranium 235, which emits neutrons radioactively, is brought together to split the uranium atoms and emit further neutrons to continue the process. The energy released in splitting the atoms produces the explosion. China has done this three times.

• The tremendous heat produced by a fission explosion of heavy atoms can be used to join lightweight atoms principally two isotopes of hydrogen, H-2 and H-3, to form helium. This joining, or fusion, also releases energy. China has done this twice, though not as well as thermonuclear powers do.

Unlike a fission reaction, which requires a minimum amount of fuel to cause an explosion, fusion can take place with any amount of fusion material. If only a small amount of hydrogen is fused, less energy is produced by the fusion than is absorbed from the fission reaction which started the process. Too much fusion material makes the device unwieldy; it may smother the reaction unless an enormous fission trigger is employed or further refinements are made to make a fusion bomb of reasonable dimensions.

Another isotope of uranium, U-238, provides the means of streamlining the thermonuclear bomb. This isotope, which is much commoner than uranium 235, does not easily fission, but it can be caused to split if struck by extremely fast-moving neutrons. The fusion of hydrogen produces such neutrons. If the fusion shell around the trigger-core of U-235 is surrounded by a jacket of U-238, then more fission occurs and more energy is released. And that secondary fission is the real muscle of the hydrogen bomb.



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Fusion device.

Another refinement in producing a hydrogen bomb lies in the means of supplying fusion material. While Hydrogen 2, also called heavy hydrogen or deuterium, is fairly common, H-3 or tritium, must be produced at considerable cost. One method of supplying tritium to the fusion process is to include an isotope of the lightweight element lithium in the bomb. Lithium can be made to decay into tritium under proper conditions.

The form of lithium used in the fusion process is important in determining the sophistication of a developer of thermonuclear bombs.

Lithium 6, a rare, costly form of the element, is relatively easy to convert into tritium. It can be converted by slow-moving neutrons. Lithium 7, however, a much more common and less expensive isotope, requires very fast neutrons and is harder to use.

The use of Li-7, added to the employment of secondary fission of U-238, constitute a major step in developing a hydrogen bomb, deliverable by a rocket or an airplane.

How far along this road are the Chinese?

• Their first two explosions, in October 1964 and May 1965, and the fourth last October, were simple fission bombs using U-235, about the size of the Hiroshima bomb—equivalent to 20,000 tons of TNT.

• The third explosion, in May 1966, was much larger, about 200 kilotons, and contained fusion materials, including lithium 6. It was a sign that China had still some distance to go to a sophisticated, lithium 7 device.

But the latest test was the largest yet, estimated at 300 kilotons. To produce such a large explosion by fission alone would use at least 120 pounds of precious U-235, a very uneconomical procedure. More significant, not only did the AEC disclose that the bomb "included thermonuclear material," but it also "contained U-238 . . . as fissionable materials," the key to high yield and low weight.

What the Commission's scientists refused to say this time, however, may be even more significant.

Despite the fact that AEC was willing to discuss the fusion contents of the cruder Li-6 bomb detonated last May, it declared such information "design information," and unavailable, this time.

The likelihood is, however, that the latest Chinese bomb was, in fact, an Li-7 bomb, indicating, despite AEC reticence, that another technical problem has been solved by Chinese engineers.

The other piece of information AEC is withholding is whether or not the Dec. 27 device was in fact a thermonuclear bomb, rather than a device containing thermonuclear materials.

According to a prominent physicist, "of course they know, and they ought to say; the Chinese already know, don't they?"

The difference is a matter of numbers.

A way of judging the efficiency of a hydrogen bomb is to measure the proportion of energy produced by fusion as compared to that produced by fission. In a full-sized hydrogen bomb, the fusion portion varies from half to two thirds of the total energy released.

However, if only 10 percent of the yield comes from fusion, the bomb may be considered a fledgling, but not quite a full-fledged hydrogen bomb.

The Chinese test explosion did include some fusion, as indicated by the fact that U-238 was fissioned. And AEC knows if it passed the magic 10 percent mark, and by how much, from analysis of the debris.

But as long as the AEC refuses to expand on the statement, "included thermonuclear material," only the Chinese and some Soviet and Western officials know for sure if China has achieved 10 percent fusion and is numerically less than thermonuclear, or has achieved higher fusion yield, and is now a member of the club.