



*In the bubble chamber's control room: John Stoffel, J. Fogelson, William Fowler. (Below) External view of bubble chamber.*

Photos: NAL

## Largest bubble chamber to track small particles

Bubble chambers are one of the prime means physicists have to visualize the behavior of subatomic particles. Bubble chambers keep getting bigger and bigger in order to see more and more, and now the world's largest liquid-hydrogen bubble chamber, 15 feet in diameter, has been dedicated at the National Accelerator Laboratory at Batavia, Ill.

A bubble chamber is a device in which liquid is kept under pressure. The pressure is maintained by a piston that can be released suddenly. When the pressure is released, boiling starts, and bubbles form at various points in the liquid, especially along the paths of electrically charged particles. The tracks of bubbles can be photographed. Because the bubble chamber is in a magnetic field, the tracks curve, and from those curves the mass and velocity of the particles can be computed. The liquid in a bubble chamber serves both as target for an incoming beam of accelerated particles and as a recording medium for the events that happen. Thus collisions occur in the chamber, and their results are recorded in it. The larger the chamber, the more can be seen.

NAL's bubble chamber, under construction for the last three years, has cost about \$7 million. This represents less expense than comparable bubble chambers built recently. Among the important money-saving features was the elimination of iron in the magnet, which is a superconducting magnet built at the Argonne National Laboratory in Argonne, Ill.

The group that oversaw construction was led by William Fowler. Russell Huson and George Mulholland also played important roles in design and



construction of the new chamber.

The new chamber is located at the end of the NAL Neutrino Line, an experimental area that extends more than a mile and a half from the point where it leaves the accelerator's main ring. One of the new chamber's chief uses will be to look for interactions between neutrinos and matter in the chamber. □

## Tightening the guard to prevent uranium thefts

The theft of nuclear fuel material by terrorists or criminals intent on extortion is a fearsome possibility in a society where such materials are continually stored and moved about. This week, the U.S. Atomic Energy Commission announced new rules for the keeping and transporting of nuclear materials.

The rules include increased requirements for the guarding of storage places and the searching of all vehicles, persons and packages entering and leaving

such areas. Shipments of plutonium and highly enriched uranium would have to be accompanied by armed guards, and truck drivers would have to telephone dispatchers at regular intervals to assure that they had not been hijacked.

The rules are intended more for the future than the present, say AEC officials. The changes look forward to a time when there will be many breeder reactors in operation and the transport of plutonium and enriched uranium will be necessary. The transport restrictions, for example, apply only to two percent of current shipments. By the end of the decade the new rules should cover 50 to 75 percent of shipments.

The rules apply mainly to AEC contractors, not to the agency's own installations. Officials denied that the new rules were in response to current political developments in the Mideast. They have been in the works for nine months, and were published in February. Now, after some revisions as a result of comments by interested parties, they are being promulgated and will go into effect in a month. For its own installations, the AEC reportedly has ordered its guards to shoot to kill. Questioned about that, officials would only say that when you have armed guards, you expect them to use the arms in appropriate situations. □

## Carnegie Commission's final report on education

Trouble on college campuses in the mid-1960's prompted the formation of the Carnegie Commission on Higher Education, whose task was to appraise higher education and suggest guidelines for future development. Since 1967 the commission has produced nearly 100 publications and 22 major reports. Last week the final report was issued and commission chairman Clark Kerr put the commission out of business on an optimistic note. "Our general view," he said, "is that higher education has gone through its greatest time of trouble since the founding of Harvard in 1636."

The commission avoided the question of the content of education but did make a variety of recommendations in other areas. Financial aid, for instance, should be made available to ensure that no student has to give up on higher education. Flexibility in enrollment should allow students to attend school all year and earn degrees in three years. Reform of tuition procedures at tax-supported institutions should make upper- and middle-class students bear a greater share of the cost. And, finally, hiring practices should be reformed to increase the percentages of women and minorities on faculties. □