altitude is not of vital concern. Good flying weather is estimated to average two days a week. While a ground party from Gulkana would require a hiking time of about a week to reach the summit, it could be flown three-quarters of the distance in a day's operation, one man at a time, plus supplies, even on a day when the upper parts of the mountain were covered with clouds. Gulkana is on the highway connecting Fairbanks with Anchorage, and is about 220 and 170 road miles respectively from these cities.

Some factors are common to all the Alaskan peaks. The geomagnetic latitude lines curve in such a way that all peaks considered here are within half a degree of each other. Also, because the air column above the peaks is on the average colder than in the U.S., the pressure at 14,200 feet (Mt. Evans) in Colorado corresponds to that at about 13,400 feet in Alaska; 10,800 feet (Echo Lake) in Colorado correspond to about 10,300 feet in Alaska.

From these studies we conclude that the Wrangell group is the easiest on which to install and maintain an observing party or high altitude station; Hayes is next and McKinley is the most difficult and expensive. An expedition to the latter would appear to be justified only if the last few thousand feet of ultimately attainable altitude was essential. Moreover, it seems to the author that Dr. Moore has conclusively demonstrated that a party can be brought in, supplied and maintained by air, and that air operations can be successfully carried out at altitudes not hitherto considered possible. Numerous Alaskan "bush-pilots" are available on charter basis to support such an operation.

The significance of this exploratory work is that it demonstrates that a party can be landed on a peak, at or close to the station which they will occupy, by air. It can also be supplied by air, and five trips, requiring less than a full day, will enable a ton of equipment and supplies to be delivered. Once or twice a week the party can be visited, additional supplies delivered, and personnel rotated and evacuated when the research is complete. In a day's flying time, it is possible to place on the mountain a party, fully supplied, instead of having to depend on weeks of overland lugging by porters. As compared to the salary budget of such personnel, the cost of air support is modest indeed. This kind of air support saves weeks of labor and much expense.

Previous experiments in air support involved large transport planes of the Air Force making drops. Personnel cannot ordinarily be landed this way; and indeed only occasionally can such an operation be arranged at all. It is also true that large Air Force transports, assisted by JATO, have landed on the ice in connection with the Juneau Ice Field Research Project, but the cost of such an operation is probably two orders of magnitude greater than ours. The mechanical features making our work possible were (a) an engine more powerful (125 hp) than the usual engine (75 hp) of a Piper Cub, and (b) a ski-wheel combination landing gear which enabled us to land at will on ice or on hard ground.

# News and views

## Two New Computers

### At Princeton and Los Alamos

Descriptions of two closely related electronic digital computers, one at the Institute for Advanced Study at Princeton, New Jersey, the other at the Los Alamos Scientific Laboratory in New Mexico, were made public for the first time in June. Both are designed to perform very high speed calculations in pure and applied mathematics and in mathematical physics.

The Institute's machine, which has been a work in progress for the past six years, is actually the prototype for the Los Alamos computer and for various other machine developments, including two more for the AEC and one which was recently completed by the University of Illinois for the U. S. Army Ordnance Corps Ballistic Research Laboratories at the Aberdeen Proving Ground. Prior to the Institute's public announcement the Princeton machine had successfully completed a number of quite extensive problems. One of these was a large calculation of about twenty million multiplications to test a conjecture of the famous 19th century mathematician, E. E. Kummer, which had never been established. The machine did this work in six hours. Two considerably shorter astrophysical problems (each requiring the solution of three simultaneous differential equations) and a number of cubic diophantine equations were calculated. In addition, work was done on several twelve-hour meteorological predictions covering the continental United States, each amounting to about 800,000 multiplications and requiring about one hour of continuous computing time.

Data can be fed into each machine in either decimal or binary form, but the instrument proper carries out the calculation in the binary number system since it is more convenient electronically. Each number handled by the machine consists of a sign and 39 binary digits which are equivalent to a decimal number with a sign and approximately 12 decimal places. It produces 2000 multiplications, 1200 divisions, or 100,000 additions per second. Each machine consists of an arithmetic system which carries out these processes, a control system which executes the instructions given the machine, a memory system in which both the numerical data of the problem and the instructions which characterize the problem are stored, and an input-output system which intervenes between the human operator and the machine. The memory, which is capable of storing 1024 numbers of forty binary digits, is a system of forty cathode ray tubes, based on an invention of F. C. Williams in Manchester, England.

The Institute's machine was created under the direction of John von Neumann, who with Herman H. Goldstine worked out the mathematical and logical design. Julian Bigelow was responsible for the engineering design. Initial sponsorship came from the Research and Development Service of the Ordnance Corps, U. S. Army. The project has continued under the joint sponsorship of that agency, together with the Office of Naval Research, the Navy, the Air Force, and the AEC.

The Los Alamos computer, which has been under construction for the past three years, was designed and built by a small group headed by Nicholas Metropolis with James H. Richardson as senior engineer. The Los Alamos Laboratory is operated by the University of California for the Atomic Energy Commission.

## Brookhaven Breaks a Record

### Cosmotron Passes Two Billion Volt Mark

On June 10th Brookhaven National Laboratory's recently completed synchrotron made history by producing a proton beam with an energy of 2.25 billion electron volts, or roughly five times greater than that of the previous record-holder, the 170-inch synchrocyclotron at the University of Chicago's Institute for Nuclear Studies (see the article by D. E. Nagle, *Physics Today*, June 1952).

The farthest advanced of several particle accelerators of the bevatron class now in varying stages of completion here and abroad, the Brookhaven instrument has been under construction since 1949. Its 2200-ton iron magnet was installed early last year, and for the past several months the Brookhaven staff has been occupied with exhaustive testing of the accelerator components. The process of tuning up the assembled machine began last March when protons were first fed into the vacuum chamber by a 3-Mev Van de Graaff generator provided for that purpose. The big machine, termed the "cosmotron" because it accelerates protons to velocities comparable to those found in the cosmic radiation, is undergoing further tests and evaluation at the Atomic Energy Commission's Upton, Long Island, laboratory, and it is expected that the instrument will not be in final operation until sometime this fall.

Designed to accelerate protons to energies approaching three billion electron volts, the cosmotron will be used to study proton-nucleon interactions and is expected to provide an important source of mesons of varying kinds. Among the first investigations to be conducted when a beam of protons of the intended energy is available for research purposes, it has been reported, will be a search for events indicating the presence of artificially-produced V-particles. These particles, which have been discovered only rarely in cloud chamber photographs of cosmic-ray events, carry no charge and are evidently several times heavier than any other known cosmic-ray particles.

Other proton synchrotrons designed to operate in the energy range above one billion volts are under construction at the University of California at Berkeley and the University of Birmingham in England.

## The Oak Ridge Swimming Pool

### Low Power, Low Cost Research Reactor

Development of a relatively inexpensive, low power nuclear reactor, unique in that it is submerged in water to protect operators from radiation, was announced on May 19th by the Oak Ridge Operations Office of the U. S. Atomic Energy Commission. The reactor, pioneered and developed by scientists at Oak Ridge National Laboratory, is the central feature of a bulk shield testing facility which is used for experiments to aid development of improved reactor shields. Popularly known as the "swimming pool", according to the AEC, the reactor is submerged in a pool of water 20 feet deep, 20 feet wide, and 40 feet long, in which it can be moved about. The reactor became "critical" on December 17, 1950, and was placed in operation soon afterward. The entire facility was constructed for less than $250,000, exclusive of fuel. Of this amount, the reactor core itself cost only $58,400, the rest of the cost being for concrete work, the building, and auxiliary equipment. The reactor uses fuel elements that had already been designed for the materials testing reactor in Idaho. The swimming pool reactor has a continuous, full load power rating of 10 kilowatts, at which it produces a maximum flux of approximately $10^{11}$ thermal neutrons per square centimeter per second.

The reactor is an assembly of movable fuel elements placed on end in an aluminum grid. It is suspended by an aluminum framework from what is called the reactor bridge, which spans the pool. The bridge rests on wheels fitted to rails along either side of the pool, so that the reactor can be moved along a center line the length of the pool. Similarly, an instrument bridge spans the pool and operates on the rails. A steel framework attached to the movable mechanism of this bridge extends nearly to the bottom of the pool. Using a carriage that slides up and down on the framework, operators can place test instruments at any point in the pool.

A useful feature is an aluminum gate, 12 feet high and 21 feet long, 10 feet from the south end of the 130,000 gallon pool. When the reactor is moved to this end of the pool, the gate can be lowered and the greater area of the pool can be blocked off and pumped dry. Thus, some repairs and adjustments are facilitated, and instruments and shielding samples can be placed easily in desired spots, with personnel meanwhile protected from radiation. Shielding measurements on samples can be made also in the open air, with samples placed near the dry side of the gate and the reactor moved close to the other side of the gate. Centered on the bottom surface of the pool is a well, 14 feet square and 5 feet deep, filled with removable blocks of high-density concrete, giving part of the pool an adjustable floor level for more flexibility in the placement of shielding samples and instruments.