

himself have had visual or auditory imagery. In any case his sweeping denial of the existence of self-observed sensory events (the acknowledgment of which would not, as we now know, have implied the dualism he was so anxious to avoid) occupied him in what he later described as "a continual storm."

The same taste for polemics led him into an extreme environmentalistic position. In *Psychology from the Standpoint of a Behaviorist* he had devoted two chapters to hereditary behavior. Like all those who want to do something about behavior, he had emphasized the possibility of environmental modification, and this was widely misunderstood. Under the stress of battle he was led at last to the well-known cry: "Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and yes,

even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years."

Watson also went beyond his facts, and in the same crusading spirit, in his views on child training. Experiments on the behavior of infants had shown him that emotional patterns could often be traced to conditioned emotional reflexes (a term he took from Pavlov via Lashley). He thought he saw the seeds of many behavior problems in early home experiences, and in his *Psychological Care of the Infant and Child*—a book he later publicly regretted—he cautioned parents against the unconsidered display of affection. (Current "mother love" theories are the other swing of that pendulum.)

And so it came about that Watson was to be remembered for a long time, by both laymen and psychologists alike, for

a too narrow interpretation of self-observation, for an extreme environmentalism, and for a coldly detached theory of child care, no one of which was a necessary part of his original program. His brilliant glimpse of the need for, and the nature and implications of, a science of behavior was all but forgotten. Perhaps history is ready to return a more accurate appraisal. A year before his death he had the satisfaction of dedicating a paperback edition of his popular book *Behaviorism* to the American Psychological Association, which on 7 September 1957 cited him as follows: "To Dr. John B. Watson, whose work has been one of the vital determinants of the form and substance of modern psychology. He initiated a revolution in psychological thought, and his writings have been the point of departure for continuing lines of fruitful research."

B. F. SKINNER

*Psychological Laboratories, Harvard University, Cambridge, Massachusetts*

## News of Science

### Frontal Cloud System Pictures Obtained by Rocket

Clear pictures from the first rocket-camera unit designed specifically to photograph weather frontal systems and their associated cloud formations, from extreme high altitudes over ocean areas where there are no permanent weather stations, have been obtained from a successful firing and recovery of a Project Hugo rocket.

This is the first time that man has been able to look down from so high a vantage point on physical manifestations of the Norwegian weather front theory by which meteorologists have been forecasting the weather for the past 40 years. The frontal cloud pictures are the best obtained to date from a rocket.

The film, recovered at sea from the nose cone of the Nike-Cajun rocket, which reached an altitude of 86.25 miles on 5 December 1958, shows the frontal cloud formations over an Atlantic Ocean area, starting about 200 miles off the Virginia coast and stretching about 700

miles further eastward. The mosaic strip, covering approximately 1000 miles in length, compares roughly with the expanse between the southern tip of Maine and mid-Florida. The launching from the National Aeronautics and Space Agency's Pilotless Aircraft Research Station at Wallops Island, Va., was accomplished from a land-based installation of a shipboard-type Terrier missile launcher, and was effected without any delays or difficulty. Signals emitted by the nose cone's miniature transmitter were easily tracked by one surface ship and one aircraft, each carrying portable radio tracking equipment. Following the flight, the instrumentation package was successfully located and recovered from the sea by the destroyer USS LEARY, despite 8- to 10-foot swells and 25- to 40-knot winds.

### Project Hugo

Project Hugo (highly unusual geophysical operations), conducted by the Office of Naval Research with funding assistance from the Bureau of Aeronautics

and the U.S. Weather Bureau, is designed to further research into meteorological phenomena in an effort to improve the accuracy of weather predictions. It will also be of assistance to the U.S. Weather Bureau's Hurricane Weather Research Project in the field of hurricane photography.

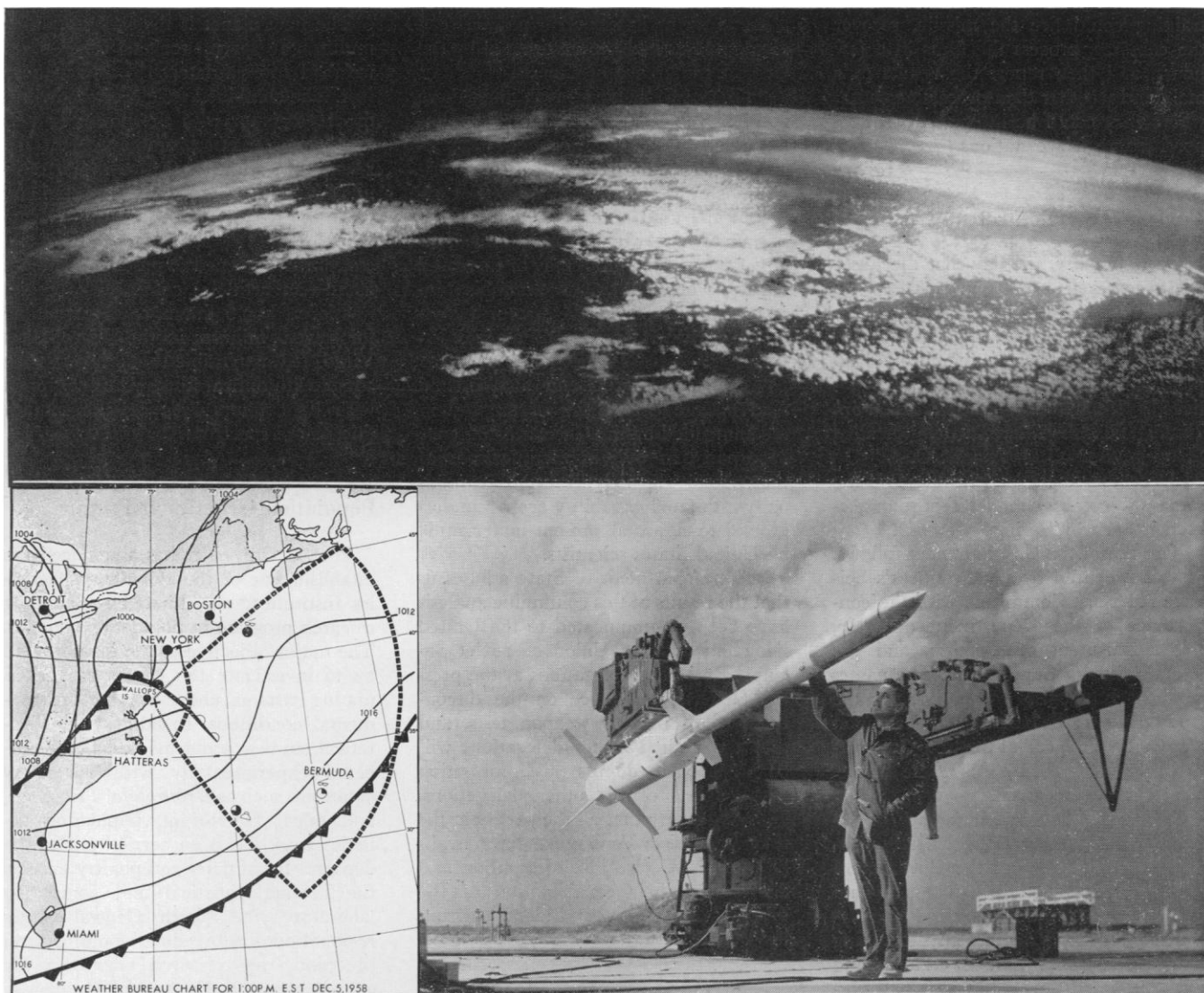
### Instrumentation

The Hugo-Nike-Cajun rocket consisted of a recoverable instrument head attached to a standard Nike-Cajun vehicle. Gross takeoff weight of the assembled rocket was 1552 pounds. Second stage gross weight was 270 pounds. The instrument head contained two 16-millimeter movie cameras, a radar tracking beacon, a Mytmouse homing transmitter, a primary programming device, a secondary programming device, a nose ogive jettison circuit, a drag parachute, a splitting separation system, four blocks of slowly dissolving sea dye marker, and appropriate power supplies.

Design and construction of the Project Hugo rocket-camera assembly was done by the New Mexico State University at Las Cruces, under contract with the Office of Naval Research. The cameras themselves were specially designed and prepared by the Naval Research Laboratory.

### Performance

In the 5 December shot the instrument head was not stabilized. The effect of this as it appeared in a showing of the film was a rather rapid turning of the



Three aspects of Project Hugo: (Top) Composite of five photographs shows a frontal cloud formation over the Atlantic Ocean starting about 200 miles offshore and extending about 700 miles further seaward. The mosaic strip covers approximately 1000 miles from Maine to Florida. (Bottom left) Map shows firing point (X) of camera-rocket and some of the area photographed from an altitude of 86 miles. (Bottom right) Nike-Cajun missile on Terrier launcher being checked by technician at National Aeronautics and Space Administration's Wallops Island, Va., station. The instrument canister, containing two cameras, is behind the nose cone.

point of view of the cameras. Of the total running time of the cameras, 220 seconds, only about a third resulted in pictures of the oncoming front. The sun, the falling Cajun carrier, and sections of the Outer Banks of North Carolina were photographed during the largest proportion of the running time. While these sections of the film were of value in calculating the exact position the rocket had had, they do represent a waste of a considerable amount of time. In future shots, the second camera, by the use of a prism, will photograph at a 45 degree angle to the other. This placement, given the limitation of two cameras, will maximize the footage depicting a weather system.

#### Background

The Wallops Island shot was just one part of a long-term program in the study

of clouds and other weather phenomena that could be said to have started about 15 years ago. Various projects, not formally connected, but dealing with the same general problem of weather and prediction have been taken up since the first studies of raindrop formation by Langmuir. Project Cirrus showed that holes could be cut in cirrus clouds by dry ice seeding. Project Scud further examined the possibilities of rain making by this and other methods. The current project relates to these studies in that it offers a means of gaining a synoptic view of a major weather system as it approaches a populated area. This wide view of a system, together with the reports from surface stations and air-borne stations, offer the weather predictors very valuable information which could serve as the basis for highly accurate forecasts.

Efforts to improve forecasting, particu-

larly of hurricanes, were intensified after the destructive hurricanes of 1954, when insured damage amounted to \$276 million.

#### Future Plans

Although future testing of the rocket-camera device will depend on funds available, the naval officer who was in charge of the test, Willard Huston, anticipated the firing of 8 to 10 similar shots during 1959. Because the canister containing the cameras can be recovered and used again in other shots, the cost of the individual shot is that of the Nike-Cajun missile alone, or about \$7000.

By virtue of its simplicity and ruggedness, the canister and its vehicle could be kept on hand for an indefinite period at isolated weather stations for use when reports of a threatening storm were received. Personnel with a minimum of

training could fire the missile, recover the cameras, process the films in a few hours, and then report the results to a mainland weather data-processing center where they could be integrated with reports from surface stations.

## Nuclear Test Control

On 5 January, the day that the East-West conference on nuclear tests resumed in Geneva, the United States announced that new data indicate that it is more difficult to identify underground explosions than had previously been believed. Immediately the *New York Times* published an article headed "Hopes Lessened for Atomic Curb." On 25 December the *Times* headline on the same subject had read "Test Ban Accord is Seen by Spring."

The text of the U.S. statement follows. It was prepared by the President's Science Advisory Committee with the concurrence of the Department of State, the Department of Defense, and the Atomic Energy Commission. The names of the seismologists responsible for the study that was the basis for this statement were not announced at the time the statement was released by the White House. No details were given.

"Since the Geneva conference of experts last summer, United States seismologists on behalf of the Government have continued to study all available data on the problem of detecting and identifying underground explosions, including new data obtained from the underground tests conducted in Nevada this past October. These studies and new data indicate that it is more difficult to identify underground explosions than had previously been believed.

"The Geneva conference of experts last summer concluded that, although it is not possible to identify an underground explosion by seismic means alone, it is possible to identify a large fraction of seismic events as natural earthquakes when the direction of first motion of the seismic signal is observed at several, appropriately located stations. This procedure reduces the number of seismic events which would be unidentified and could, therefore, be suspected of being underground tests.

"Analysis of all available seismic data on underground tests, including the data new since last summer, has shown that this method of distinguishing earthquakes from explosions is less effective than had been estimated by the Geneva conference of experts. These analyses and new data also indicate that the seismic signals produced by explosions are smaller than had been anticipated and that there are consequently about twice as many natural earthquakes equiv-

alent to an underground explosion of a given field as had been estimated by the Geneva conference of experts.

"These two factors mean that there will be a substantial increase in the number of earthquakes that cannot be distinguished from underground nuclear explosions by seismic means alone. For example, the total number of unidentified seismic events with energy equivalents larger than five kilotons may be increased ten times or more over the number previously estimated for the system recommended by the Geneva conference of experts.

"The effect of this new analysis and data on the capabilities of the system recommended by the Geneva conference of experts, as well as modifications of that system which could restore its originally estimated capability against underground tests, are at present under study by United States scientists.

"The Department of State advises us that the results of this continuing analysis have been communicated to the United Kingdom and the Union of Soviet Socialist Republics delegations at the present Geneva conference on the discontinuance of nuclear weapon tests, and that the United States delegations will be prepared to discuss this information with experts of the other delegations. This will assure that all the parties at the present Geneva conference have available the best scientific information and analysis in their consideration of the problem of detecting and identifying underground tests."

## Soviet Solar Rocket

The rocket that the U.S.S.R. launched toward the moon on 2 January passed the moon on 4 January and went into orbit in an elliptical course around the sun on 7 January, according to reports from scientists in the Soviet Union. The Soviet news agency Tass reported that in its first 5 days of flight the rocket, which was moving 621,000 miles ahead of the earth, had traveled approximately 9 million miles from the point in space occupied by the earth at the time the rocket was fired. The earth, speeding along in orbit at 18.6 miles per second, traveled about 8,370,000 miles in the same period.

On 14 January the rocket reached its nearest point to the sun, about 91 million miles, and achieved its maximum speed of approximately 20 miles a second. At the most distant point in its recession from the sun, the vehicle's speed is expected to drop to some 17.34 miles a second. Soviet scientists predict that once every 5 years the rocket may come close enough to the earth to be visible with powerful telescopes.

The new planet is the last stage of a multistage space rocket. The stage weighed approximately 1½ tons without fuel. The combined weight of the instruments, together with the power sources and the container, amounted to 794 pounds. In addition to two radio transmitters, which went dead on 4 January when the rocket was 373,125 miles from the earth, the vehicle carried special equipment designed to produce a sodium cloud—an artificial comet. This comet was formed on 3 January and was visible for several minutes in the constellation Virgo. It was possible to photograph the comet with optical instruments equipped with light filters isolating the sodium line of the spectrum.

## Population Genetics at Purdue

Purdue University has announced the establishment of the Population Genetics Institute to coordinate an expanding research program in population genetics. The major objective of the institute will be to investigate the effects of various mating systems under varying environmental conditions. In addition to theoretical studies, problems will be investigated experimentally with laboratory organisms such as *Drosophila*, *Tribolium*, and mice. Heretofore, population genetics work has been carried out in the departments of dairy and poultry science, the Purdue statistical and computing laboratory, the North Central States regional poultry breeding laboratory and the pioneering research laboratory for animal genetics, the Animal Husbandry Research Division, Agricultural Research Service, U.S. Department of Agriculture.

Facilities for the institute in Purdue's new Life Science Building will include offices, fully-equipped laboratories, and three specially designed controlled-climate chambers. The facilities of the statistical and computing laboratory, including a digital computer, will be used for expanding the theoretical or mathematical approach to problems of population genetics.

A. E. Bell, professor of poultry science, has been appointed chairman of the institute. Others from the Purdue staff named to the institute include V. L. Anderson, B. B. Bohren, S. C. King, W. H. Kyle, J. H. Martin, T. G. Martin, and H. E. McKean.

## Report on Medical Education

American medical colleges had a record enrollment of 29,473 students in 1957-58. Sixty of the 85 operating medical schools reported major construction, costing \$47 million, in the planning, beginning, or completion stages. Forty-nine