June 28, 1962

Memorandum

To: Chief, Division of History and Archeology

From: Staff Historian Appleman

Subject: Stratobowl, South Dakota: Ascensions into Stratosphere by National Geographic Society and U.S. Army Air Corps

This memorandum is in response to your request for a summary of occurrences at the site commonly known as the Stratobowl, South Dakota, and the present condition of the site. What follows concerns mostly the first part of the inquiry. That part concerning conditions at the site cannot be determined here but will depend on a field investigation. I have included, however, what information I could obtain bearing on the matter. I understand the National Geographic Society has proposed that the site be established as a national monument in the National Park System because of the scientific experiments and achievements in the exploration of the stratosphere that originated there.

The Stratosphere

Webster's New Collegiate Dictionary (1953 ed.) defines the stratosphere as "The upper portion of the atmosphere, above seven miles, more or less (depending on latitude, season, and weather) in which temperature changes but little with altitude and clouds of water never form." Accepting this definition as adequate for the purpose of this discussion, we will assume that the stratosphere begins in the region of 7-8 miles above the earth.4 For a quick reference on the number of ascensions into the stratosphere and their dates prior to those of the National Geographic Society - U.S. Army Air Corps with Explorer I and II I have compiled the following table from sources I could find. It may not be complete for all such efforts throughout the world (one reference I have seen mentioned 11 prior to the Explorer II ascension). But it does show that there were several successful ascents into the stratosphere before those which are the principal point of discussion here -- that is, those of 1934 and 1935 from the Stratobowl. Perhaps the most famous of the early ascents into the stratosphere were those of August Piccard in Europe in 1931 and 1932. Piccard with Paul Kipfer made his first ascent on May 27, 1931, from Augsburg, Bavaria, and his second the next year with Max Cosyns from Zurich, Switzerland.

Table of Ascensions into Stratosphere (Possibly Incomplete)

	Date		Height
(1)	1927	Capt. Hawthorne Gray, U.S. Army Air Corps in open basket. Died on way down from effects of exposure to rare air.	8 miles
(2)	1930 June 4	Lt. Apollo Soucek	8.17 miles (43,166 feet)
(3)	1931 May 27	Prof. Auguste Piccard - first ascension in air tight gondola	9.8 miles (51,775 feet)
(4)	1932 Aug 28	Prof. Auguste Piccard	10.07 miles (53,152 feet)
(5)	1932 Sep 16	Capt. Cyril F. Uwins	8.33 miles (43,976 feet)
(6)	1933 Sept	Three Russian Balloonists	11.8 miles
(7)	1933 Nov	Commander Settle & Major Fordney	11. miles
(8)	1934 Jan	Three Russian Balloonists all killed in crash of balloon	13. plus miles
(9)	1934 Jul 28	Stevens-Kepner-Anderson National Geographic-US Army Air Corps	11.48 (60,613 feet)
(10)	1935 Nov 11	Stevens-Anderson National Geographic-US Army Air Corps	13.7 (72,395 feet)

The Stratobowl

The stratobowl is a cliff-rimmed oval pocket in the Black Hills about 12 miles southwest of Rapid City, South Dakota. It has a level or semi-level floor about 600 feet across, and was selected as the most suitable site in the United States for the launching of a balloon into the stratosphere. The surrounding and protecting cliffs and hills rise about 300 feet above the bowl's floor. The site is located just north of U.S. 16 a few miles northeast of Mount Rushmore, and is near the gold-mining ghost town of Rockerville.

The peculiar combination of circumstances that caused the selection of the stratobowl site in South Dakota by the National Geographic Society and the United States Army Air Corps may be summarized as follows. Three considerations controlled. First, the place selected must be far enough west to allow the balloon to drift 700-800 miles eastward from the take-off site and come to earth on relatively level, unforested country. Secondly, the site must have a record of good, fair weather during the summer period. Thirdly, it must have protection from surface winds. All these conditions were met by the site selected in the Black Hills. In this secluded pocket the balloon could be inflated to a height of 305 feet and remain protected from winds. It was estimated that it would require nine hours to inflate and that during this time even a 5-mile an hour breeze would be dangerous for the large area of balloon cloth that would have to be inflated and controlled during the process.

In a telephone conversation (June 27) with Dr. Melvin Payne, Vice President of the National Geographic Society, I learned from him that the Society does not own any property at the Stratobowl. He said that the floor of the bowl, 75.67 acres in extent, including some land that runs back from the bowl along a creek, is held by the Bonanza Realty Company of Rapid City, South Dakota. The National Geographic Society has retained a firm in Rapid City, which in turn has employed legal talent, to prepare chains of title and obtain estimates of cost of the bowl area and for private holdings along the rim of the bowl. Most of the land around the rim or close to it is in the ownership of the U.S. Forest Service, although there are some private holdings interspersed throughout. Dr. Payne said the Society is presently trying quietly and confidentially to gather data necessary for acquisition of the site and its environs. Information that has come to them is to the effect that private interests have plans to develop the Stratobowl into a tourist trap. The only permanent building erected at the site by the Society during the experimental work in 1934 and 1935 was the gondola shed. It is still there. Dr. Payne said their studies had not progressed to the point of forming any opinion as to what acreage is needed to protect the Stratobowl and its environs.

Officials and organizations in Rapid City were active in sponsoring the site and were helpful in getting a road built to it. But the selection was made by the sponsors for the scientific reasons enumerated above. Maj. ~~William~~ W. E. Kepner and Lt. Orvil A. Anderson of the Army Air Corps visited all the major sites under consideration.

The Expedition established a base camp at the natural bowl in the Black Hills in June 1934. It soon became known as the Stratocamp, and the site itself soon became known as the Stratobowl. In the weeks that followed, construction there established a drainage system, sawdust paved streets, a waterworks, electric lighting system, a sewage disposal plant, a fire department, a hospital, a gondola shed, and parking spaces. There are many photographs in the National Geographic Magazine of the period illustrating the site and the construction activities there.

The Stratosphere Project Announced.

The National Geographic Society in its issue for April, 1934, announced that it was sponsoring together with the United States Army Air Corps an expedition to explore the stratosphere during the summer. Its stated purpose was to increase knowledge of the upper air. A group of sponsors was to join with it and the Army Air Corps in providing a balloon, to be known as Explorer I. Explorer I was to have a capacity of 3,000,000 cubic feet, and would be the largest free balloon ever built. The balloon would carry aloft a spherical gondola of dowmetal (magnesium), lighter than aluminum, 8 feet, 4 inches in diameter, In it would be the three passengers and a number of scientific instruments and automatic recording devices. This gondola was 16 inches larger in diameter than the one used by Professor Piccard, and had a cubic capacity almost twice as great. The balloon was designed to ascend to a height of about 15 miles above sea level.

Secretary of the Army George H. Dern, through the Army Air Corps, assigned three balloon officers to the flight -- Maj. William E. Kepner, pilot; Capt. Albert W. Stevens, observer; and Lt. Orvil A. Anderson, alternate pilot. The Air Corps shops and laboratories at Wright Field, Dayton, Ohio, collaborated in preparations for the flight.

President Gilbert Grosvenor of the National Geographic Society appointed an advisory committee to counsel on preparations for the flight and the experiments to be conducted. This committee had the following membership:

Dr. Lyman J. Briggs, Chairman (Director, U.S. Bureau of Standards)

Brig. Gen. Oscar Westover (Asst. Chief, U.S. Army Air Corps)

Capt. R.S. Patton (Director, U.S. Coast and Geodetic Survey)

Dr. W. F. G. Swann (Bartol Research Foundation, Franklin Institute, Swarthmore, Pennsylvania)

Dr. Floyd K. Richtmyer, (Department of Physics, Cornell University and Member National Research Council)

Dr. Charles E. K. Mees (Director, Research Laboratory, Eastman Kodak Company)

Mr. Willis Ray Gregg (Chief, U.S. Weather Bureau)

Dr. Charles F. Marvin (Former Chief, U.S. Weather Bureau)

Dr. John Oliver La Gorce (Vice President, National Geographic Society)

Explorer I Ascension, July 28, 1934

Major Kepner, Captain Stevens, and Lieutenant Anderson made the ascension in Explorer I from the Stratobowl on July 28, 1934. The gas used in the balloon was hydrogen. The ascent went pretty much as expected until the balloon was at an altitude of about 11 miles, 60,613 feet as recorded on instruments. Then a tear developed in the balloon's lower surface. The gas was almost down to the point of the rip when the tear was discovered. Explorer I was now over Nebraska. The Three men decided it would be inadvisable to go higher. The technical problems involved in trying to bring the balloon down safely in the circumstances will not be discussed here. The unfortunate accident made it impossible now to ascend to the planned 75,000 feet. Suffice to say, the crew succeeded in getting the huge bag started downward. Something below 20,000 feet altitude the bottom dropped out of the balloon. When about 5,000 feet above sea level, and about 3,000 above the ground, the balloon exploded. The three men were barely able to get out of the gondola, which fell like a plummet, and parachuteto earth. They landed in a cornfield not far from Holdrege, Nebraska.

A study by experts determined later that the explosion was caused by a mixture of hydrogen and air. When air became mixed with hydrogen a very explosive situation is present, which any spark could set off. In some way, the rubbing of parts of the balloon had provided the spark, and the explosion occurred. The National

Geographic Society collected $30,170 from Lloyds of London in insurance. No firm in the United States would insure the venture. Many of the film records were salvaged from the wreck and considerable scientific data was obtained. Calculations from photographs indicated that the altitude reached was 62,100 feet instead of the 60,613 recorded by the instruments in the gondola.

Second, and Abortive, Attempt, July 12, 1935.

The sponsors of the first Explorer I ascent into the stratosphere announced that they would continue their experiments in 1935 and make additional launchings from the Stratobowl. Preparations for this were under way throughout the first part of the year. The take-off on July 12, 1935, was only an hour away when a big opening appeared in the balloon, Explorer II, and the gas rushed out. The bag collapsed on workmen underneath, but fortunately they were saved from injury by certain rigging that was still in place. The tear occurred in the "rip panel", a special section of the balloon at the top. There had been no previous failures of this special feature in balloons. The sponsors decided to try another launching in October.

There was an important difference in Explorer II from Explorer I. Because of the hydrogen explosion on July 28, 1934, the sponsors and their advisory committee decided to use helium instead of hydrogen as the lifting agency in the balloon. This would make it the first to be inflated with helium. Apparently the eleven flights previously made into the stratosphere had all used hydrogen for inflating the gas bag. Helium will not explode, and therefore provided a safety factor that was impossible to obtain with hydrogen. Helium had certain drawbacks, however, as it had a lifting capacity only 92% that of hydrogen. To provide for the larger capacity needed for helium, the new gas bag for Explorer II (all were made by the Goodyear-Zeppelin Company of Akron, Ohio) was designed for 23% greater capacity, giving it 3,700,000 cubic feet. It had a height of 316 feet above the ground when inflated for take-off. The envelope of the balloon was alleged to enclose a cubic space more than four times greater than any previously built in other countries.

Explorer II Ascension, November 11, 1935.

On November 11, 1935, Capt. Albert W. Stevens, observer, and Capt. Orvil A. Anderson, pilot, took Explorer II aloft in the second successful ascension of the jointly sponsored National Geographic Society - U.S. Army Air Corps venture in exploring the stratosphere. They had a successful takeoff early in the morning at 7:01 a.m. from the Stratobowl in the Black Hills. The ascension reached a height of 72,395 feet above sea level. ~~If the reports on the Russian ascent in September 1933 were true only they had gone higher into the stratosphere.~~ Explorer II came to earth about 12 miles south

of White Lake, South Dakota, 225 miles from its take-off site, after being in the air 8 hours and 13 minutes. It had carried nearly a ton of scientific instruments, all of which were undamaged, and upon examination were found to have functioned properly and as desired.

Summary and Evaluation

No attempt will be made here to assess the scientific knowledge obtained as a result of the work done with Explorer I and II. That information, if desired, could be obtained munh more satisfactorily from appropriate scientific bodies. I understand, however, that the results of tests in the stratosphere in the two ascents with respect to pressurized cabins, wind velocities, temperatures, radio reception, photography, and related subjects were used subsequently by the Army Air Corps in designing high altitude air craft for World War II. There were, of course, many fields of pure science and in weather studies that must have used the information obtained and on it built toward an ever-increasing body of scientific knowledge about the stratosphere and what was to be expected in outer space.

An evaluation of the place of the experiments and work done with Explorer I and II in the 1934 and 1935 ascensions necessarily would have to be undertaken, I should think, by scientists competent to assess this work in relation to what had gone before and what followed.

It can be said, however, that the 1934 and 1935 ascensions from the Stratobowl were not the first into the stratosphere, there having been several previously from European sites. Those of Professor Piccard in 1931 and 1932 were especially well publicized in Europe and the United States. Explorer II reached a height of 13.71 miles, the greatest distance above sea level of any human ascension up to that time, so far as I have been able to learn. Explorer I and II were the first ascensions into the stratosphere, from the United States and the Western Hemisphere so far as I have been able to determine.

References

The foregoing discussion has been based principally on articles, by sponsors and members of Explorer I and II crews, in the National Geographic Magazine describing the project, the ascensions, and the results. A telephone conversation with Vice President Melvin Payne of the National Geographic Society provided the information

on current plans and activities of the Society relative to the Stratobowl. The following issues of the National Geographic Magazine have articles and illustrations on the subject: March 1933; April, July, and October 1934; February, June, and October 1935; January 1936.

ROY E. APPLEMAN

Roy E. Appleman
Staff Historian

REAppleman:bj:6/28/62

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Bergman 7/27

JUL 30 1962

L58-BNP

Memorandum

To: Regional Director, Midwest Region

From: Assistant Director

Subject: Stratosphere Bowl, South Dakota

Enclosed for your information is a print of the Rockerville, South Dakota quadrangle showing the site of the Stratosphere Bowl in the Black Hills. The print has been colored to show federally owned land in the vicinity of the bowl. This map has been furnished you in accordance with the discussion between Chet Brown and Ted Swem on July 24, 1962.

We have also enclosed for your information, a copy of Historian Roy Appleman's memorandum of June 26, 1962 on this same subject.

William L. Bowen
Acting Assistant Director

Enclosures 2

In duplicate

Copy to: Park Planning w/o encl.
RKBergman:TRS:ml
7/27/62

File

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON 25, D.C.

IN REPLY REFER TO:
L58-RNP

OCT 8 1962

Memorandum

To: Director

From: Assistant Director, Resource Planning

Subject: Stratobowl, South Dakota

Proposal: To preserve in Federal ownership, as a unit of the National Park System, the site of the Stratobowl--also called the Stratosphere Bowl--in South Dakota.

Significance: The Stratobowl is the site from which two early balloon ascensions into the stratosphere were made. These scientific explorations were jointly sponsored by the National Geographic Society and the U.S. Army Air Corps. The second ascension, made by Explorer II on November 11, 1935, reached a record height of 72,395 feet (13.7 miles). A large body of scientific knowledge was obtained on these ascensions, some of which was particularly valuable to the U.S. Army Air Corps during World War II.

Description of Area: The Stratobowl is a cliff-rimmed natural amphitheatre located on private land within the boundaries of the Black Hills National Forest. The precipitous cliffs rise 300-350 feet above the relatively level floor. The bowl itself is about 600 feet across. The amphitheater and certain adjacent lands, totaling about 76 acres, are privately owned while most of the surrounding land beyond the rim is in National Forest ownership. The Stratobowl can be viewed from a Forest Service overlook and apparently thousands of people stop to see this area each year. The National Geographic Society has offered to purchase the privately owned lands involved and donate them to the Federal Government for inclusion as a unit of the National Park System.

Recommendation: That this area be submitted to the Advisory Board, that it be recommended as an addition to the National Park System, and that upon approval by the Board the Service seek legislation, to establish it as the Stratobowl National Monument.

Ben H. Thompson

Ben H. Thompson

Approved:

Conrad L. Wirth

Director 10/8/62
Date

July 9, 1963

L 58

Memorandum

To: Assistant Director Thompson

From: Director

Subject: Stratobowl, South Dakota

Attached is the brief on the Stratobowl in South Dakota. I would appreciate it very much if this matter could be brought to some sort of conclusion. There apparently was a map attached to this at one time but I don't seem to be able to find it.

According to your note, this encompasses about 700 acres--part of which is private land and part Forest land. When I was out there last year, I discussed this project with the Superintendent and the Regional Forester, who came on over at my request. He told me at that time that they could not see any objection to establishing this as a National Monument or National Historic Site but, of course, he would have to take it up through channels. The way we left it, we were to write a letter to the Forest Service, which I believe has not been done.

There are some 76 acres of private land within the boundary line which the National Geographic Society has been trying to buy without success. However, I would still like to take it up with the Forest Service and get their concurrence, and then seek legislation which would authorize the establishment of the National Monument or National Historic Site, with some sort of arrangement whereby these lands could be purchased with donated funds or accepted as a gift in the future. I think these people would sell eventually, but they do not want to give up their home at the present time. I would appreciate it very much if you would follow through on this.

or appropriate

(SGD) CONRAD L. WIRTH

Conrad L. Wirth
Director

Attachment

cc: Mr. Wirth
CLWirth:ram