Washington, D.C., June 28, 1926

Dr. Gilbert Grosvenor, Dr. Frederick V. Coville, Colonel F. Lester Jones,
National Geographic Society,
Washington, D.C.

Dear Sirs:

We have the honor of submitting the following report of our examination of Lieutenant Commander Richard Evelyn Byrd's "Navigation Report of Flight to Pole". We have carefully examined Commander Byrd's original records of his observations en route to and from the North Pole. These records are contained on two charts on which Commander Byrd wrote his observations, made his calculations, and plotted his positions. We have verified all his computations. We have also made a satisfactory examination of the sextant and sun compass used by Commander Byrd.

The plane left Kings Bay, Spitzbergen, at 00 hour 37 minutes Greenwich Civil Time 9 May, 1926, passed the north end of Amsterdam Island at 1 hour 22 minutes G.C.T. headed north following closely the 11° 04' meridian of east longitude.

The dead reckoning position of the plane is given for hourly intervals, after leaving Amsterdam Island, and also at the times sextant observations were made. Ten sextant observations to determine the altitude of the sun were made, six at various intervals between Amsterdam Island and the Pole, and four while the plane was flying at the Pole. The accompanying chart shows the route and the positions when observations were taken.

Under the conditions of flying it is manifestly impossible to make more than one astronomical observation from any one point. A single astronomical observation does not give a location but only a line passing through the position of the observer. Such lines are called "Sumner Lines". If the latitude or longitude of the point of observation is known or its direction or distance from some known point, the position on a Sumner line may be determined.

In the present case we have both the direction and the estimated distance

from Amsterdam Island to give the position on the Sumner lines resulting from the sextant observations of the altitude of the sun.

The resulting positions obtained by using the direction may differ from those obtained by using the estimated distance. This is to be expected. The distances depend upon estimates of speed and estimates of speed depend upon the altitude of the plane obtained with an aneroid barometer. The barometer readings of altitude depend on the assumption that the sea level atmospheric pressure remains constant over the whole route of the flight, something which in ordinary latitudes rarely happens between points so widely separated. We do not know if these conditions are better in the polar regions. It is our belief, therefore, that estimates of speed may be subject to large errors. But the direction of flight from Amsterdam Island could be known with a comparatively high degree of precision as it depended only on the skillful use of two optical instruments, the drift indicator and the sun-compass, both capable of giving the direction within one degree. When these instruments were used almost continuously, as they were, it seems probable that the route flown followed closely the route planned, the deviations to the right tending to balance the deviations to the left.

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V.G.A.

Attention is called to the fact that the Sumner line determined at 4 hours 56 minutes, coinciding so nearly in direction with the direction of flight, gives a splendid determination of longitude and check on his steering at a point about midway of the flight; just as the one determined at the Pole and intersecting the course at an angle of about 56 degrees gives a good condition for the determination of latitude. The amount which the plane may be actually off the Sumner line is not affected by inaccuracies of steering, such as

enter into the holding the compass course, or determining and correcting for drift, but are wholly due to errors in the observed elevation of the sun. These elevations were determined with a sextant, in which the bubble supplies the horizon of reference, an instrument developed by Commander Byrd and in the use of which he was most skillful. An estimate of the error attending such an observation may be obtained by fitting the dead reckoning to the Sumner lines and by a consideration of the capacity of the sextant. From this evidence, it is believed that five miles, plus or minus, represents a reasonable estimate of the limits of this error, which is not accumulative, but is the same for all Sumner lines thus determined.

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It may be noted also that in comparing positions determined at 8 hours 18 minutes, 8 hours 38 minutes and 8 hours 59 minutes, it becomes necessary to assume errors of only two minutes in the observed altitudes to bring them into full accord with the average speed between the determined positions. This would indicate that 5 minutes is a very reasonable limit to assign to the uncertainty of an observed altitude.

At 8 hours 58 minutes 55 seconds an observation of the altitude of the sun gave a latitude of 89°55.5' on the meridian of flight. This point is 4.7 miles from the pole. Continuing his flight on the same course and at the speed of 74 miles per hour, which he had averaged since 8 hours 18 minutes, would bring Commander Byrd close to the pole in 3 minutes 49 seconds, making the probable time of his arrival at the Pole 9 hours 3 minutes Greenwich Civil Time.

At the time Commander Byrd was close to the pole he estimated the moment of his arrival there at 9 hours 2 minutes. Our calculations differ from his estimate less than one minute during which time he would have flown about

one mile. From this it appears that he chose the right place to maneuver.

Flying his plane to the right long enough to take two sextant observations he turned around and took two more observations. These four observations confirmed his dead reckoning position of the Pole. He then attempted to fly his plane in a circle several miles in diameter with his pole position as a center.

Flying at and about the Pole at an altitude of 3,000 feet Commander Byrd's field of view was a circle more than 120 miles in diameter. The exact point of the North Pole was close to the center of this circle and in his near foreground and during more than two hours of his flight was within his ken.

Soon after leaving the Pole the sextant which Commander Byrd was using slid off the chart table breaking the horizon glass. This made it necessary to navigate the return trip wholly by dead reckoning. In accomplishing this two incidents should be specially noted. At the moment when the sun would be crossing the 15th meridian, along which he had laid his course, he had the plane steadied pointing directly toward the sun and observed at the same instant that the shadow on the sun-compass was down the middle of the hand, thus verifying his position as being on that meridian. This had an even more satisfactory verification when at about 14 hours 30 minutes G. C. T. he sighted land dead ahead and soon identified Grey Point (Grey Hook), Spitzbergen, just west of the 15th meridian.

It is unfortunate that no sextant observations could be made on the return trip. But the successful landfall at Grey Hook demonstrates Commander Byrd's skill in navigating along a predetermined course, and in our opinion, is one of the strongest evidences that he was equally successful in his flight northward.

The feat of flying a plane 600 miles from land and returning directly to the point aimed for is a remarkable exhibition of skillful navigation and

shows beyond a reasonable doubt that he knew where he was at all times during the flight.

It is the opinion of your committee that at very close to 9 hours, 3 minutes, Greenwich Civil Time, 9 May, 1926, Lieutenant Commander Richard Evelyn Byrd was at the North Pole, insofar as an observer in an airplane, using the most accurate instruments and methods available for determining his position, could ascertain.

Respectfully submitted,

Hugh Mitchell
Albert H. Bumstead
Henry G. Avers