

HOUSE MEMORANDUM

To Mr. Madison Cawein

Date June 9, 1944

From Mr. Robert Sanders & Mr. C. C. Larson

Subject Flight Tests on Prop. #4165.

FORM G.O.37 100M 1-43

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This memorandum concerns two weeks spent by Messrs. Larson and Sanders at the Tonopah Army Air Base in conjunction with tests on Prop. #4165.

The B-25 was scheduled to arrive at Tonopah Thursday, May 18. We arrived at Las Vegas on May 19 and immediately called Dr. Molnar at Tonopah. The plane was not in but was definitely to be in by Saturday noon. Eventually, the B-25 arrived Monday noon. The balance of Monday, all day Tuesday, and Wednesday morning were spent in making installations in the plane. This included complete "buttoning up" of bomb #123 and mounting it in the bomb-bay of the B-25. The receiver in the plane was powered from five 6-volt storage batteries and the monitor was powered from two of these same batteries. A 12-volt auxiliary battery was placed in parallel with the small battery in the bomb for preliminary flight tests. The monitor was located in front of the back compartment of the plane facing the rear. The receiver was mounted about 10 ft. from the monitor near the tail of the plane and facing the monitor. The crossed-dipole receiving antenna was mounted about 3 ft. behind the rear hatch. A 45-degree mirror was placed in front of the bomb to enable it to look at the ground while still in the bomb-bay.

The first preliminary flight test was made Wednesday afternoon. Bomb #122 was set up on the ground about 600 ft. west of the hangar. The tail section of the bomb was disconnected and set up vertically so that the antenna was in the north-south plane. The ground receiver (first model) was set up about 400 ft. from the ground. The ground receiver was turned on and would not operate. Since it was getting late, it was decided to skip the ground receiver for the first flight.

The main purpose of this flight was to check the new receiver in the plane with the transmitting bomb on the ground. Secondly, the bomb in the bomb-bay was to be turned on and the quality of the dissector picture at 15,000 ft. above ground determined (15,000 ft. above ground at Tonopah is actually 21,000 ft. above sea level).

The receiver and monitor in the plane were turned on while still on the ground and a good picture was obtained from the ground bomb. The equipment was turned off during take-off and was again turned on at 5,000 ft. above ground. The monitor gave a raster for about one minute and then broke down. Nothing could be done with it due to our inability to move around with oxygen masks on. The monitor was then turned off for the balance of the flight.

The plane immediately climbed to 15,000 ft. One pass was made over the bomb at about 11,000 ft. and a good picture obtained. Several passes were made over the bomb from east to west and reverse at 15,000 ft. The picture held in with no touching of controls for about three minutes at a speed of 4 miles per minute for about 12 miles. A slightly better picture could be obtained if the oscillator control was adjusted as the plane passed over the target. In doing this, the oscillator control was being operated as a manual gain control.

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Two passes were then made at 90 degrees to the first pass in order to check the effectiveness of the crossed-dipole, receiving antenna. The picture again held in for a distance of 12 miles, indicating the pattern of the antenna to be circular. This concluded very satisfactorily the tests on the new receiver.

We next flew to the bombing range in order to look at the target from an altitude of 15,000 ft. The receiver in the plane and bomb #123 in the plane were turned on before the bomb-bay doors were open. With the bomb-bay doors closed the receiver would sync fairly well. The cross hairs of the dissector were visible on the receiver due to stray light coming through the bomb-bay doors. Sync tearing of the cross hairs under this condition was not bad. However, when the bomb-bay doors were open, the sync tearing was so bad that practically no information could be obtained from the picture. An attempt was made to stabilize the picture by various methods of tuning of the receiver, but to no avail. Under no conditions could the target ever be seen. This difficulty was caused by two factors: (1) Propeller modulation; and (2) Overload of the receiver. This terminated the first flight tests.

Thursday was spent in getting the ground receiver and monitor in operating condition. The monitor was removed from the plane and set up in the hangar. It was then turned on, operating from 12 volts, and found to work satisfactorily. Upon checking in the plane, it was found that the monitor had been operating from 14 volts instead of 12. This caused the high voltage to be nearer 7 Kv. than 5 Kv. This was the reason for the break-down at 5,000 ft. It was decided on the next flight to wire the monitor directly to the bomb. In order to do this, it was necessary to make some changes in the monitor. The monitor, when shipped to Gulf, required a negative, horizontal sync pulse. The bomb in the plane delivered a positive sync pulse to the monitor. In order to overcome this, it was necessary to jump one sync stage in the monitor. It was also necessary to ground the automatic brilliance control circuit in the monitor.

The ground receiver was next checked. It was found that the HF oscillator would not oscillate. Several new tubes were tried and eventually a good oscillator was found. On Thursday a picture was shown to General McClellan. In order to do this, we set up one of the bombs on the ground near the hangar and used the receiver in the B-25. In our estimation, the picture was only fair, however, General McClellan thought it quite good and seemed quite impressed.

Friday was spent in obtaining a good picture on the plane receiver from the bomb in the plane. With bomb #123 in the bomb-bay and the receiver mounted in the plane, it was found that even on the ground a good stable picture could not be obtained. In order to get a picture on the ground, another mirror was set on the ground under the bomb at a 45-degree angle. In order to determine if bomb #123 was at fault or the fact that it was in the bomb-bay was giving the trouble, bomb #122 was set up on the ground directly under the

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bomb-bay. This bomb gave a fair picture in the receiver. We then lowered bomb #123 and put bomb #122 in the bomb-bay. This gave no better picture than bomb #123. It was then decided that the receiver was being overloaded and the AVC was insufficient. In order to decrease the field strength, a single dipole antenna was placed at the extreme rear of the plane. This antenna gave no improvement in performance and, therefore, was discarded. The AVC lead was then brought outside the receiver case and a manually variable voltage placed on the AVC lead. It was then possible, by biasing the receiver sufficiently, to obtain a good stable picture from the bomb in the bomb-bay. It was also found under these conditions the receiver oscillator could be tuned to the proper frequency.

The monitor was then installed in the plane and connected directly to the bomb in the bomb-bay. A good picture was obtained on both the monitor and receiver. Both plane engines were then "revved" up to the point that the vibration was terrific. With the rear hatch closed, there was some effect due to propeller modulation. The effect of propeller modulation was much less with the hatch door open. There were no microphonics in either the receiver or monitor picture at any time, even though the vibration was much greater than ever encountered in the air.

It was decided to put a new battery in bomb #123 and re-install it in place of bomb #122. A good picture was then obtained on both monitor and receiver. However, the plane engines were not again "revved" up.

The second test flight was scheduled for 9:30 A.M. Saturday morning. The ground receiver was set up in the same position as before. No ground bomb was used. The plane immediately climbed to 15,000 ft. and passes were made over the ground receiver. The ground receiver was able to pick up sync bars at this altitude but no picture information could be obtained. The plane then started descending and making passes at various altitudes over the ground receiver. The only time a picture could be obtained on the ground receiver was at an altitude of approximately 5,000 ft. and about 3 miles west of the ground receiver antenna. No picture could ever be obtained when we were directly over the ground antenna. This concluded the testing of the ground receiver. The tests were satisfactory, as it was doubtful that a picture could ever be obtained on the ground with the bomb in the bomb-bay.

We then proceeded to the range and to climb to an altitude of 15,000 ft. However, clouds over the range prevented us from going more than 11,000 ft. over the range. A picture of the ground was obtained on both the monitor and receiver in the plane. The receiver picture was stable and the effect of propeller modulation was negligible. Microphonics were quite bad on both the monitor and receiver pictures. These microphonics were attributed to the particular dissector in bomb #123. It will be recalled that bomb #123 was the one in which the dissector was broken during shipment from Gulf to Tonopah. It was found that if the engine speed was dropped from 2400 rpm to 2000 rpm, the microphonics would improve about eighty percent. In going to our target

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we passed the target used by the heat seekers. This target showed up beautifully in the picture. The contrast was excellent and it was the best picture of a target we had ever seen. The heat target differs from the other target in that it is covered with white cloth. Several passes were made over the television target but it could not be seen. Captain Forbes, the pilot, pointed out that it was difficult at that altitude to pass directly over the target. On about the fourth pass we were able to see the target and it looked comparable to the picture seen on the first equipments which were dropped. Both detail and contrast of the picture were better than was anticipated. This concluded this test.

Monday was spent in complete "buttoning up" of the other two equipments, since the weather would not permit a drop. The balance of the week was spent waiting for a break in the weather so we could make our initial drop. The weather had been very unfavorable for over three weeks and there was little sign of it letting up immediately. Dr. Molnar and Mr. Wyckoff were becoming quite discouraged at the long delay due to the weather and were talking of packing up completely and going home, to return in approximately one month when the weather would be more favorable. About noon Thursday an accident occurred to one of the Special Weapons B-17's which was used on the high-angle heat project. This plane was completely ruined and it left the heat-seeking project without a plane. The B-25 we were using, if free, could be used on this project. These two factors, coupled to the fact that we had pressing duties on other projects, were sufficient to warrant calling off the tests until better weather. The entire Gulf, Remington-Rand, and Farnsworth groups returned home.

Before leaving, we removed our complete installation from the B-25. The batteries were removed from all the bombs and everything packed away. It is estimated that approximately eight hours will be required between the time we arrive at Tonopah and the time we are ready for the first drop flight.

During our stay at Tonopah, a Block-III LAB equipment was dropped from a distance of six miles from the target and at an altitude of 5,000 ft. The bomb missed the target 20 by 100 ft. Mr. Rand, of Remington-Rand, watched the ground receiver and said that the picture, in his estimation, was poor, quite inferior to the Block-I picture as seen on the high-angle equipment. He said the shading was bad, microphonics bad, and either detail or focus was poor.

/vs

R. W. Sanders & C. C. Larson