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SPECIAL SUPPLEMENT NO. 1

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JAPANESE BALLOONS

Detection

Destruction

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# OPDIB SPECIAL SUPPLEMENT NO 1

## JAPANESE BALLOON COUNTERMEASURES

The possibility that the increasingly frequent Japanese free-balloon landings may develop into a large-scale strategic attack has led the War Department to initiate a study of all possible methods and equipment for combating this potential threat. Bulletins such as this will be issued from time to time to disseminate information on the development of defensive measures

Based upon an analysis of normal weather maps for 20,000 ft. and 30,000 ft. above sea level, a recent report (No. 917) by the Weather Division of AAF Headquarters states that the normal trajectories of balloons released in the free air flow over Tokyo and set for the 20,000 ft. level will intersect the western coastline of the United States roughly between Roseburg, Oregon, and Seattle, Washington, in all months except August, September, and October. Still excepting the same three months, trajectories of balloons set for 30,000 feet will intersect the coastline roughly between San Francisco, California, and Seattle, Washington. The report points out, however, that the trajectory for any one day is likely to vary greatly from the normal. The 20,000 ft, and 30,000 ft. trajectory maps for each month of the year show that in all months except July and August the winds are favorable at those altitudes for directing the balloons to our western coast regardless of the location of the launching in Japan.

A discussion of current studies of possible defensive measures is presented below for the information of interested commanders.

### I - DETECTION

#### RADAR DETECTION AND TECHNIQUE

Based on experiments conducted to date, radar in the 200-mc frequency is dependable to a range of 24 miles in detecting the metal parts of the balloon.

In tests to determine radar detection ranges of the balloon less the metal parts, an SCR-584 (3,000 mc frequency) tracked a helium-filled repaired Japanese paper balloon having only a small metal valve attachment to a range of 33,000 yards. AN SCR-545 (3,000-mc) tracked the same balloon to a range of 24,000 yards. Several other radar sets with various frequencies were tested, but the results were not so good. The Joint Army-Navy Testing Agencies concluded that the S band equipment will give the greatest range of detection of the paper balloon (less metal parts) and that the maximum expected range in this band is about 40% of the maximum range on a medium bomber.

Further tests to determine the most effective radar and radar detection technique including airborne radar are being continued and will be reported.

#### VISUAL DETECTION AND IDENTIFICATION

FROM THE GROUND

Experience has indicated that scanning in space with high-powered optical instruments is impracticable; scanning with the unaided eye is generally more effective in locating objects in space than scanning with binoculars and telescopes, which are useful only when something has been detected and magnification for identification is needed.

Based on the look-out experience of aircraft warning systems and of Naval and land-based AA batteries, the visual detection of a Japanese balloon at 30,000 feet is highly improbable - and yet the naked eye offers the best hope of visual detection of balloons in space. The limit of resolution of the eye is about one minute of arc. The balloon at 30,000 feet would intersect about three minutes of arc. It is questionable as to whether the balloons at 30,000 feet could be detected from the ground even if they remained stationary and their general position in the sky were known to the ground observer. However, as the balloons begin their descent the possibility of visual detection increases rapidly.

FROM THE AIR.

It is also true that for visual searching from aircraft the naked eye offers the best hope of detection. The visibility of these balloons would vary greatly according to the background against which they were seen, and in searching for them one might expect to find them any place within two or three thousand feet of 30,000, which means scanning both up and down in a hemisphere forward of the plane. In view of the speed of the search aircraft and the neutral color of these balloons, which would offer little contrast with a sky background, adequate search would involve several observers scanning continuously various sections of the hemisphere forward of the plane. From the ground as well as from the air - except at very close ranges- direct vision would be needed, for these would not be big enough targets to be seen with peripheral vision. An illustration of the difficulty of detecting such small objects in space from an aircraft is the infrequency with which aircraft sight each other.

INFRA-RED DETECTION

Investigation has disclosed that infra-red devices would not be effective in detecting the balloons because of inherent technical limitations.

II - DESTRUCTION

ATTACK BY AIRCRAFT

AMMUNITION

A type of incendiary ammunition under procurement for one Air Force was found by actual test to be the most effective aircraft ammunition for destruction of hydrogen-filled balloons. One hit suffices to destroy the balloon. However, it is effective only up to its tracer limit, which is 500 to 600 yards. Development work is proceeding to achieve an effective tracer range of 1,000 yards. Procurement of this ammunition, known as

Cartridge, Headlight, Caliber .50, T1E1, is being increased to provide a strategic reserve.

CAUTION

Briefing of attacking aircraft should include consideration of appropriate areas for the attack so that destruction of the balloon and consequent dropping of its possibily lethal load will not be accomplished over densely populated or critical areas.

ANTIAIRCRAFT WEAPONS

90-mm AA USING VT FUZE

Based upon the quantity and arrangement of the metal in the present Jap balloons, it is estimated that the VT fuze is sensitive enough to function within 15 to 25 feet of the balloon and that 100 to 200 rounds of 90-mm AA with VT fuzes would be required to obtain one effective burst on a balloon at an altitude of 15,000 feet. It is not believed practicable to increase the sensitivity of the 90-mm AA VT fuze due to many factors including the loss of damage effectiveness at greater distances of burst and limitations imposed by the projectile length.

NAVY 5"/38 GUN USING VT FUZE

The Navy 5"/38 gun would probably require fewer rounds per effective hit than the 90-mm AA because the former's projectile is larger and its VT fuze is more sensitive. However, this advantage is offset by its lower fire rate and less accurate fire control.

120-mm AA GUN

The 120-mm AA gun would be more effective than the 90-mm against high altitude balloons. However, VT fuzes will not be available for this gun until late spring. It is estimated that time-fuzed projectiles would require four times the number of rounds that are needed for an effective hit when VT fuzes are used.

AA GUN LIMITATIONS

The wide dispersion of the balloons reported almost precludes the use of antiaircraft guns to cover the front effectively. In addition, falling antiaircraft flak and ground bursts might in some areas cause more damage than the balloon. However, if balloon paths tend to merge into a definite route or routes antiaircraft guns could be set up to cover these routes.

PROBABLE NATURE OF DEFENSE AGAINST BALLOONS

Although studies on all possible defensive means are being continued, at the present time it appears that the most practicable interim defensive system would consist primarily of a spoting organization utilizing naval

offshore patrols (including air patrols), coastal observation stations at high altitudes, Forest Service patrol planes and lookout stations, and local volunteer spotters in most-threatened inland areas. This system for visual spotting would be complemented by radar coverage of the sea approaches.

In view of the wide dispersion of free balloons, their great altitude throughout the major portion of their flight, and their haphazard landings, the most effective means of attack will probably be strafing aircraft. However, the capabilities of antiaircraft artillery for the attack of balloons within range are being studied.

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Robert Storer

Robert Storer
Chief, Records and Declassification Division

Enclosures:
1. DTIC request
3. Six documents

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