COAST ARTILLERY JOURNAL

FOUNDED IN 1892 AS THE JOURNAL OF THE UNITED STATES ARTILLERY

VOLUME LXXXIX MARCH-APRIL, 1946 NUMBER 2

CONTENTS

PUBLICATION DATE: April 1, 1946

Published bimonthly by the United States Coast Artillery Association. Editorial and executive offices, 631 Pennsylvania Avenue, N.W., Washington 4, D. C. Terms: $3.00 per year. Foreign subscriptions, $4.00 per year. Single copies, 75c. Entered as second-class matter at Washington, D. C.; additional entry at Richmond, Va., under the Act of March 3, 1879.

Flak versus Heavy Bombers

The Air Forces learned in Europe that flak is a major hazard. The pilot who flew the missions doesn't need statistics but for us who were not so fortunate—or unfortunate—as to get our information the firsthand hard way, let's let the record speak. After all, the record helps to determine future Air Forces tactics and that's the nut we're interested in.

The charts show some interesting figures. Six times as many heavy U. S. bombers were damaged by enemy flak as were damaged by enemy fighters. As to actual heavy bomber losses, the enemy fighters held the edge over flak until May-June 1944 when flak took over the lead.

There was a steady increase in the relative importance of flak until in June, July, and August 1944 flak accounted for about 66% of the 700 bombers lost and 98% of the 13,000 bombers damaged. Flak, always a major cause of loss and damage, had steadily increased in relative importance to become the greatest single combat hazard.

No matter how many or how few bombers attacked, the same approximate percentage returned with flak damage.

For instance, 26.2% of the attacking bombers were hit by flak during the six months ending December 1943; 24.9% were hit during the first six months of 1944; and 23.0% were hit during the three months period ending September 1944. In numbers, this rate was startling: from 3,360 to 4,453 bombers returned with flak damage in each of the six months ending in September 1944—a monthly average just about double the total number damaged by flak in the entire first year of operation. All efforts of the Air Forces to reduce flak damage were apparently offset by the fact that they had to increasingly fly over targets defended by more and more guns and against improved enemy equipment, gunnery and ammunition.

* * *

Enemy flak became so effective that in November 1944, General James H. Doolittle, the Commanding General, Eighth Air Force, caused a study to be made of means to lessen the losses. As a result of this study, the following principles of bomber operation were evolved for conditions of the European Theater:

Avoid flying over flak defenses en route to and from the target. Enter and leave the target area on courses which cross over the weakest flak defenses in the shortest possible time, i.e., with allowances for the wind vector.

These tactics were applied continuously, and unquestionably prevented a great deal of flak damage and loss. Constant efforts were made to obtain accurate information as to the location of flak defenses, to plan the route in, the route over the target, and the route back to avoid flak, and to improve navigation so as to ensure that the planned routes were flown.

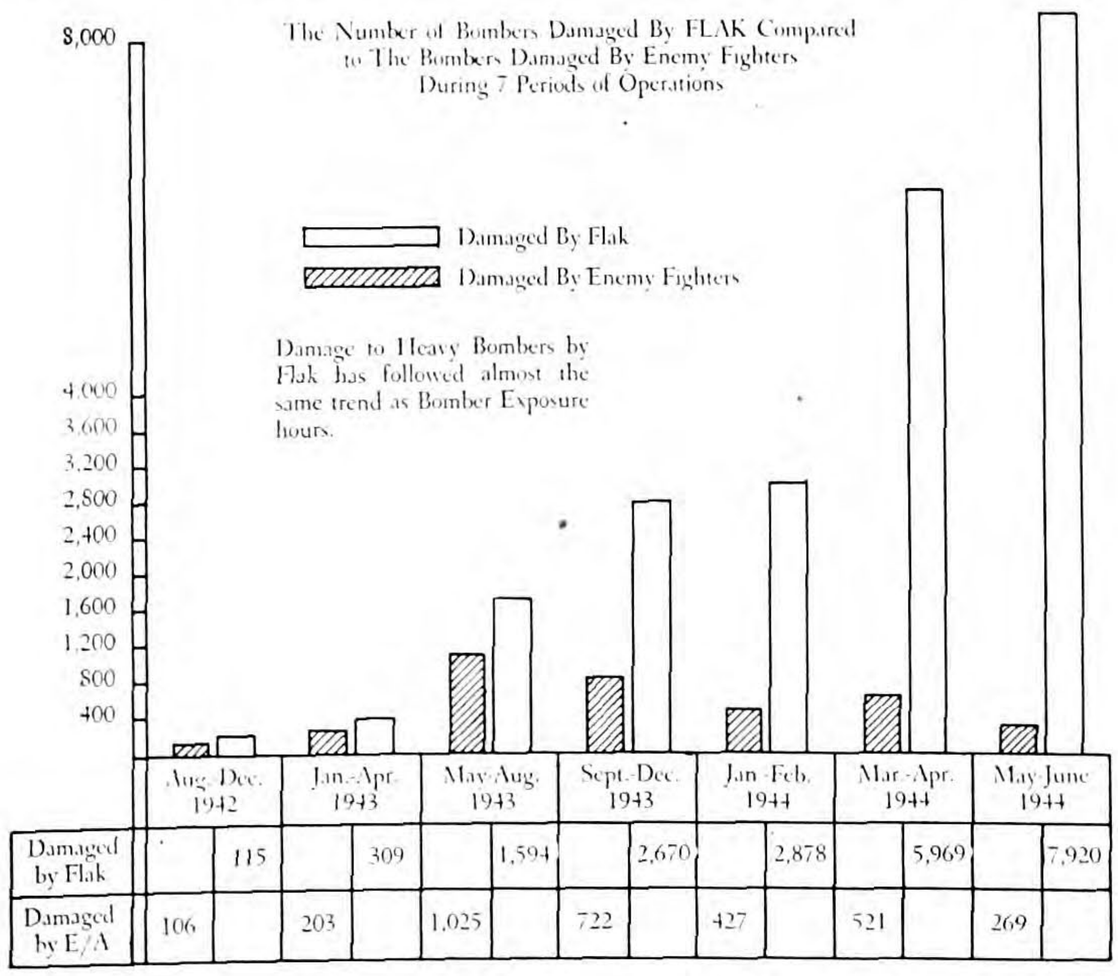
Fly at the highest altitude consistent with other defensive and offensive considerations.

Operations were consistently planned for bombing a the highest altitudes consistent with other offensive an defensive considerations. While there was some genera lowering of the average altitude, primarily in the cas of tactical targets, there was no appreciable lowering o altitude against heavily defended targets.

Plan the spacing and axis of attack of bombing units t make the fullest use of radio countermeasures.

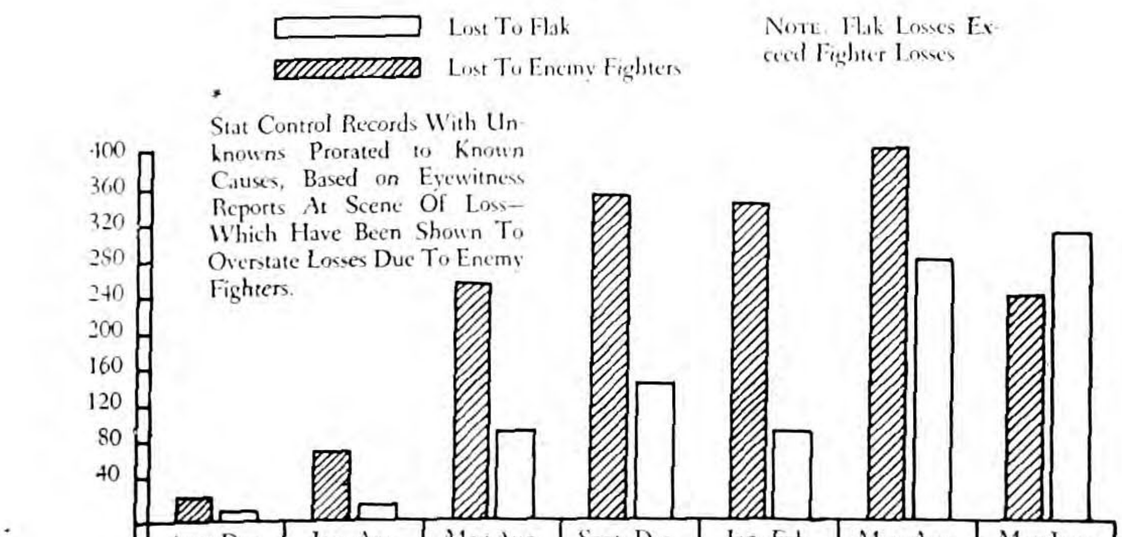
Starting in October 1943 the Eighth Air Force fir employed the radio countermeasure "carpet" and in D cember 1943 they first employed the radio countermea ure "window." The objective was to jam the enemy radar so that under "unseen" conditions he would forced to use the much less efficient barrage fire, a under "seen" conditions he would be forced to use op cal range finders with a resultant decrease in accura The greatest effectiveness of radio countermeasures c be obtained only when: (1) enough carpet or windo is used to obscure the enemy's radar screen complete (The amount required varies directly in proportion the number of bombers flying together as a unit) a (2) bombers fly close enough to the source of their p tection. Very little protection is afforded to units fly two miles or more from carpet equipped aircraft;

The Number of Bombers Damaged By FLAK Compared to The Bombers Damaged By Enemy Fighters During 7 Periods of Operations



	Aug.-Dec. 1942		Jan.-Apr. 1943		May-Aug. 1943		Sept.-Dec. 1943		Jan.-Feb. 1944		Mar.-Apr. 1944		May-June 1944	
Damaged by Flak		115		309		1,594		2,670		2,878		5,969		7,920
Damaged by E/A	106		203		1,025		722		427		521		269	

The Number of Bombers Lost to FLAK Compared to The Bombers Lost To Enemy Fighters During 7 Periods of Operations*



	Aug.-Dec. 1942		Jan.-Apr. 1943		May-Aug. 1943		Sept.-Dec. 1943		Jan.-Feb. 1944		Mar.-Apr. 1944		May-June 1944	
Lost to Flak		5		10		88		135		98		281		286
Lost to E/A	26		71		25		91		343		398		239	

optimum spacing between two carpet equipped aircraft is about one mile. For window protection against the German type radar in use at the time, bombing units flew within 4,000 feet of the window trail left by preceding aircraft. However, a bombing unit receives no protection from the window it releases and therefore window protection of leading bombing units depends on window released ahead of the bomber force, perhaps by specially equipped bombers or fighter-bombers. Successful execution of this tactic might effectively conceal the entire bombing force under "unseen" conditions.

Minimize the number of bombers flying together as a bombing unit.

If the individual elements of a twelve or eighteen aircraft bombing unit are spread out 1,000 feet in trail, the flak risk is reduced by at least one-half. This formation is very difficult of operation, however, and is considered impractical due primarily to vulnerability to enemy fighter aircraft and difficulty in maintaining formation. Furthermore, if the separate elements of a formation are extended in trail, it requires individual sighting for both range and deflection, and additional blind bombing equipment.

At first the Eighth Air Force tried to bomb by elements of three aircraft but the intensity of enemy fighter opposition quickly forced them to increase the size of the bombing unit to six and then to eighteen aircraft.

In the latter part of 1943 the eighteen-plane formation was reduced to a twelve-plane formation, primarily to eliminate trailing elements, introduce greater maneuverability, reduce flak risks, and present a solid wall of fire against nose and tail attacks.

Increase the spread of the entire formation in altitude and breadth to reduce the risk from barrage fire.

The primary danger is from accurate firing methods and it is seldom possible to predict when the enemy may use or be forced to use the less efficient barrage fire. This makes it impractical to plan a maneuver or a formation to reduce the risk from barrage fire. However, we can appraise our formation or proposed formations from the standpoint of vulnerability to barrage fire—when, if and as used.

Increasing the length in trail did not decrease barrage risks but barrage risks did decrease with an increased vertical or lateral dimension of the entire formation. If the enemy increased the dimensions of his barrage box in proportion to the increased vertical or lateral dimensions of our entire formation, his density of fire in the area through which our bombers flew was decreased and each bomber was thereby subjected to a smaller risk. If the enemy did not increase the dimensions of his barrage box while we increased the vertical or lateral dimensions of the entire formation, the bombers outside of his barrage box got a risk-free ride.

Close up in trail so as to reduce the time between attacks of successive bombing units and thus saturate the enemy flak defenses when they are employing continuously pointed or predicted concentration firing tactics.

Flak guns employing accurate firing methods have definite limitations in their rate and continuity of fire. They get hot and have to cool off, and they must allow a few seconds for the transfer of fire whenever they cease firing at one bombing unit and plan to fire at a succeeding bombing unit.

If we fly successive targets of bombing units in trail three or more minutes behind each other we create an ideal situation for the flak gun. Then, each gun can fire a maximum number of rounds at the first target, change targets, and fire a maximum number of rounds at a succeeding target.

The more bombers we can get within a given interval the greater the reduction in flak risk per bombing unit. For instance, when our bombers fly at 20,000 feet and at 260 MPH ground speed on a course tangent to the dead zone of 88mm flak guns firing one shell every four seconds, two wings flying eleven miles apart instead of four miles apart are exposed to around twice as many shells —and the trailing wing is exposed to about three times as many shells per gun; three bombing units flying two miles apart instead of one mile apart in trail are exposed to about 18% more shells—and the trailing units are exposed to around 60% more shells per gun.

By using two or more bombing units abreast, a substantial reduction will be made in the trail length of the formation. Unfortunately, most targets do not lend themselves to bombing with units abreast and the only means of effectively saturating the enemy's flak defenses is to close up in trail. Properly flown, close formations in trail would also obtain maximum protection from radio countermeasures, would reduce the hazard from enemy fighters and would reduce the area to be guarded by our fighter escort.

Evasive action.

Evasive action offered large possibilities in reducing flak risks. Its object was to prevent the enemy from calculating the future position of our bombers. The possibilities of taking effective evasive action were, however, limited by the size and lack of maneuverability of the formations flown. Evasive action by groups or wings must be planned so as to maintain the desired fighter defensive character of the formation, permit achievement of the briefed bombing altitudes and headings, and be coordinated to enable assembly at the rallying point without loss of time.

Generally, the plans for evasive action by groups included flying groups at different altitudes, starting bombing run at altitude different from that used in crossing coast defenses, changing altitude by at least 1,000 feet (preferably diving) between the I.P. and the bomb run (when selected I.P. is too close to the target, such altitude change was made prior to the I.P.); loss of altitude after "bombs away" and on withdrawal; making turns onto bomb run and after "bombs away" as sharp as is consistent with other flight requirements; minimizing the length of the bomb run; making irregular changes in course of at least 20° every twenty to forty seconds, except on the bomb run; and feinting toward another target when possible.