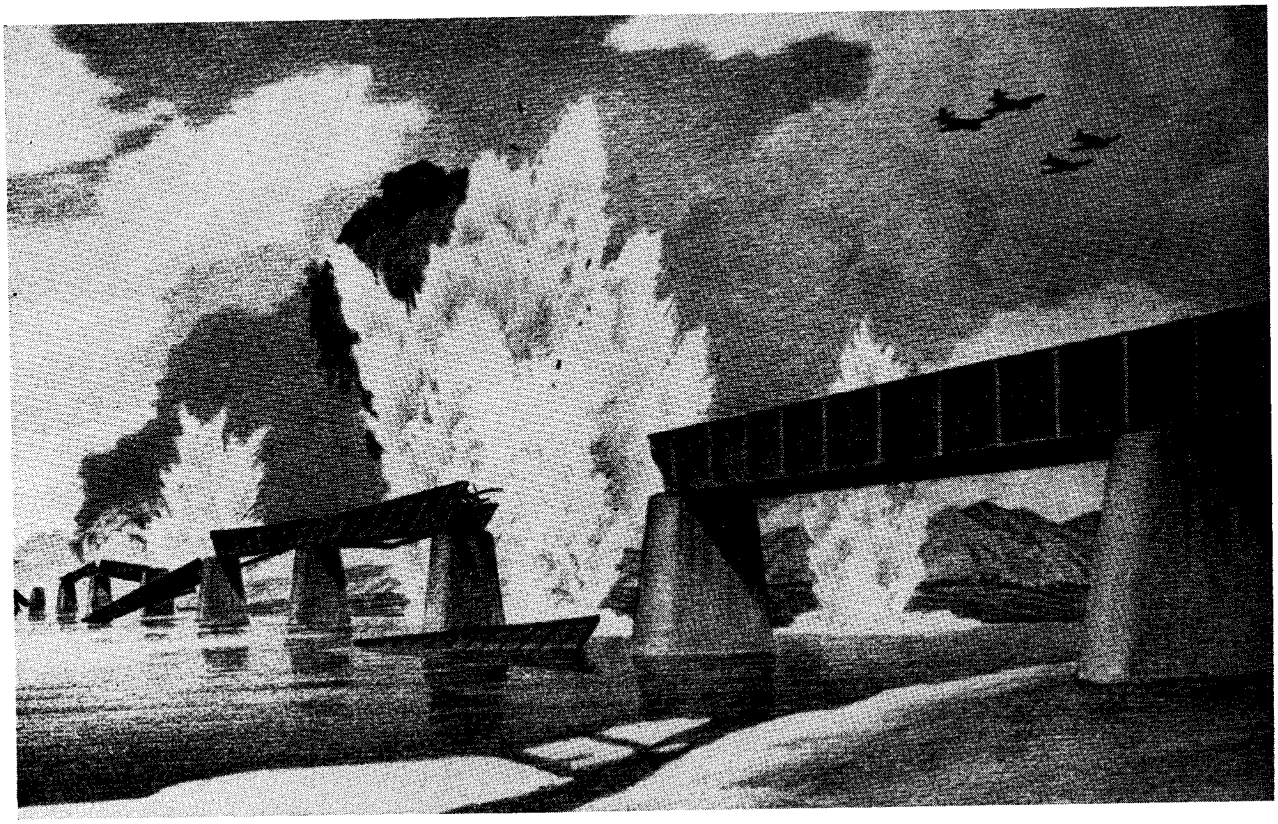

Bridge-Busting with Jets

The cessation of hostilities in Korea leaves unresolved some of the questions on the use of aircraft, ordnance and tactics. Here, Maj. John F. Bolt of VMF–115, only Marine ace in the Korean conflict, presents the case for what he calls "point blank bombing," basing his conclusions upon the experience of his squadron.

Following the statement, argument and experience which Maj. Bolt marshalls in support of the tactics he recommends, is the comment of P. B. Coggins, a staff member of the Operations Evaluation Group, Office of the Chief of Naval Operations. Mr. Coggins finds advantages and limitations in the new tactic.

Major Bolt States His Case

IT IS my belief that interdiction in Korea is a partial failure, for two reasons. It cannot destroy the physical means of transportation, nor can it render the road and rail network unusable.

The locomotive and vehicular traffic runs at night and ceases during daylight hours. During the daylight hours, these vehicles are cleverly concealed or strongly protected. Destruction of enemy transportation is very infrequent during daylight hours. Most of the damage done to enemy transportation is done at night. However, owing to the hazardous nature of night interdiction in mountainous country, such missions are relatively inefficient. [Editor's note: LCol. Folsom contends they were inefficient because there was no emphasis, consequently no development, of night interdiction. His article appears on page 7.]

The main effort in the daylight interdiction program has been against rail networks. Bridges, considered the weak spots in this network, are so numerous that the enemy is frequently unable to fortify them with AA protection. Most of the

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bridges have been cut (a span destroyed) and recut many times. As a result, the bridges and bypass bridges are nearly always made of wood. Compared to concrete spans, the wooden bridges are easily destroyed by medium and small bombs, but hitting them is the rub. It is not uncommon to have 20 or more jet fighter bombers (FB) fail to cut a bridge. The use of horizontal bombers against them is, I presume, even more inefficient.

Bomb Blast Danger—Fighter bomber aircraft have a low-hit probability for several reasons. They are plagued by a very high ratio of bomb blast inflicted damage; in fact, it is much higher than statistics indicate since questionable cases are always reported as flak damage.

The jet FB suffers more in respect to blast than did the accurate dive bombers of WW II for several reasons. Radius of turn or dive recovery is directly proportionate to the square of the speed. Therefore the F9F fighter bomber recovering at a true air speed (TAS) of 480 knots will have approximately three times the recovery altitude an SBD dive bomber had when recovering at 240 knots.

For example, compare the recovery from a 45° dive of an FB today and an SBD. (The 45° dive is a compromise between the normal dive angle of each aircraft—70° for the SBD; 30°–40° for the F9F.) Assume that both aircraft are level at 2,000 feet. To accomplish this, the F9F has had to release at 3,200 feet; the SBD, at 2,400 feet.

This means, obviously, that the jet must release its bomb at a higher altitude than the slower aircraft because of the increased recovery altitude required for the same angle of dive. For a given release altitude, shallow angle dives, 45° and less, are less accurate than steep angle dives. This is due to the fact that the bomb has a greater linear distance to travel, and the wind force is applied for a longer period. The gravitational force is more opposed to the line of sight to the target.

The jet fighter bomber, compelled to compromise the above-mentioned forces, normally uses the 30°–40° dive in bombing. This angle with the high speed of the jet has an attendant hazard from increased bomb blast damage. Although generally described as "blast damage", the blast wave from the bomb is no hazard compared to that of the fragments. The fragment pattern about the bomb is especially dense where it is perpendicular to the longitudinal axis of the bomb. Since the bomb is oblong, there is a greater area of the bomb case along the longitudinal axis of the aircraft than there is along the lateral axis.

Using the 70° dive for the SBD at 240 knots and a 30° dive at 480 knots for the F9F, the jet will be hit many times more frequently than the dive bomber. In order to keep the self-inflicted damage within reason, both the 5th AF and the 7th Fleet required that 3,000 feet be used as a minimum altitude for jet FB aircraft. This increase in the minimum altitude above that used by dive bombers further decreases the target hit expectancy of the jet FB. To get target hits, the range must be reduced.

Fuzes—A long delay—that is 4–5 seconds or 8–15 seconds—fuze permits the aircraft to release at low altitudes and have sufficient time to clear the blast danger area. The tactical difficulty in the use of this kind of fuze is that the time interval in the attack is very great. Fragments and debris that have been blown into the air by the bomb of the preceding plane are a great hazard to all but the first aircraft if the time interval between dives is short.

A jet recovering at 420 knots TAS is moving at 700 feet per second. A piece of blast debris with even zero velocity will have considerable impact force if the fast moving aircraft strikes it. To be safe in low altitude attack with 8–15 second fuzes, the time interval must be in the vicinity of 30 seconds in order to permit debris to settle. This long interval, however, permits enemy AA gunners to concentrate fire on each aircraft during its attack.

Point Blank Tactic

Use a dive angle of between 35° and 40°.

Enter the dive at 12,000 feet below 230 knots IAS, power about 75%, and speed brake out.

Reduce the normal mil lead about 20 mils in no-wind condition.

Release at 1800 feet above the terrain, raise the speed brakes, apply 100% power and recover with a five G force.

Long delay fuzing (in the order of five minutes) is recommended to permit an entire division of aircraft to complete their runs on the bridge and retire to a safe distance from the bomb explosion.

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Other Problems—Another difficulty with the low altitude attack is the danger of bomb ricochet. However, the striking inertia force of bombs is such that they could normally be expected to carry through the piling supports of wooden bridges. Planned ricochets into steep fills or stream banks stand a fair chance of sticking in the planned position, but are difficult to place.

At the present time, there are available and ready for test 20 12″ x 1¼″ spikes that fit on the nose of GP bombs. There is a good chance that this spike will reduce ricochet on ice and frozen ground.

If a delay on the fuzes in excess of five minutes is used, the attack could be made at a 30° dive angle with very little interval. Target obscuration by bomb smoke would be eliminated. There would be no bomb fragment danger and no debris in the air.

The figure below shows target as pilot would see it at release point with his two mil gunsight pip superimposed on the target. The left side of the illustration shows it for the normal dive; the right side, for a point blank attack. The increase in hit probability is even greater than the apparent increase in bridge size.

The low altitude, high angle release is necessary if fighter bombers are to score against bridge targets. Basically there is nothing new in advocating the old advice of "Don't fire until you see the white of their eyes."

When VMF–115 used long delay fuzes in 74 sorties they averaged .3 cut per aircraft. On 25 sorties flown against bridges using short or non-delay fuzes in the same period the hit average was 0.0 per aircraft. Thus a division of VMF–115 (four aircraft) using this point blank bombing technique has a 1.2 cut expectancy on a bridge.

Conclusions—Actual experience points to these conclusions:

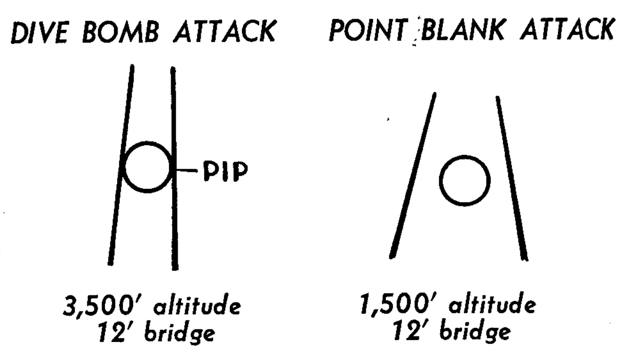
- The danger from the blast of the preceding aircraft is serious.
- Ricochets are likely at bomb impact angles in the vicinity of 22 degrees.
- The bomb spike is helpful in preventing ricochets through a narrow range of dive angles. By making a dive run steeper by only a few degrees, it was found to be unnecessary.
- A fuze with a delay in excess of five minutes is necessary when the attack is exposed to AA fire.
- A dive angle in excess of 30 degrees is necessary to prevent ricochets. Using a 35° to 40° angle insures against ricochets. Keeping the dive angle below 45° is essential to avoid the dive angle range in which a small increase in angle causes a disproportionate increase in release altitude.

Comment by Operations Evaluation

Advantages—High accuracy of delivery can be achieved by experience in a "canned" tactic with release at a small slant range—about 1,000 yards—and a small mil lead. The statement that "accuracy is inversely proportional to the square of the range" [Maj Bolt used this statement in another part of his discussion which did not appear above] is questionable, but an accuracy somewhere between two and four times that obtained in glide release from twice the slant range might well be expected. The experience of VMF–115 of 0.3 bridge cuts per F9F sortie appears to compare favorably on an ordnance tonnage basis with TF–77 pilot claims (period February 1952–January 1953) of 0.3 bridges "damaged or destroyed" per ton of ordnance. (It is assumed that VMF–115 aircraft averaged about one-half ton of ordnance per sortie.)

Long-delay fuzing would permit an entire division of aircraft to complete their runs on target in rapid succession without risk of damage from own bomb blasts and without obscuration of the target by smoke and debris.

Damage to piers, abutments, cribbing and other embedded supports resulting in collapse of a span is generally more difficult and time-consuming to repair than span collapse resulting from hits on superstructure, and is more likely to result in abandonment of the bridge. Long delay fuzing in



Pilot's view of bridge through his mil sight pip.

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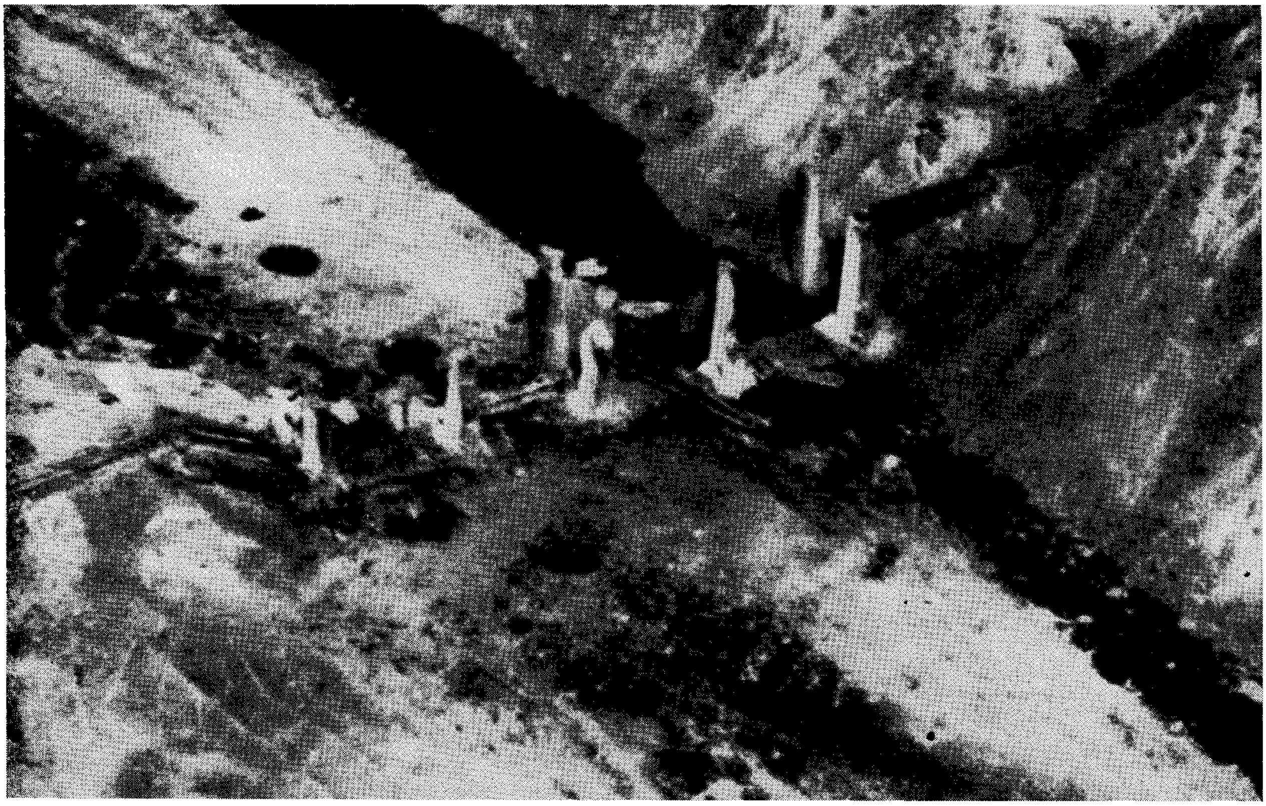

As Maj. Bolt points out, bridges were regularly attacked because they were considered weak spots of rail network. Extremely heavy damage was done this Korean bridge in 1951, the piers and spans being completely demolished.

effect implies that the attack is not against superstructure, but against piers, abutments, or cribbing. For this purpose, the long delay fuze is preferable to the non-delay or .01 second fuzing appropriate to attack on superstructure.

Limitations—A bomb release and recovery from very low altitude involves considerable risk of small arms and light AA damage. While VMF-115 experience with "point blank bombing" has been favorable on this point, overall Korean experience shows that the great bulk of all damage received by USN and USMC aircraft has been due to light armament (less than 20 mm) and at altitudes less than 3,000 feet. Small caliber weapon damage is, of course, less likely to be lethal, and there is strong indication that reducing the total number of runs on a given target (using small numbers of aircraft on each mission and restricting each aircraft to one or at most two runs on target) contributes more to aircraft safety than increasing the altitude of release. Nevertheless, wherever small arms and light AA defenses are strong, point blank bombing must be considered a dangerous tactic.

Hung bombs with long delay (chemical) fuzing present a serious hazard to an aircraft and its base—so much so that the use of such bombs is generally restricted to bomb stations having positive manual release. The wide range of operating times of such fuzes, depending on temperature, may be somewhat of a drawback from the viewpoint of damage observation, but this is probably a minor consideration.

The type of bridge has a great deal to do with the suitability of point blank bombing. The bridges against which this tactic was originally used appear well-chosen; many other bridges, however, would be entirely unsuitable. In general, the longer the spans and the heavier the piers and abutments, the more attractive becomes attack on superstructure, for which long delay fuzing is useless. (Piers over 5 to 8 feet thick will seldom be

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damaged by a bomb as small as the 500-lb. GP.) In selecting bridges for point blank attack, the presented vulnerable area of superstructure should be compared with that of pier, abutment, cribbing, or other embedded supports. The text and tables of AFM 200–5 (pp. 61–66) will be helpful in this regard.

Two points should be kept in mind:

- Bombs fuzed for attack on superstructure may, if they miss the superstructure, still cause some undermining or earth shock damage to piers, etc. The reverse is not the case.
- If a GP bomb hits a pier directly, with long delay fuzing, either ricochet or case rupture is almost sure to occur. (Ricochet will occur on direct impact with a pier at impact angles less than 70° to 80°; rupture will occur at angles greater than this when the concrete is over 15″ to 20″ thick). Thus, as noted in AFM 200–5, it is usually advisable to aim the bombs some distance in front of the pier so that they will pass thru earth or water before striking a pier.

Summary—Point blank bombing does appear valuable against properly chosen bridge targets, undefended or lightly defended. The proper approach angle to use would appear to be the one for which the presented area vulnerable to non-super-structure damage is greatest, probably one in which the line of flight reaches a 15° to 30° angle with the bridge length. Continued successful use of point-blank bombing against bridges would suggest that it be tried against other targets for which high accuracy is required and for which long delay fuzing is appropriate; reference should be made to AFM 200–5 and OEG Report 65 in the choice of such targets.

LOFT BOMBING DIRECTOR

LOFT as well as toss bombing solutions are incorporated in Navy's latest bomb director Mk 3 Mod 5. The term loft is used to describe a low-altitude, tactical delivery where the attack approaches the target in level flight, pulls up, and releases the weapon in a climb attitude to loft it at the target.

The Mod 5 retains all of the features of the Mod 4 minus a second rocket solution. The capabilities and components of the two systems are as follows:

Bomb Director Mk 3	*Mod 4*	*Mod 5*
Capabilities	Toss (bombs and rockets).	Toss and loft (bombs and rockets).
Components:		
Computer Mk 63	Mod 2 or Mod 3	Mod 3.
Power Supply Mk 42	Mod 2 or Mod 3	Mod 3.
Control Box Mk 27	Mod 1	Mod 1.
Altimeter Mk 6	Mod 1	Mod 1.
Interval Timer Mk 3	None	Mod 0.
Publications Available	OD 7800	OD 7831.

Aircraft installations calling for a bomb director Mk 3 Mod 4 can use either computer Mk 63 Mod 2 or Mod 3, and either power supply Mk 42 Mod 2 or Mod 3. The interval timer Mk 3 Mod 0 is a new componnet designed to be mounted in the cockpit of the aircraft.