SECOND AIR DIVISION

Bombardier's ORDNANCE Guide

• RESTRICTED •

HEADQUARTERS 2d AIR DIVISION
Office of the Commanding General
APO 558

To the Bombardiers of 2d Air Division

The moment when the Bombardier releases his bomb load is the culmination of all the stupendous effort which has gone into the planning, preparation and execution of the mission. I know that each Bombardier realizes this, is determined to do everything in his power to see that his bombs land squarely on the target and wants each sighting to be as close to perfect as possible.

But accuracy alone is not enough. The mission of the Bombardier is to destroy the target and that can only be accomplished if every bomb has its full destructive effect when it lands. The enemy gets nothing but satisfaction out of duds.

That is why each Bombardier must be thoroughly familiar with the bombs and fuzes which are his stock in trade, and that is why this pamphlet has been published. Proper loading, arming and handling of bombs and fuzes and careful checking to see that each necessary step has been accomplished is an essential part of the Bombardier's responsibility and will enable you to keep your results, in terms of target destruction, commensurate with the ever increasing bombing accuracy which you are displaying. Furthermore, strict observance of the necessary safety precautions which are outlined in these pages will insure that bombs destined to explode on enemy targets are not a source of danger to our own crews and airplanes.

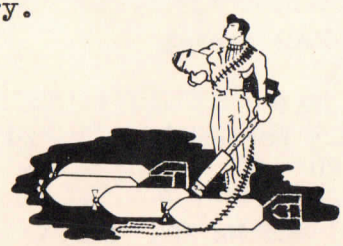
This pamphlet will add to your professional knowledge, refresh your memory on things which may have been forgotten and answer your questions on points that may be obscure. Careful study and practical application of this material will pay dividends in terms of increased target destruction and in terms of saving lives and airplanes.

W. E. KEPNER
Major General, USA
Commanding

Foreword

Bombs are designed to cause destruction. They are simply a tremendous amount of destructive energy in a small package. Enough energy to lift their own weight to a height of over a hundred and fifty miles. This energy, released almost instantaneously, exerts itself in all directions to cause damage. It is obvious that so much latent force is potentially very dangerous, not only to the enemy, but to those handling it before it is dropped. To harness this force and insure the safety of our own personnel many features providing safety are built into each one of our bombs.

Every precaution is taken in the manufacture and handling of bombs and fuzes to make them safe for you to fly with. It is the function of this booklet to give you a readily available source of information about the loads you carry so that you may effectively meet emergencies. It is also hoped that it will enable you to cut down the incidence of 'duds' through a more complete understanding of the bombs and fuzes you are called upon to carry.



Prepared under the direction of the
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BOMBS

A bomb is a missile intended to be dropped from aircraft and designed to cause damage to enemy installations, materiel or personnel by blast, earth-shock, fragmentation, or fire. The bombs now in general use are of three major types:

1. Demolition bombs (GP, SAP, AP)
2. Fragmentation bombs (Frags)
3. Incendiary bombs

Demolition bombs are designed to cause damage principally by blast. Earth shock damage is caused by near-misses and therefor is a secondary function. There is also a certain amount of damage caused by flying fragments of the case, but in proportion to the total effect of the blast, such damage is light.

GP (General Purpose) bombs, as the name implies, are the most commonly used of all bombs. They have a fairly heavy case of seamless steel tubing which is swaged at both ends to conform with the ballistic requirements of the design of the bomb.

GP bombs are filled with TNT, Amatol (a mixture of TNT with ammonium nitrate which has nearly the same explosive force as TNT), or RDX Compound 'B' which is more sensitive and more powerful than TNT. A core of a more sensitive explosive, usually tetryl, is cast in the center of the filler so that it is in contact with one or both fuze cavities. This is known as a booster and its function is to insure detonation instantaneously throughout the length of the bomb. Approximately half of the total weight of the bomb is made up of explosive. The case and other metal parts account for the other half.

GP bombs cause destruction by blast, mining or earth-shock. When an explosive is detonated gas is formed almost instantaneously in a quantity 10,000 times the volume of the explosive in its solid form. At the bomb the pressure created by the sudden manufacture of this quantity of gas is calculated to be 147,000 pounds per square inch, the pressure, of course, falling down rapidly away from the point of detonation. The effective velocity of the gas is approximately 8,000 feet per second so that fragments of the case may reach a velocity equal to that of rifle bullets, 2,750 feet per second. Destruction caused by the extreme pressure generated upon detonation is known as 'blast-effect'. Destruction done by flying particles of the case is called 'fragmentation effect'.

If detonation occurs at, or above ground, practically all of the force of the explosive will be manifested in blast-effect. If detonation occurs below the surface of the ground, the explosive force will be confined by the surrounding earth and shock-waves travelling through the ground will cause what is known as earth-shock. In the case of a near miss, earth-shock may be sufficient to shake down the walls of buildings. Earth is somewhat elastic and experience has shown that it may be displaced as much as eight inches by an explosion and yet return to its original position. The result is a violent two-way jerk.

In order to cause damage by any of the above methods, bombs must be very close to their objectives. It is true that blast will kill humans, but only at relatively short range. Fragments of the case and flying debris are far more likely to cause injury and are effective at much greater range.

Incendiary bombs cause damage by fire. Usual procedure is to follow an attack by high explosive bombs with numerous incendiaries to cause fires in the debris left by previous explosions. The filler of the AN-M47A2 is of such a nature that when it is discharged from the bomb it sticks to whatever surface it strikes and burns, causing many fires in a fairly large area. Magnesium bombs are smaller, but are dropped in greater quantities so that they have a similar effect. Magne-

sium burns at a very high temperature and is extremely difi-
cult to extinguish. The explosive charge carried in a number
of these bombs not only scatters the molten magnesium, but
serves the additional purpose of preventing personnel from
attempting to approach the fire.

Incendiary bombs require the functioning of a fuze to ignite
them. If they are dropped and the fuze does not function, they
are relatively harmless. If, however, they are in an aircraft
which is afire, the heat, if intense, will cause ignition of
the filler. In many instances the heat will cause the fuze to
detonate, functioning the bomb just as if it had been dropped.

SAP (Semi Armor-piercing) bombs are very similar in construc-
tion and filling to GP bombs except that the case is formed
of very thick steel to permit penetration of heavily reinforced
installations without fracturing the case. A nose fuze cavity
is provided, but in most instances a pointed steel plug is in-
serted in the nose fuze cavity to assist penetration. In this
case only a tail fuze is employed.

AP (Armor-piercing) bombs are made from rejected coast artil-
lery shells to which have been added a sheet metal tail section
with fins. They are of extremely heavy cast steel construction
and contain only about 15% explosive by weight. There is no
nose fuze cavity.

FRAG (Fragmentation) bombs are constructed of a length of steel
pipe around which is wrapped a piece of square steel bar. Two
sizes of frag bombs are in use in this theatre; the 20 pound
M-41, which is carried in clusters of six bombs, and the 260
pound M-81. In both cases the bombs have relatively little
explosive and depend entirely on fragmentation for their des-
tructive effect.

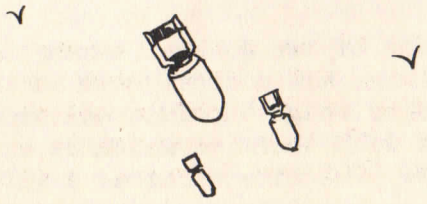
Incendiary bombs are of two general types; a magnesium case
with thermite filling, and a steel case with NP (NaPalm) fil-
ling. AN-M50A1 bombs weigh 4 pounds and are made up of a mag-
nesium case filled with thermite which is a mixture of iron
oxide and aluminum. Thermite burns at a very high temperature

and ignites the magnesium case. It is impossible to suffocate these bombs with extinguishers because the iron oxide provides oxygen for burning and air is not needed. The bombs are ignited upon impact. The same bomb, except for the addition of a tetryl explosive charge at the base of the igniter which detonates near the end of burning, is designated the AN-M50XA3.

M-17 incendiary clusters are made up of 110 AN-M50A1 and AN-M 50XA3 bombs bound together in a cluster weighing 500 pounds. The clusters are fitted with a clock-work fuze (M127) which may be set to burst the cluster open in from 5 to 93 seconds, after it is released. The fuze is set to operate at from 3000 to 5000 feet above the ground, giving good concentration of hits even when dropped from very high altitude. The cluster has good ballistic characteristics and is therefor called 'aimable'. The fuze in each bomb is held safe as long as it is in the cluster. If the bomb is dropped safe, none of the individual bombs will function. The breaking open of the cluster arms the bombs.

AN-M47A2 bombs have a light steel case similar to the M38A2 practice bomb which is filled with NP, a mixture of gasoline, kerosene, and aluminum soaps. A burster tube runs through the center of the bomb and is detonated by a fuze (AN-M26A1) upon impact, throwing blobs of ignited filler in all directions.

Propaganda bombs are carried on most missions. A heavy cardboard case, about the size of a 500-lb bomb is filled with leaflets. The case is burst open by two lengths of primacord which are detonated by a British barometric fuze, set to function about three thousand feet above the ground. Normal load is ten propaganda bombs and two 500-lb GP bombs.



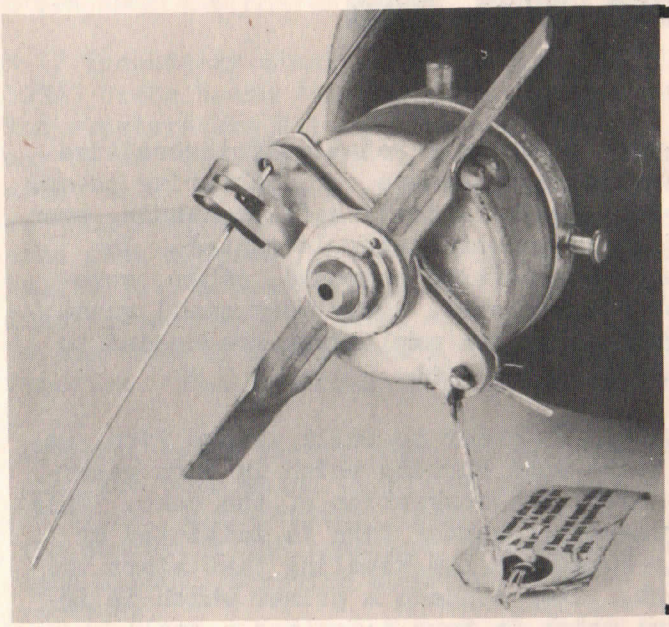
FUZES

The filler used in most bombs is a relatively insensitive explosive, which has a high brissance, or shattering power. Due to this fact, bombs are relatively safe to handle, even though they are extremely powerful when detonated. In order to detonate this insensitive compound, other, more sensitive explosives are employed. Only very small quantities of these highly sensitive explosives are needed to initiate the detonation of the bomb.

Coke is hard to ignite. In order to build a coke fire, we first use paper to start wood burning which in turn generates enough heat to start the combustion of the coke. This whole train of progressively hotter fire is initiated by a match, or primer. Fuzes are the kindling that start the explosion of the bomb. They contain a primer which is ignited upon impact and which in turn detonates a small detonator charge, setting off the booster, which sets off the filler, or main charge. Delay elements may be incorporated in this sequence to give the desired results against various types of targets. The whole series of explosives is known as the explosive train.

There are many types of fuzes in use by all nations now at war. They are similar in that they perform the same function - detonating bombs. The main differences lie in the methods used to arm them. American fuzes are all made so that they are safe, or unarmed until considerably after they have been released from the aircraft. All of the fuzes now in use employ arming vanes which are rotated by the wind as the bomb falls and which, in turn, arm the fuze. This applies to both nose and tail fuzes.

Most nose fuzes are functioned by impact with the ground or some other object. Some, however, are functioned by clockwork above the ground. Tail fuzes are functioned upon impact through the inertia of a large striker or firing pin.

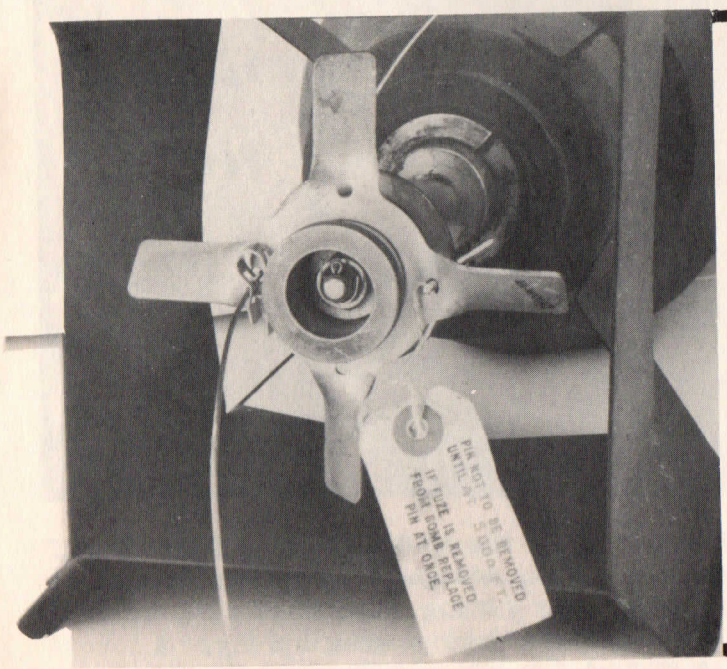


AN-M 103 NOSE FUZE

The arming vane of the AN-M103 fuze is prevented from rotating by the arming wire which is pulled out when the bomb is dropped and by a cotter pin which is removed after the ship is airborne. The striker, or firing pin, is held in the safe position by a number of circular metal discs which are located between the striker head and the fuze body. A cup retains these discs while the fuze is unarmed. As arming progresses the cup is withdrawn until it clears the discs at which time a spring forces the discs from the fuze, freeing the striker so that it may be driven into the primer upon impact.

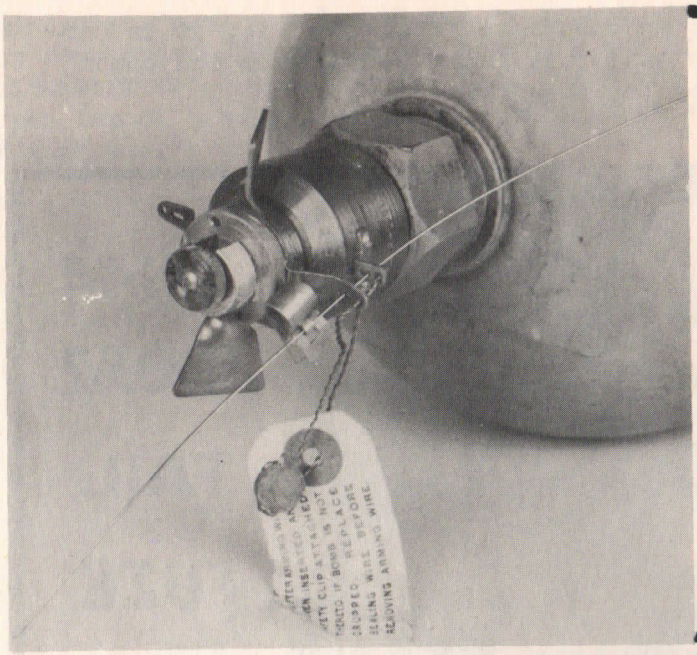
The AN-M103 fuze may be set, by means of a small brass set pin, to function instantaneously or 1/10th second after impact. The delay setting is usually used because this

fuze is employed as an insurance fuze. That is, it is carried so that if the tail fuze fails to function the bomb will be detonated by the nose fuze.



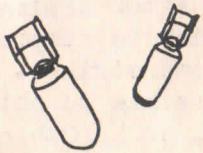
AN-M 100A2 TAIL FUZE

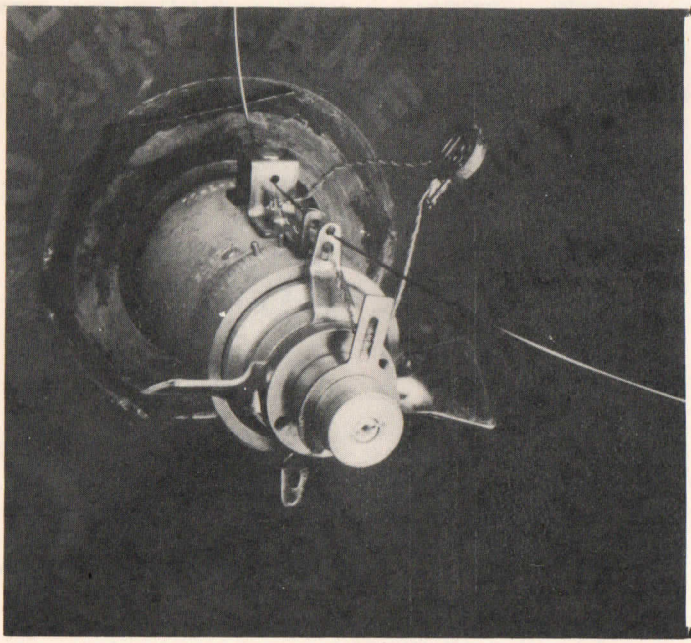
The AN-M100A2 series tail fuzes are identical with the exception that the arming stem varies in length. The AN-M100A2 is used in 100-lb and 250-lb bombs, the AN-M101A2 in 500-lb bombs, and the AN-M102A2 in 1000 and 2000 pound bombs. These are arming vane type fuzes. As the vanes rotate, a stem which holds the firing pin at the safe position is unscrewed until, when the fuze is fully armed it is free to drive forward on impact. After arming it is held to the rear by a weak spring which is compressed by the inertia of the firing pin when the bomb strikes. Interchangeable primer-detonators make it possible to obtain delays of instantaneous, 1/100th, 1/40th, or 1/10th of a second.



AN-M 126A1 NOSE FUZE

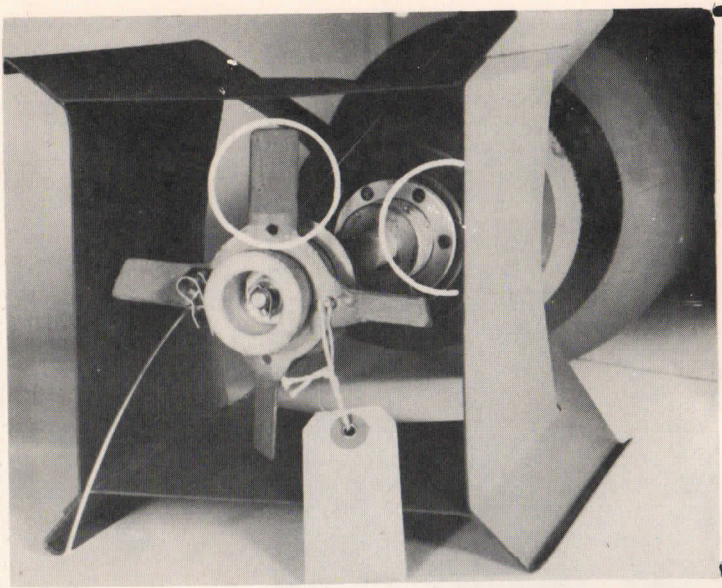
The AN-M126A1 fuze is used in the AN-M47A2 incendiary bomb. It is an arming vane type fuze designed to be detonated upon impact. The striker, or firing pin extends beyond the arming vanes and is held forward by a weak spring. A slotted collar fits around the pin and is prevented from falling off by a sleeve over which it fits loosely. This sleeve is gradually withdrawn as the vanes rotate and the fuze becomes armed when it is withdrawn sufficiently to permit the slotted collar to pass over the arming stem. A strip of adhesive tape is wrapped around the collar to prevent it from falling off if the fuze should accidentally become armed during handling. Always check these fuzes to make certain that the tape has been removed before take-off.





AN-M 127 NOSE FUZE

The AN-M127 nose fuze is used in M17 incendiary clusters. It can be set to detonate from five to 93 seconds after release. This also is an arming vane type fuze, requiring travel through the air to arm. If the fuze has not been armed by rotation of the vanes, it will not detonate because until that time a safety disc prevents the firing pin from being driven into the primer. If the arming wire and pins are not pulled, the bomb will be dropped safe regardless of the time setting of the fuze. The horseshoe clip inserted between the collar and the striker head must be removed together with the seal wire and cotter pin attached to it. No Fahnstock clip is required on the arming wire, becausethe spring loaded pin which holds the clock stopped serves the same purpose.



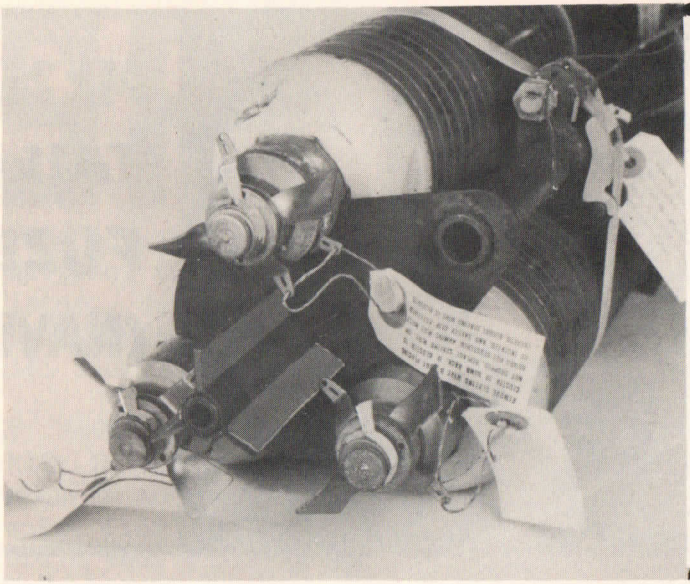
AN-M 123 TAIL FUZE (LONG DELAY)

Long delay fuzes resemble the AN-M100A2 series tail fuzes in outward appearance, except that the arming vanes are painted red. They are equipped with anti-withdrawal devices which will cause instantaneous detonation of the bomb if the fuze is unscrewed. The fuze is armed by the rotation of the vane and the delay functions at the designated time after arming. Like other fuzes the fuze is safe until the arming vanes have been rotated the required number of turns. Specially trained Ordnance personnel will fuze the ship just prior to takeoff and will answer any questions you may have at that time. Delays are available from thirty minutes to 144 hours. Before each mission on which these fuzes are carried personnel concerned will be specially briefed.

Circled in the photograph above are the distinctive characteristics of these fuzes; red-painted vanes and a locking ring at the base of the fuze.

NEVER ATTEMPT TO DEFUZE LONG-DELAY FUZED BOMBS!

They are BOOBY-TRAPPED!

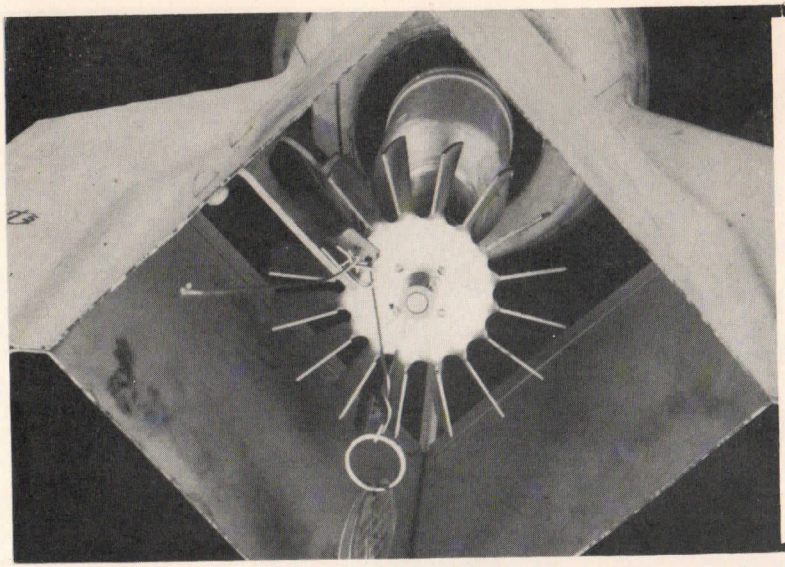


AN-M 110A1 NOSE FUZE

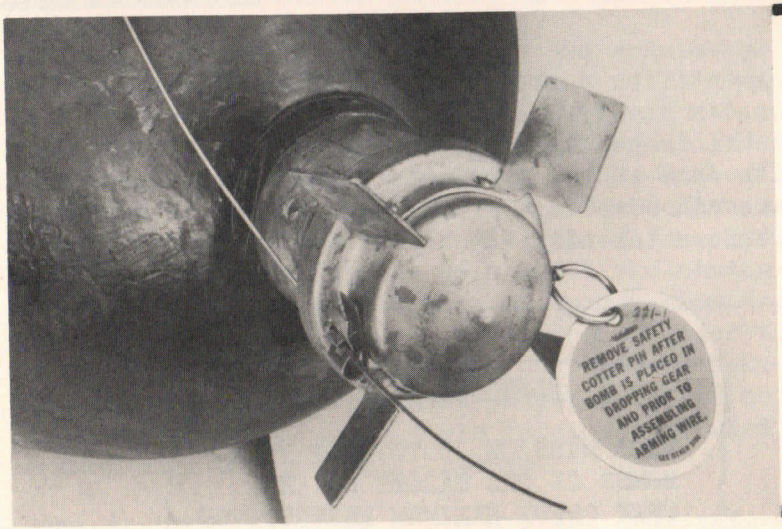
In outward appearance and function, the AN-M110A1 nose fuze, used in fragmentation bombs is identical to the AN-M126A1. It has a booster charge which extends into the bomb fuze cavity. As all fragmentation bombs are carried in clusters equipped with vane-stops, the fuzes do not have arming wires. They may have adhesive tape around the stop block which must be removed before takeoff.

REMEMBER THIS

YOUR MISSION IS TO DROP YOUR BOMBS ON THE TARGET SO THAT THEY CAUSE MAXIMUM DESTRUCTION OF ENEMY INSTALLATIONS. MAKE SURE YOU ACCOMPLISH THIS AIM!



Mk 223 TAIL FUZE (NAVY)



Mk 221 NOSE FUZE (NAVY)

The Mark 221 and 223 fuzes are Navy fuzes used only in Navy bombs. They are arming vane type fuzes and except in outward appearance are much the same as our own fuzes. In the event Navy bombs and fuzes are carried you will be specially briefed.

SAFETY

Every possible precaution has been taken in the design of equipment and methods of loading to insure a maximum safety factor. In order to make certain that the advantages of these devices and methods are obtained, you should be familiar with them.

All bombs, when loaded into the airplane have an arming wire which immobilizes the fuzes. These wires are run through holes in the arming vanes and the vane stops and are prevented from vibrating loose by a Fahnstock clip. This clip should bear directly against the fuze so that there is very little slack in the arming wire. The wire should extend at least three inches beyond the fuze. A swivel loop at the center of the arming wire is either hooked over the arming lever of the shackle or on a special hook provided elsewhere in the bomb bay. If it is necessary to drop the bombs safe and the pins cannot be inserted, removing the arming wire from the hook will allow the bomb to drop safe.

When loaded into the airplane, all fuzes, (with the exception of those in fragmentation clusters) are equipped with either cotter pins or seal wires which prevent the arming vanes from rotating. <u>These pins must be removed before the bombs are dropped on the target</u>. If it is necessary to drop bombs in friendly territory they must be released in such a condition that they will not detonate upon impact. This may be accomplished by (1) leaving the cotter pins in the fuzes, (2) unhooking the arming wire so that it will drop with the bomb, (3) cutting the arming wire and twisting it in such a way that it prevents the vanes from rotating, or (4) removing the fuzes from the bombs before they are dropped.

Under normal conditions when bombs are returned to the base it is safe to land if the fuzes have the pins in them or if they are otherwise secured so that the vanes may not turn. If, however, bombs are brought back due to faulty release there is the possibility that the shock of landing may cause the bombs to fall clear. In such instances, fuzes must be removed from bombs and stowed in the ship before landing.

All bombs are fuzed 'hand-tight'. They should be snugly screwed into the bomb by hand, without excessive force. If it is necessary to remove fuzes after they have been at altitude for a prolonged period, it is probable that the low temperature may cause them to stick or freeze. Careful manipulating of the fuze should loosen it so that it may be unscrewed easily.

On every fuze used in GP bombs there are two vane stops, located on opposite sides of the fuze, through the holes in which the arming wire and safety pin are inserted. The arming wire should be through the stop on the left side of the fuze (when facing it) so that when the bomb is dropped the tug of the arming wire will tend to tighten rather than loosen the fuze. The safety pin is inserted in the stop on the opposite side.

Each bombardier is responsible for the safe condition of his load before the ship takes off on an operational mission. As the bombardier, you are the crew's expert on bombs and fuzes. They depend on you and you owe it to yourself to be certain that not only are your bombs safe to carry, but that when they are dropped on the enemy every one of them will cause damage. If bombs are for any reason dropped safe, you and your whole crew will have risked your necks for nothing.

Make it a point to learn all you can about the way the ship is loaded. - Take a night when you are not scheduled to fly the next day and be on hand while the ships are being bombed up. Your squadron Ordnance or Armament officer will be glad

to make arrangements for you. This first-hand contact will be interesting and informative and will give you confidence in your ground crew.

PREFLIGHT LOAD CHECK

The following check points are given as a guide for inspecting your load before takeoff. Experience will probably show up many more things that you will want to make certain of. -This is a minimum and for your own safety these points must be carefully gone over. Ships and crews have been lost simply because these simple precautions were not taken. Don't put your name on the list.

1. Check all shackles and releases to see that they are properly installed. Make certain that the arming and release levers of the shackles are properly engaged in the levers of the release mechanism.

2. See that all fuzes are screwed in hand-tight and that they are properly assembled. Look for any pre-armed fuzes.

3. Check all arming wires. They are hooked in specified places in the ship. This point may vary in different organizations, so make sure you know where yours is located. Every fuze must have an arming wire with the exception of those in fragmentation clusters.

4. A Fahnstock clip (battery clip) must be on every arming wire between the vanes of the fuze and the end of the wire. Never remove these clips; they are pulled off by the bomb as it drops. Do not bend the arming wire if there is no Fahnstock clip. -Get another clip. If you bend the arming wire, it probably will break off the fuze instead of pulling free.

5. Check tail fins to make certain they are secure and that they are lined up so that one of the corners is not jammed against the bomb rack.

6. Inspect all fuzes for tape, seal wires, etc. In addition to the arming wire there should be only one safety. -Either a cotter pin or a seal wire. Seal wires, where used instead of cotter pins, should have been cut and twisted so that they are easy to remove in the air.

7. Make certain that all safety pins are in place. Do not remove them until you are at 5000 feet or over water. Save the pins and return them at interrogation.

8. If you are carrying a load in which bombs are double or triple slung, see that the bombs are hanging on the cables and not resting on the bomb below them with the cable slack. Make sure that the cable connectors do not interfere with the hooks on the shackle.

FLAK SUITS

Each member of the crew is now authorized a flak suit and helmet, and is responsible for seeing that they are in serviceable condition. Emergency releases should be checked on the ground to see that they are operating properly.

Flak suits are a very efficient form of protective armor when worn as intended. Many men, because flak is shot up from the ground, feel that better protection is given when the suit is placed on the floor of the ship. This is a false impression. True, it does come up from below, but when the shell bursts it is in almost a vertical position and by far the largest and most potent number of fragments travel in a nearly horizontal direction. For this reason, flak suits which cling close to the body offer the greatest protection when worn. They are lined with a corduroy material which

dheres to the body and takes much of the weight of the suit off the shoulders. Even so it is uncomfortable to wear so much extra weight. You will be briefed when to expect flak and the actual time of wearing the suit need be only relatively short. When there is flak, though, wear your suit. -it's good insurance.

According to existing regulations flak suits and helmets are issued as follows:

	VEST	APRON	HELMET
PILOT	M2	M5	M3
CO-PILOT	M2	M5	M3
ENGINEER	M1	M4	M4
TAIL GUNNER	M1	M3	M4
WAIST GUNNERS	M1	M4	M3
BOMBARDIER	M1	M4	M3
NAVIGATOR	M1	M4	M3
RADIO OPERATOR	M1	M4	M3
BALL GUNNER	M1	—	M4

Vest, M1 - armored back and front
Vest, M2 - armored front, fabric back
Apron, M3 - tapered over groin
Apron, M4 - square over groin
Apron, M5 - for use only in sitting position. Has armored leg and groin sections
Helmet, M3 - solid steel with earflaps
Helmet, M4 - close fitting, cloth or leather covered

In order to facilitate handling of flak suits, the airplane commander is responsible for seeing that they are placed at a position in the ship upon landing which is designated by the operations officer.

Smoke Bombs—
as Bombs-away markers

Two types of bombs away markers are in use at the present time. The most satisfactory, from the standpoint of ready visibility, is an AN-M47 bomb case filled with FM (a mixture which, on contact with the air forms titanium hydroxide smoke and a small percentage of hydrochloric acid vapor). FM is a liquid and is retained in the bomb by light plastic closure plates at the nose and tail. Modified AN-M100 fuzes which detonate as soon as they are dropped break these plates, releasing the FM. The titanium hydroxide formed produced a dense, persistant white smoke which is highly visible. As the bomb descends it leaves a trail of smoke almost to the ground.

While the FM marker bomb produces smoke, there is no fire. The smoke is produced chemically without combustion. There is no fire hazard, however, the hydrochloric acid vapor will cause irritation of the eyes and lungs in strong concentration within the ship. If pure oxygen is breathed and goggles are worn, discomfort to personnel will be eliminated.

Another type of marker bomb is an M47 incendiary bomb to the fins of which are attached four smoke grenades. Arming wires hold the strikers of the grenades in the cocked position until the bomb is dropped. Care must be taken when entering the plane to avoid dislodging the arming wires. Smoke is produced by burning and there is the resultant fire hazard if the bomb is ignited inside the aircraft.

Further research is being conducted to obtain more effective bombs away markers. If these tests meet with success and new devices are adopted they will be brought to your attention before they are used.

What about .....

Flak detonating bombs in the bomb bay? -Bullets have deliberately fired at bombs and detonation has not occurred in those bombs filled with TNT or Amatol. RDX filled bombs in a very small percentage of cases have been detonated. In general, the hazard from flak is negligible.

Low-order detonation? -This is the opposite of a normal, or high-order detonation. In low-order detonation the filler is not completely enclosed by the case of the bomb as when the case is ruptured. This causes a reduction in the pressure created at the instant of detonation. Bombs in burning aircraft will frequently detonate low-order with a resultant explosion similar to that of a gas cell.

Markings on bombs? -All high explosive bombs are painted olive drab with yellow bands. TNT or Amatol filled bombs have a single stripe around the nose, one around the tail and one in the middle on the line of the center of gravity. RDX filled bombs have two stripes around the nose and tail and one at the center of gravity. The complete nomenclature of the bomb and a list of the components necessary for a complete round is painted is painted in black on the bomb bady. Incendiary bombs and chemical bombs are painted gray with bands of various colors to indicate the type of filler.

Armed fuzes? -All nose fuzes have some type of stop block between the firing pin head and the body of the fuze. As long as stop blocks are in place, the firing pin cannot be driven into the primer and the fuze is considered safe. If the blocks are missing assume that the fuze is armed. Most nose fuzes have a shear pin which is an additional safety feature. Tail fuzes of the AN-M100 series are considered to be armed when the distance between the vane stop ears on the arming head and the flange of the fuze body is more than one-quarter of an inch.

Arming wires coming out of fuzes? -If there is no Fahnstock clip the arming wire is free to work itself out of the fuze. If the cotter pin has been removed the vanes will be rotated by any air stream and the fuze will become armed.

Handling armed fuzes? -It is possible to safely remove armed fuzes, and this should be done before the bombs are dropped because if a bomb with an armed fuze should strike another bomb it might detonate. If the armed fuze is a nose fuze, be careful not to strike the firing pin and place it somewhere in the ship where it will not be disturbed. Throw it overboard when you are over water or enemy territory. Tail fuzes should also be withdrawn and the primer-detonator unscrewed. Dispose of the primer-detonator as you would the nose fuze, or return it to your Ordnance or Armament man upon landing.

Jettisoning bombs? -The decision to jettison bombs is up to the pilot. If it is possible to fly over water the bombs should be salvoed there. Even though dropped in a safe position, bombs have been known to detonate, so drop them in a clear field if you must get rid of them over land. Be sure the fuzes are safe, that they have cotter pins or that the arming vanes are immobilized in some other manner. Do your best to determine the exact position of release so that the bombs may be located speedily.

Leaky incendiaries? -The hazard from fire due to leaking M47 incendiaries is less than that normally encountered with gas fumes in the bomb bay.

Fire in a loaded ship? -Persistent heat is required to detonate bombs. If the fire is isolated from the bombs there is very little danger of their being detonated by it. If, however, there is intense heat around the bombs they may be expected to explode. Usually, in cases of detonation by fire, the explosion is low-order and similar to an exploding gas cell. Occasionally a high-order detonation will be caused by fire, however, and it is this possibility that makes it mandatory that personnel be kept at least four hundred yards from a burning aircraft containing high explosive bombs.

Detonation of frag bombs soon after released? -Frag bombs have a fuze of the arming vane type which arms the bomb about sixty feet below the airplane. By this time the tumbling of the bombs will have ceased and they will have stabilized themselves in their normal falling attitude where they cannot strike another bomb.

Bombs dropped through bomb bay doors? -If they are not armed GP bombs may be safely dropped through the doors without danger of detonation.

Ships loaded with long-delay fuzes? -Ships containing long-delay fuzed bombs will not return the bombs to the station. Coordinates of a point in the North Sea to be used as a jettison point are given at each briefing and bombs should be salvoed there.

Pulling cotter pins before takeoff? -Cotter pins are left in the fuzes on takeoff so that if it is necessary to salvo the bombs due to engine failure or similar emergency, they may be dropped safe.

Landing with bomb load? -When a normal landing is anticipated bombs should be returned to the station unless they are fuzed with long-delay fuzes. Bombs are expensive and are a high-priority item. Don't drop them in the channel just to see what kind of a splash they will make.

Returning with 'hung-up' bombs? -If all efforts to dislodge a hung-up bomb have failed, before landing remove the fuzes after having properly safetied them. When bombs fall out of the bomb bay on landing they tend to ride up on the nose and the resultant damage to the fuze if left in may cause detonation.

"THE SAFE WAY IS ALWAYS
THE *Right Way*—"

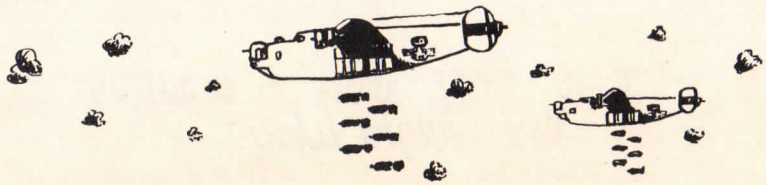
The load. . . .

Bomb loads will vary considerably, depending upon the mission and the gas load carried. The following is a table of the maximum loads which are carried:

2,000 pound	4
1,000 pound	8
500 pound	16
250 pound	24
100 pound	52

Inasmuch as there are only twenty stations on the bomb rack, several bombs are hung on a station in the case of 100 and 250 pound bombs. This is done by means of a cable clustering device which has a loop at one end and a hook at the other. Two bombs are layed side by side and the loop of the cable is placed over the lug of the first bomb before attaching the shackle. This makes a secure fastening for the second bomb which is hooked at the other end of the cable. When they are released, the loop of the cable slides over the lug of the first bomb and the two bombs fall separately. These cables are used with 100 pound demolition and incendiary bombs, frag clusters and 250 pound demolition bombs.

On special missions a load, other than bombs, may be carried. Supply of ground troops by parachute has been successfully accomplished with Liberators and they have also been used to land supplies in newly captured territory where the supply situation is critical.



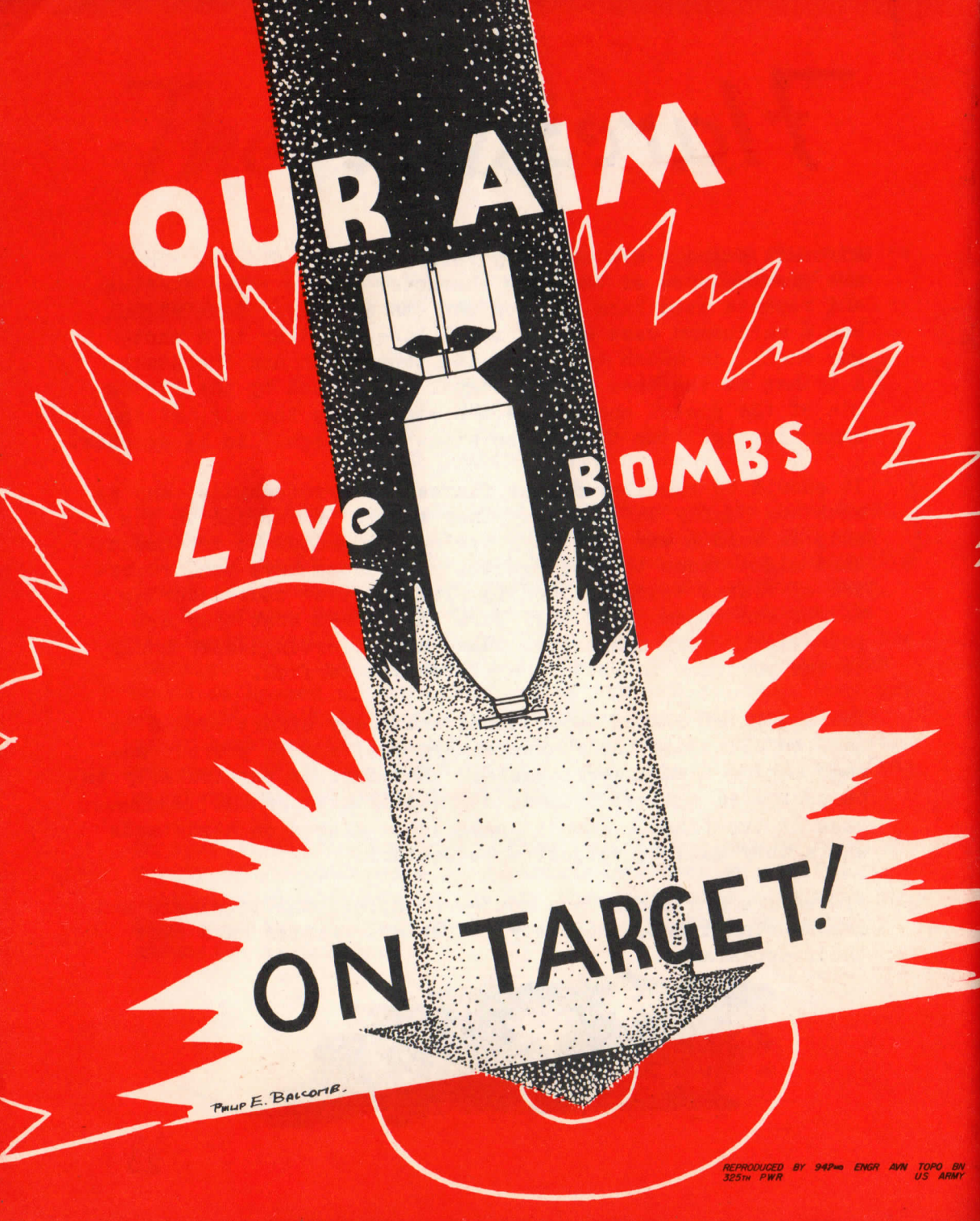
Flares . . . . . .

Aircraft signals are commonly referred to as flares. They are pyrotechnics of the same character as the roman candles and rockets used back home on the 4th of July. Each signal has a cardboard case with a metal base, similar to a shot-gun shell, in which is loaded the propellant and the stars. A primer at the base of the signal is ignited by the firing pin of the pistol and throws the stars into the air, at the same time igniting them. The stars burn from 7 to 13 seconds.

It should be remembered that flares are pyrotechnics, and as such are highly inflamable. They should be carried in the ship in such a way that they are not subjected to treatment that might cause them to ignite. Instances have been reported of flares being ignited by flak or other causes during flight and inasmuch as they burn with great heat they are potentially very dangerous. Have a fire extinguisher handy to the position in which the flares are carried.

The supply of flares is critical and every effort should be made to eliminate their unnecessary use, and to prevent damage making them unserviceable. Moisture is particularly to be protected against because it readily attacks the cardboard case of the flare. -Don't leave loose flares on hardstands where they will be subjected to weather.

Flares are available in a number of colors and in single and double-star types. Recently, three-star flares have made their appearance.



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