Acceleration Limits

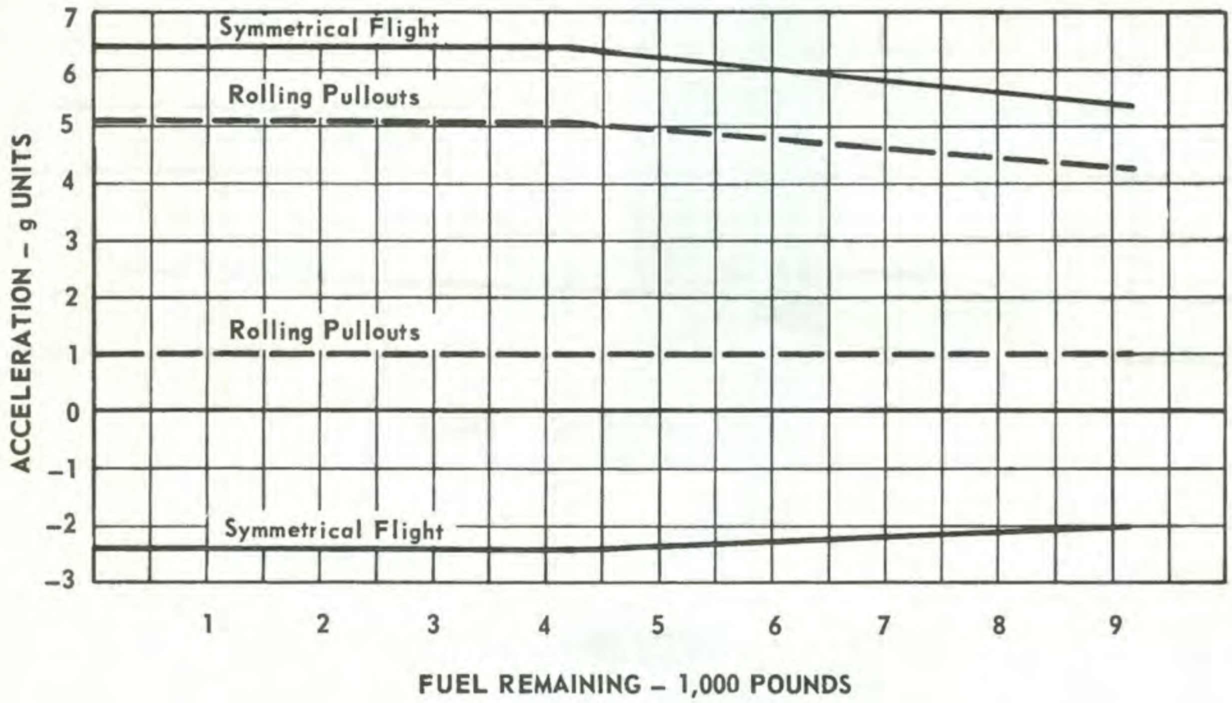
F-8C, F-8K – AIRPLANES WITHOUT WING STORES (WITH OR WITHOUT FUSELAGE STORES)

CLEAN AND CRUISE CONDITION – S.L. TO 30,000 FEET

NOTES

1. Airplane may be configured with wing pylons and unloaded Aero 7A-1 bomb racks.

2. Aileron rolls shall not be initiated at less than 1.0 g. During rolls the stick shall not be moved forward of the level flight longitudinal stick position for the entry airspeed used.



AZ–258–03–69

Figure 2–4 (Sheet 5)

Acceleration Limits

F-8C, F-8K – AIRPLANES WITH WING STORES (WITH OR WITHOUT FUSELAGE STORES)

CLEAN AND CRUISE CONDITION – S.L. TO 20,000 FEET SUBSONIC FLIGHT

NOTE

1. Aileron rolls shall not be initiated at less than 1.0 g. During rolls the stick shall not be moved forward of the level flight longitudinal stick position for the entry airspeed used.
2. Restrictions of figure 2-3 (sheet 5) apply for airplanes configured with wing pylons and unloaded Aero 7A-1 bomb racks. Rocket launchers and multiple bomb racks are considered to be wing stores.

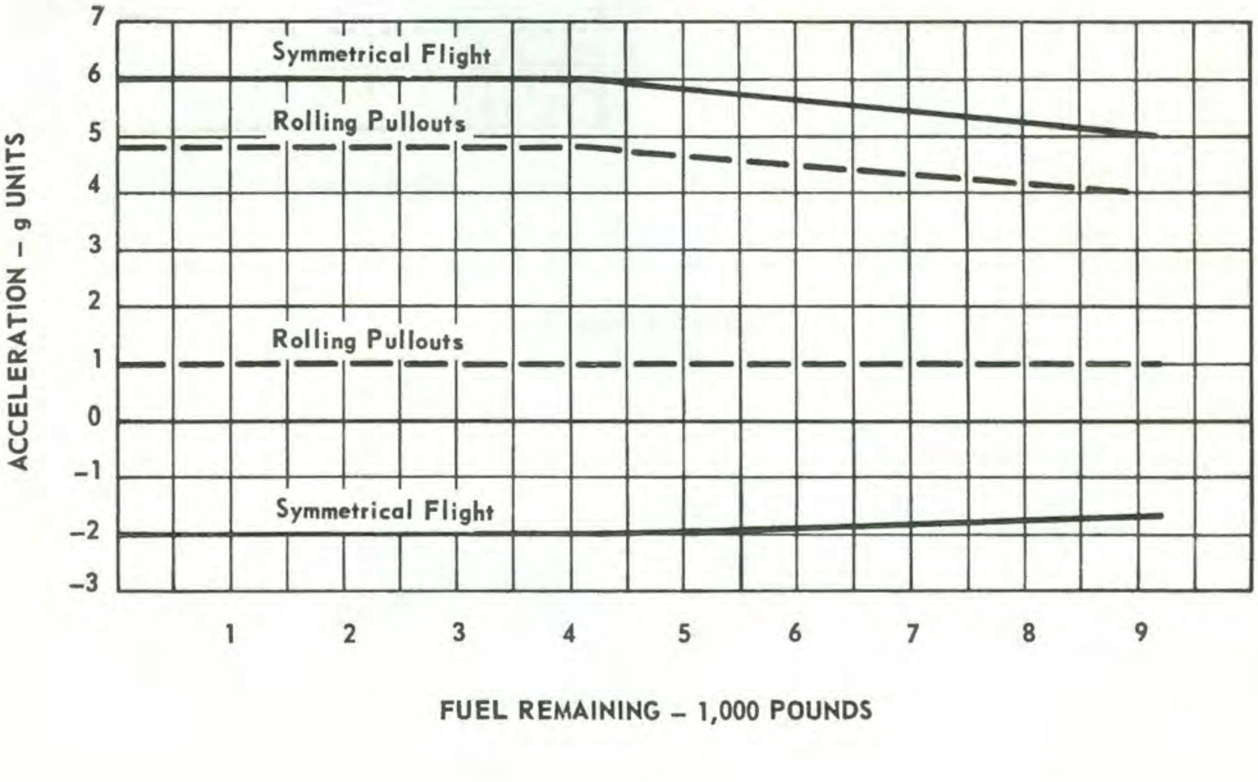


Figure 2–4 (Sheet 6)

Acceleration Limits

F-8L – WITH OR WITHOUT FUSELAGE STORES

NOTE

Aileron rolls shall not be initiated at less than 1g, and during rolls the stick shall not be moved forward of the level flight longitudinal stick position for the entry airspeed used.

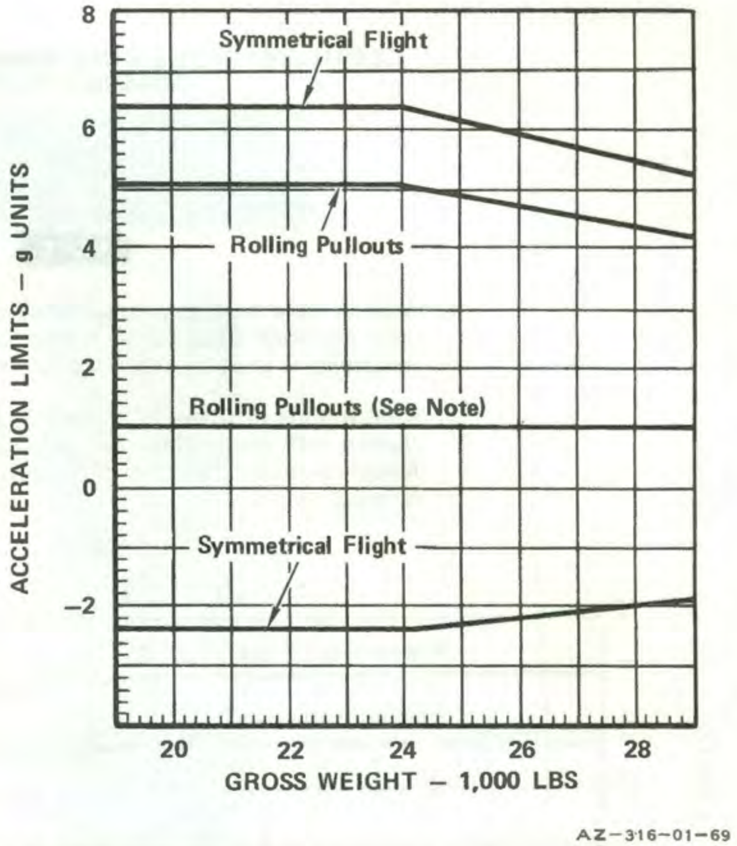
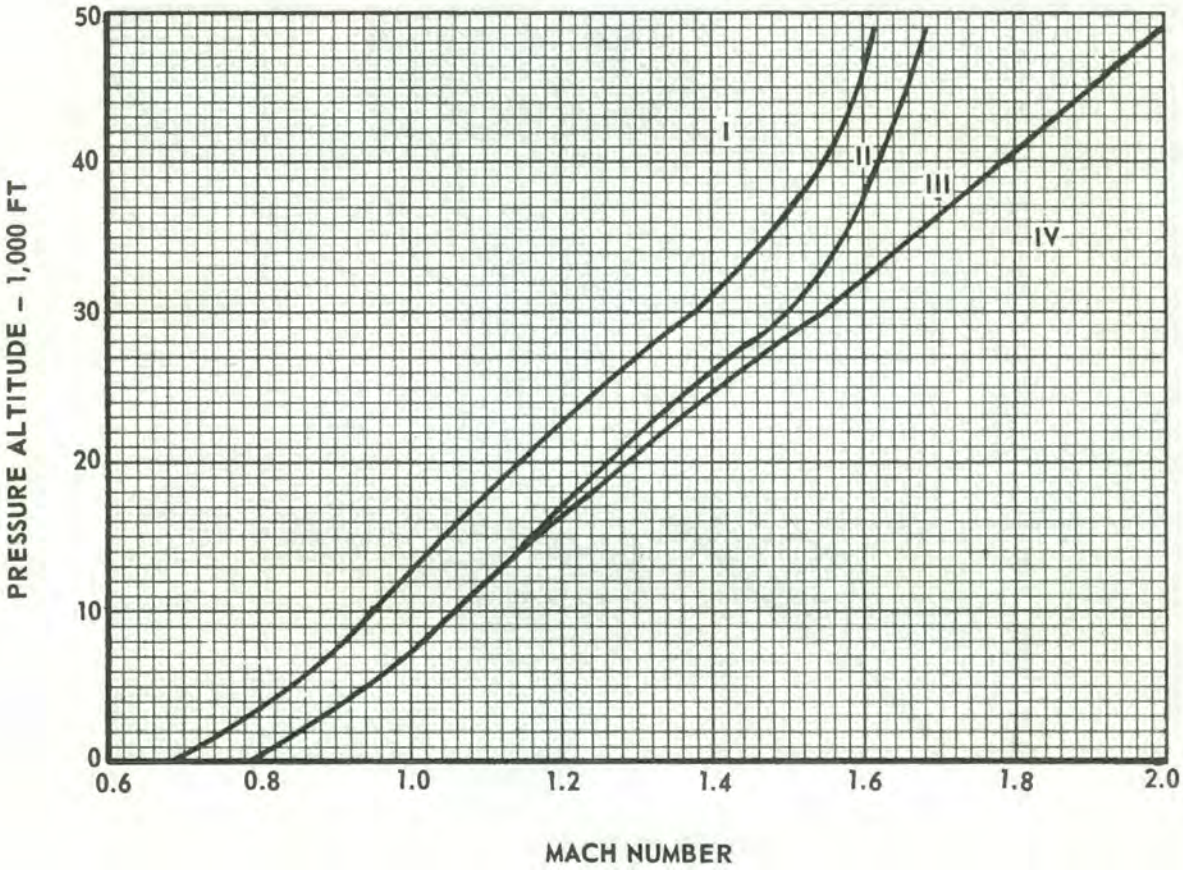


Figure 2–4 (Sheet 7)

Airspeed Limitations

AIRCRAFT CARRYING AIM-9B MISSILE(S) WITH MK 8 MOD 0/1/2 WARHEAD HOT DAY – 103°F (39.5°C) AT SEA LEVEL



LIMITATIONS

ZONE I:	No restrictions
ZONE II:	Repeated excursions of no more than 10 minutes each permissible
ZONE III:	Repeated excursions of no more than 5 minutes each permissible; inspection of warheads recommended after each excursion into Zones II and III.
ZONE IV:	Avoid

NOTES

1. Limitations do not apply to aircraft climb schedules.
2. If limitations of Zones II, III and IV are violated, the warhead should be destroyed by jettisoning the missile, if possible. If not possible, landing on the carrier or airstrip can be made with low order risk.
3. Limitations apply only to the Mk 8 Mod 0/1/2 warhead. The Mk 8 Mod 3 warhead is unrestricted.

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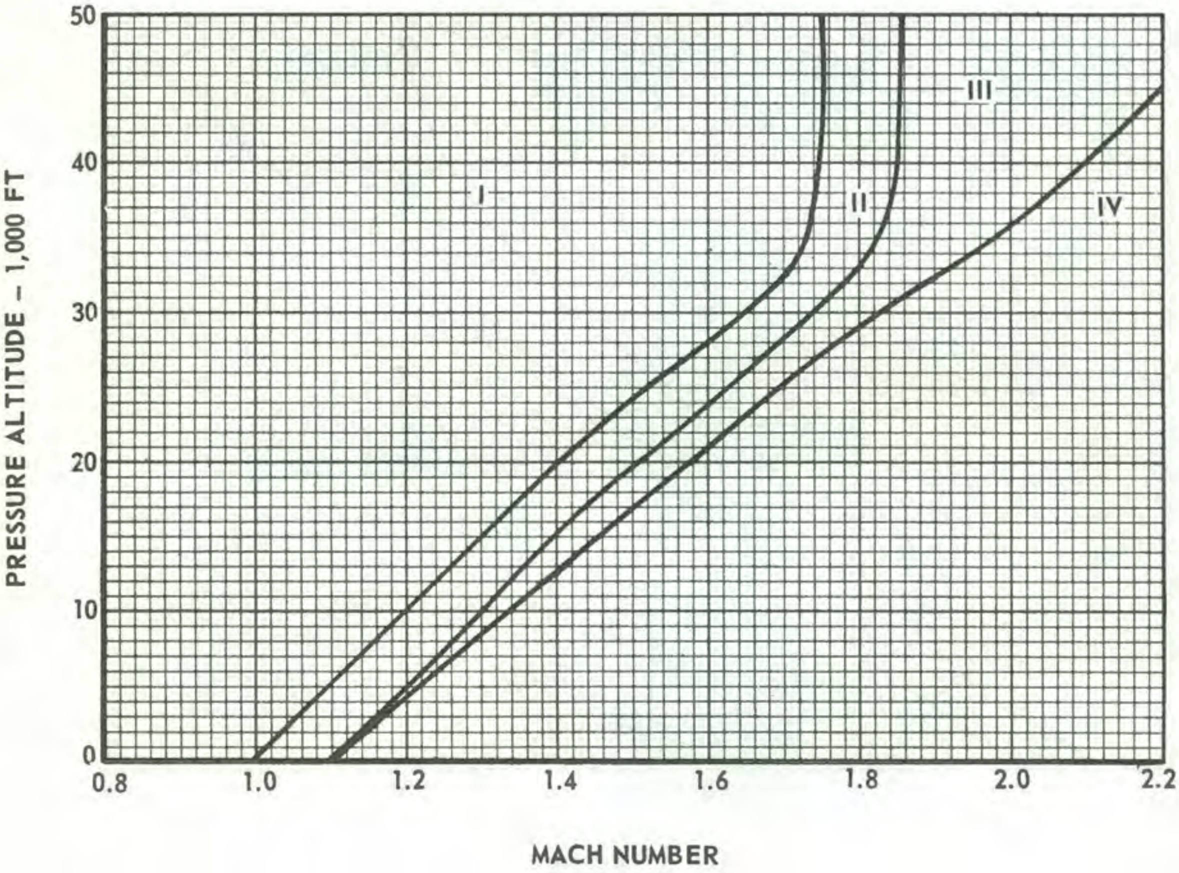
Figure 2-5 (Sheet 1)

Airspeed Limitations

AIRCRAFT CARRYING AIM-9B MISSILE(S) WITH MK 8 MOD 0/1/2 WARHEAD STANDARD DAY – 59°F (15°C) AT SEA LEVEL



LIMITATIONS

ZONE I:	No restrictions
ZONE II:	Repeated excursions of no more than 10 minutes each permissible
ZONE III:	Repeated excursions of no more than 5 minutes each permissible; inspection of warheads recommended after each excursion into Zones II and III.
ZONE IV:	Avoid

NOTES

1. Limitations do not apply to aircraft climb schedules.
2. If limitations of Zones II, III and IV are violated, the warhead should be destroyed by jettisoning the missile, if possible. If not possible, landing on carrier or airstrip can be made with low order risk.
3. Limitations apply only to the Mk 8 Mod 0/1/2 warhead. The Mk 8 Mod 3 warhead is unrestricted.

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Figure 2-5 (Sheet 2)

Pylons, Racks and Weapons Compatibility

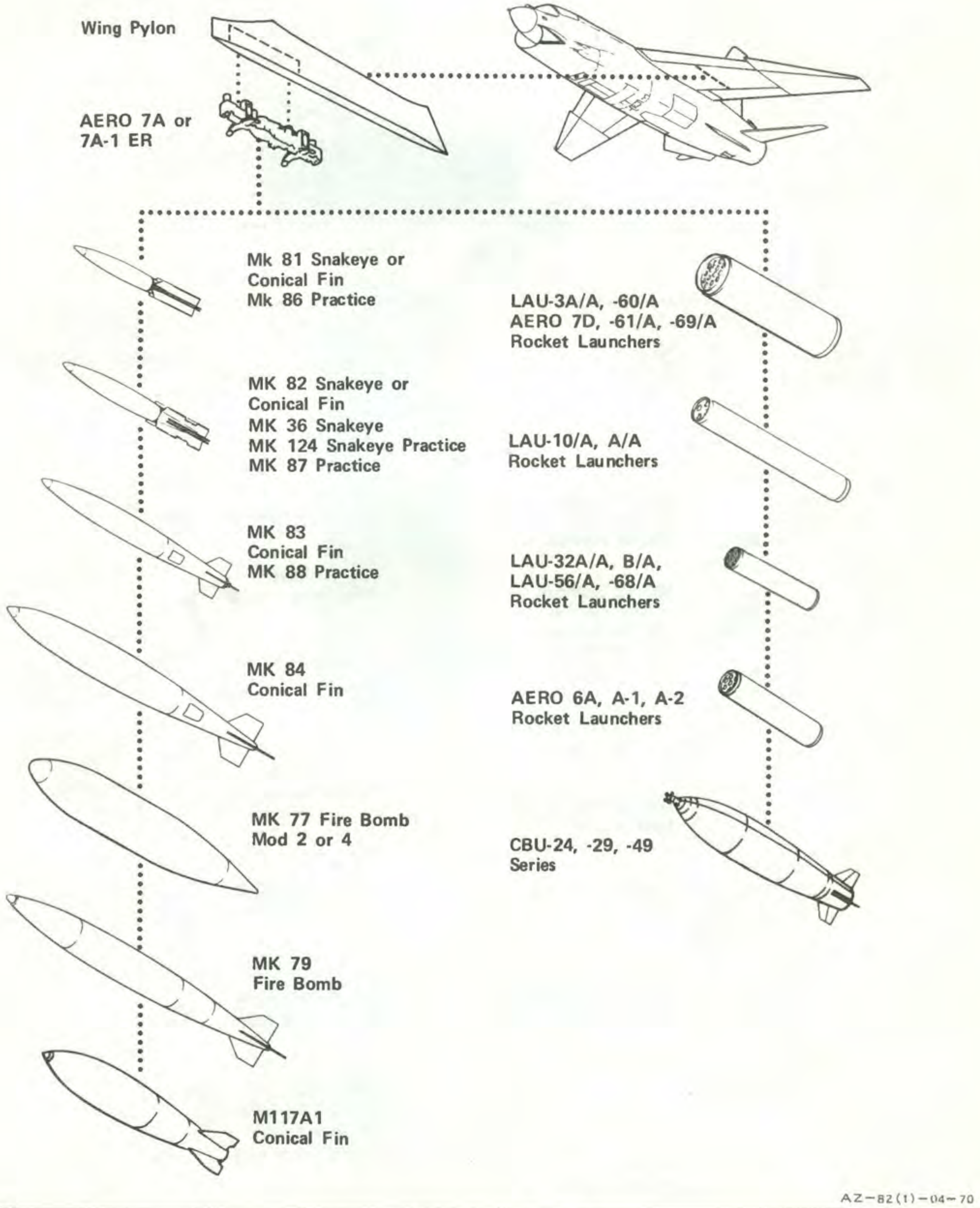


Figure 2-6 (U) (Sheet 1)

Pylons, Racks and Weapons Compatibility

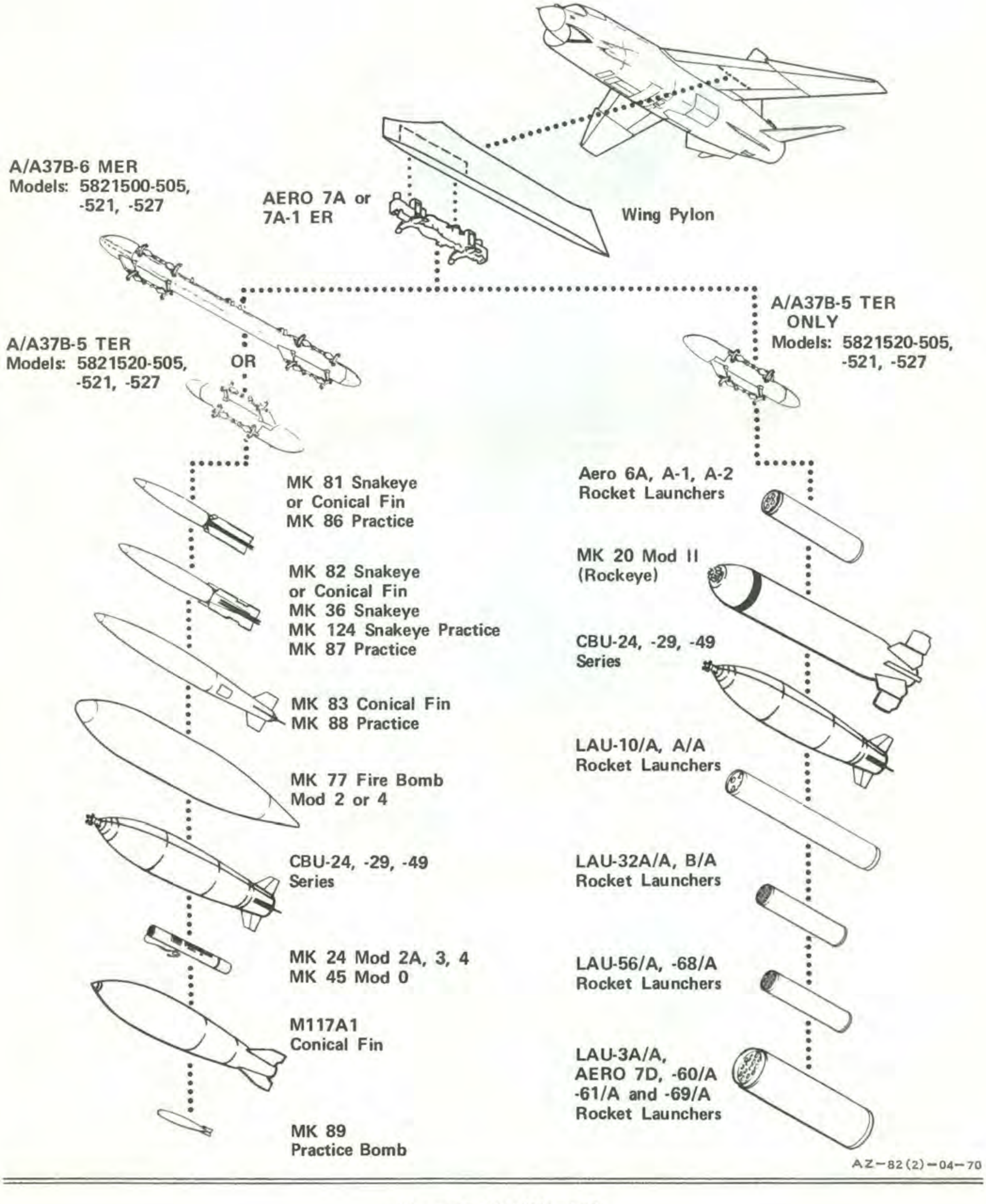


Figure 2-6 (U) (Sheet 2)

Pylons, Racks and Weapons Compatibility

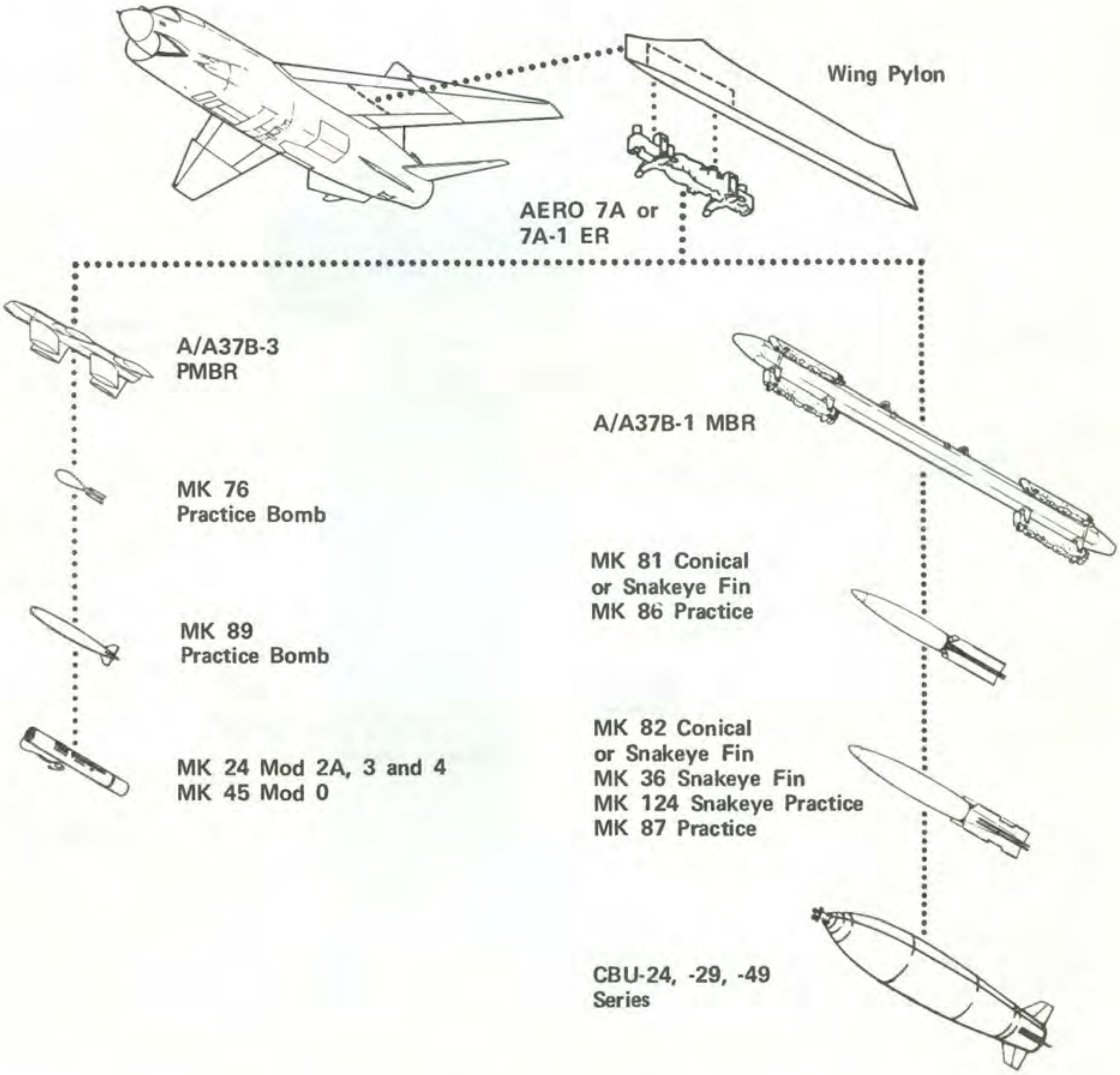


Figure 2–6 (U) (Sheet 3)

Pylons, Racks and Weapons Compatibility

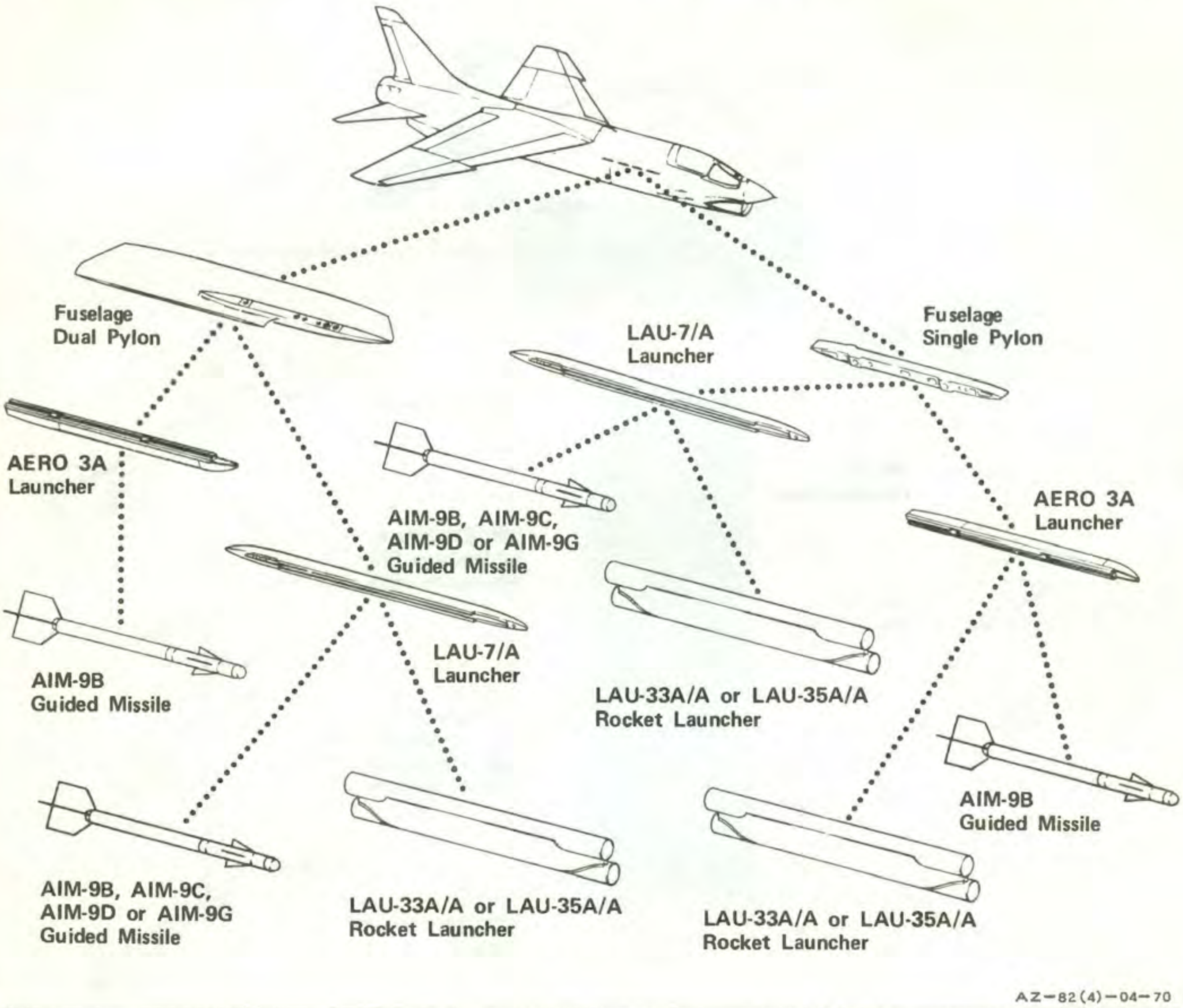


Figure 2-6 (U) (Sheet 4)

BOMB FUZING

INTRODUCTION

Proper selection of bomb fuzes is absolutely essential for safety of the delivery aircraft and effectiveness of the mission. Because mission requirements vary widely, it is necessary to maintain a number of different types of fuzes in stockpile, each fuze having its own unique delivery characteristics and imposing its own delivery requirements.

Fuzes may be most conveniently divided into two categories: electrical or mechanical. Each category has its own advantages and disadvantages. The primary advantage of electric fuzes is flexibility. They allow the use of advanced VT devices for airbursts, they can provide inflight selection of arming and functioning delay times, and they impose no speed restrictions.Electric fuzes, however, are more prone to early burst or arming, are more susceptible to electromagnetic radiation. (HERO), and increase the opportunity for pilot error in the selection of fuzing options. Mechanical fuzes are more reliable in operation but generally no inflight options of arming and functioning delays are available. The arming vanes and arming wires used with mechanical fuzes impose carriage and release restrictions.

Pertinent characteristics of these types of fuzes are summarized below. A compatibility summary of authorized bomb/fuze combinations and detailed summary sheets for each fuze currently authorized for carriage are provided in this section.

MECHANICAL FUZES

Most current mechanical fuzes contain the same basic elements and operate on a similar principle. See figure 2–7.

Fuze Arming

An arming vane on the fuze is driven by the air stream and provides mechanical energy to operate the fuze mechanism. This vane is held stationary while on the aircraft by an arming wire, which extends through the blades of the vane and is connected to an arming solenoid on the bomb rack.

If the weapon is to be released armed, the bomb rack solenoid is energized, thus locking the arming wire to the rack. Upon bomb release, the arming wire is withdrawn from the fuze and the arming vane begins rotation.

This rotation drives a gear train in the fuze which removes safety blocks and aligns the firing pin with a sensitive explosive detonator. The fuze is then considered armed and ready to function.

The gear train mechanism is designed to provide a definite delay after separation from the aircraft. This is called "arming delay."

Some of the latest fuzes permit the selection of various arming delays before flight and also contain a governor mechanism so that arming delay time will remain constant regardless of the release airspeed.

Fuze Functioning

With most impact fuzes, the firing pin is driven into a detonator or primer on impact. This, in turn, initiates an explosive booster and detonates the main charge in the weapon.

In air burst (time) fuzes, the firing pin is actuated by a preset clockwork mechanism rather than by impact.

A short delay (functioning delay) between impact and detonation can be provided by the use of slow-burning pyrotechnic elements. The delay element is integral to some fuzes and in others must be inserted in the fuze before installation in the bomb. For long delays (several seconds up to several hours) various methods are used including pyrotechnic, clockwork, or electric delay elements.

Selection of the proper functioning delay is necessary to maximize the effect of the bomb against various targets. The Joint Munitions Effectiveness Manual (JMEM) provides data on this subject.

Safe-Jettison

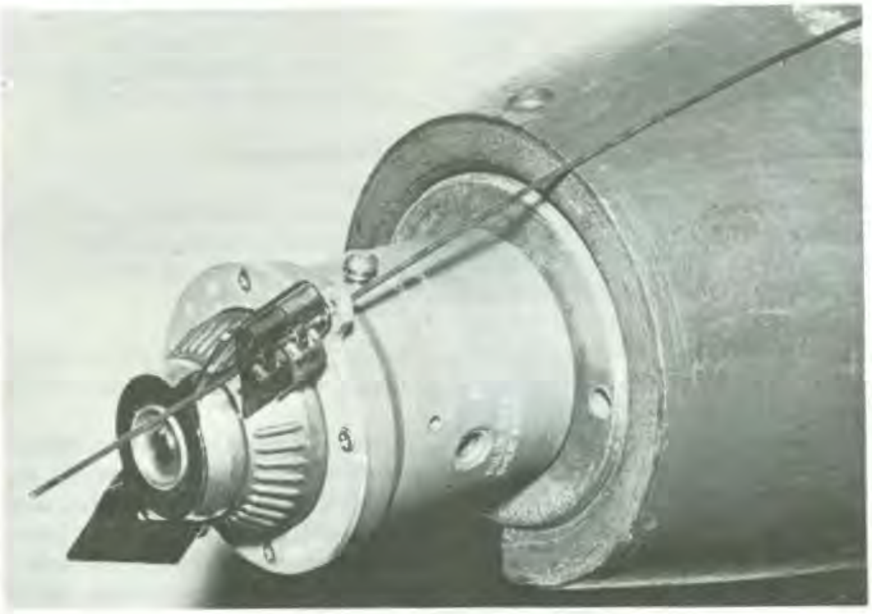
To safe-jettison a mechanical fuze, the bomb rack solenoid is deenergized allowing the arming wire to remain with the weapon on release. This locks the arming vane and prevents fuze arming.

In bomb racks used on jet aircraft, it has been necessary to increase the holding tension of the solenoid in the deenergized (SAFE) position. This prevents the high-speed airstream from inadvertently pulling the arming wire from the solenoid. Under service use environment, this holding tension can further increase to the point where it is impossible to jettison a weapon in the safe condition regardless of the position of the mechanical fuze arming switch. To minimize this possibility, maintenance and loading procedures outlined in current Technical Directives and Loading Manuals must be carefully observed.

If an unarmed weapon impacts with sufficient velocity on a hard surface, a significant detonation can still occur, with bomb fragmentation creating a hazard to the delivery aircraft. Therefore, if it is necessary to safe-jettison stores,

Mechanical Fuzes

M904E2/E3 NOSE FUZE



CHARACTERISTICS

Type	Mechanical-impact
Location	Nose
Limit speeds	
Max carriage	475 KIAS
Max release	525 KIAS
Min release	175 KIAS
Inflight options	None
Authorized bombs	M117, Mk 80 series LD, SNAKEYE I

ARMING AND FUNCTIONING DELAYS (Preflight Selectable)	
ARMING (Sec)	2/4/6/8/10/12/14/16/18
FUNCTIONING (Sec)	Instant/.01/.025/.05/0.10/0.25 *
Arming Tolerance: ±10% of arming delay setting	

DESCRIPTION

The M904E2/E3 fuzes permit preflight selection of several different arming and functioning delays. The arming delays are selected by a dial on the nose of the fuze. Functioning delays are selected by installation of the appropriate delay element in the fuze prior to installation in the bomb. The E3 embodies internal design changes which provide improved reliability against hard targets and increases sensitivity against soft targets (mud or water) in the retard mode. The E2 may dud if delivered against soft targets in the retard mode.

Due to the potential hazards of short arming delays, a stop screw in the head of the fuze must be removed to select the 2- or 4-second setting. The stop screw must not be reinstalled with the fuze set at 2 or 4 seconds or the fuze may dud.

The 2- and 4-second settings are for use in the retard mode. See table for minimum safe arming times. The fuze must be interconnected with the Snakeye fins by an arming wire if delivery is to be in the retard mode.

If this fuze is used with the M1A1 fuze extension (Daisycutter), a nondelay (INST) element must be installed in the fuze.

Regardless of the delay setting used, any mechanical nose fuze may detonate instantaneously on impact with very hard targets (concrete runways, dams) and is therefore ineffective when penetration is desired. Use tail fuzes for these conditions.

PREFLIGHT CHECKS

Assure that proper fuze is installed and desired arming delay set. Check arming wire rigging, Fahnestock clips, and removal of warning tags. Check that stop screw is removed at 2- and 4-second setting.

WARNING

If observation window shows full red at any setting, fuze is armed. The M904E2 will show a white line and the E3 will show a white S on a green background at the 6- and 18-second settings if fuze is fully safe. A white line or green background at any setting other than 6 or 18 indicates partial arming. Do not use a partially armed fuze; arming delays will be shorter than that set on the dial.

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Figure 2-7 (C) (Sheet 1)

Mechanical Fuzes

M1A1 FUZE EXTENSION (DAISYCUTTER)

CHARACTERISTICS

Type . . . . Fuze Extension (Daisycutter)
Location . . . . Nose
Limit Speeds:
Carriage and Release . . . . 475 KIAS
Authorized Bombs . . . . Mk 80 Series, M117A1
Authorized Fuzes M904E2/E3

DESCRIPTION

The M1A1 fuze extension is an explosive-filled metal tube which provides above ground burst capability. This capability improves the effectiveness against personnel and unarmored targets.

The fuze extension contains Composition B which is sealed in a tubular insert fitted loosely in the metal tube and is available in 18-inch and 36-inch lengths.

See External Stores Limitations Charts for minimum release intervals and restrictions on bomb rack loading.

WARNING

The M1A1 fuze extension is not authorized for carrier-based use and is restricted from any arrested landings.

If an unsuccessful attempt to release has been made during flight, weapons equipped with the fuze extension should be jettisoned prior to landing.

PREFLIGHT CHECKS

Make the normal checks presecribed for the fuze which is installed. Ensure that the fuze delay is set for INSTANTANEOUS functioning delay.

A single length of arming wire must be used. Arming wire extensions may break upon release and cause duds.

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Figure 2-7 (C) (Sheet 2)

Mechanical Fuzes

AN-M173A1/M918 MULTIPOSITION IMPACT FUZES

CHARACTERISTICS

Type . . . . Mechanical-impact
Location . . . . Nose, tail or side
Limit speeds
Max carriage . . . . 475 KIAS
350 KIAS (see AN-M173 discussion)
Max delivery . . . . 525 KIAS
450 KIAS (see AN-M173 discussion)
Min delivery . . . . None
Inflight options . . . . None
Authorized bombs
AN-M173A1 . . . . Mk 77 Mod 2/4 and Mk 79
M918 . . . . Mk 77 Mod 4

ARMING AND FUNCTIONING DELAYS	
ARMING (A Function of Airspeed)	FUNCTIONING
0.8 seconds at 350 KIAS	AN-M173A1 – Instantaneous
0.6 seconds at 500 KIAS	Instantaneous M918 – 0.3 seconds

DESCRIPTION

The AN-M173A1 and M918 fuzes were designed for use in firebombs and are similar except that the M918 has been altered to provide a 0.3-second functioning delay. Although these fuzes are physically interchangeable, they must be installed only in the specific igniters indicated below to ensure proper functioning.

To increase reliability, two fuzes are normally installed in all firebombs and both fuzes must be of the same type. The 0.3-second delay provided by the M918 will produce a larger ground pattern with longer burn time than that resulting from instantaneous fuzing. The fireball at impact may, however, appear smaller to the pilot. Use M918 in preference to the AN/M173A1.

The AN-M173AI fuze (with AN-M23A1 igniter) is compatible only with the nose and tail wells of the Mk 77 Mod 2/4 and two side wells of the Mk 79. At high speeds, vibration can develop in the tail section of the Mk 77 of sufficient magnitude to sever the arming wire and arm the fuze. As a result, the lower speed restrictions noted earlier must be observed when this fuze is installed in the tail well of the Mk 77 Mod 2/4.

The M918 fuze (with Mk 273 Mod 0 igniter) is compatible only with the two side wells of the Mk 77 Mod 4. It may be carried and delivered at the high speeds noted above.

PREFLIGHT CHECKS

Ensure that the proper fuze and igniter combination is installed. Check arming wire rigging, Fahnestock clips, fuze condition, and removal of fuze warning tags.

WARNING

SAFE jettison of fire bombs with these fuzes installed cannot be assured. Impact may rupture the igniter, regardless of ARM/SAFE condition of the fuze, and ignite the fuel mixture.

These fuzes should be considered armed if the clearance between the hub of the arming vane and the hexagonal shoulder of the fuze body is greater than 3/16 inch.

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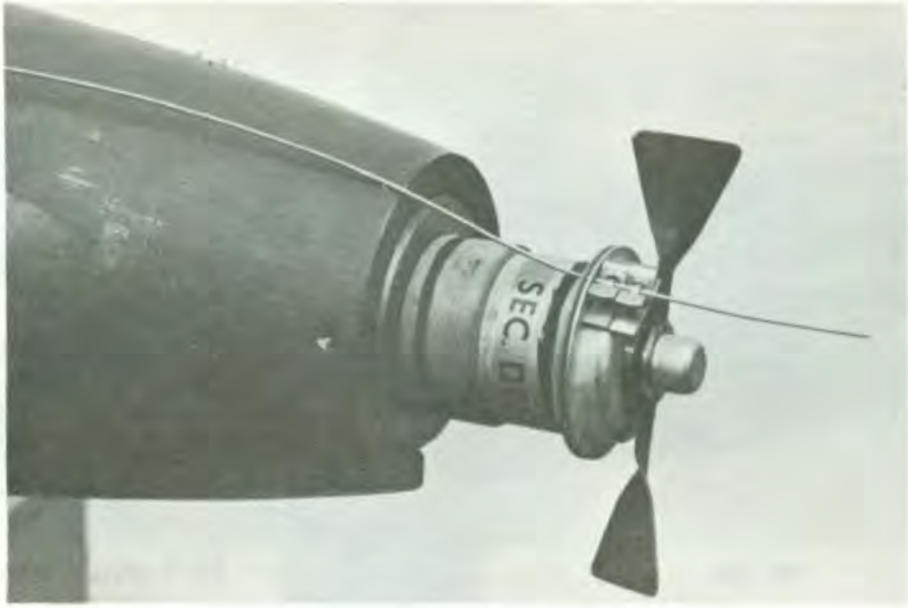
Figure 2-7 (C) (Sheet 3)

Mechanical Fuzes

MK 347 NOSE FUZE



CHARACTERISTICS

Type	Mechanical-impact
Location	Nose
Limit speeds	
Max carriage	475 KIAS
Max release	400 KIAS
Min release	175 KIAS
Inflight options	None
Authorized bombs	
Mk 347	Mk 81/82 LD and SNAKEYE

ARMING AND FUNCTIONING DELAYS	
ARMING	.7 to 1.2 Seconds (a function of airspeed)
FUNCTIONING	12 Sec

DESCRIPTION

The sensitivity of the Mk 347 will provide detonation on impact with shallow water or marsh. This sensitivity and the long functioning delay were designed for slow-speed, low-altitude retarded delivery. Release of this fuze at speeds in excess of 400 KIAS will result in unpredictable operation due to aerodynamic instability. Use only the FLAT vane that is shipped with these fuzes.

Although the probability of early burst is low, the short arming time of the Mk 347 does not provide safe separation in the event an early burst does occur. This fuze should not be used if M904E3 fuzes with selectable arming times are available. The fuze must be interconnected with the Snakeye fin by an arming wire if delivery is to be in the retarded mode.

This fuze must not be used with the M1A1 fuze extension (Daisycutter) due to the long functioning delay.

Regardless of the delay settings used, any mechanical nose fuze may detonate instantaneously on impact with very hard targets (concrete runways, dams) and are therefore ineffective when penetration is necessary. Use tail fuzes for these conditions.

WARNING

This fuze does not provide safe separation in the event of early burst. Use release conditions in which there is a low probability of bomb-to-bomb collision.

PREFLIGHT CHECKS

WARNING

Fuze should be considered armed if the clearance between the two flanges on the head of the fuze is greater than 1/8 inch.

Check arming wire rigging, Fahnestock clips, removal of warning tags, and fuze condition. A decal which reads '12 SEC DELAY' is affixed to the fuze body. Fuze should be considered armed if the clearance between the two flanges on the head of the fuze is greater than 1/8 inch.

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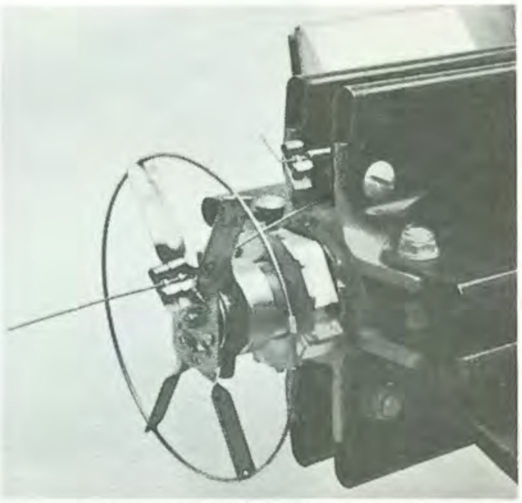
Figure 2-7 (C) (Sheet 4)

Mechanical Fuzes

MK 346 LONG DELAY FUZE

MK 346



MK 4 MOD 1 TAIL DRIVE

CHARACTERISTICS

Type . . . . Mechanical long delay
Location . . . . Tail

Carriage Restrictions: These restrictions are imposed due to tail fin vibrations which can cause damage to fuze and arming vane.

Snakeye fins . . . . 525 KIAS
Conical fins . . . . 450 KIAS

Authorized bombs . . . . . Mk 81, 82, 83 LD and SNAKEYE I

DELIVERY RESTRICTIONS

The following delivery parameters will ensure 90% fuze reliability. These restrictions may be exceeded for tactical reasons but reliability will be degraded. See DESCRIPTION for further details.

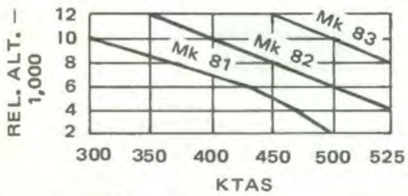
LAND TARGETS		WATER TARGETS
UNRETARDED	RETARDED	UNRETARDED ONLY
MAX RELEASE SPEED  MIN REL SPEED – No MINIMUM MIN REL ALT – 1,000 ft. AGL	MAX REL SPEED – 525 KTAS MIN REL SPEED – 300 KTAS MIN REL ALTITUDE – 300 ft. AGL	MAX REL SPEED – 525 KTAS MIN REL SPEED – 450 KTAS MIN REL ALTITUDE – 3,000 ft AGL

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Figure 2–7 (C) (Sheet 5)

Mechanical Fuzes

MK 346 LONG DELAY FUZE

DESCRIPTION

Mk 346 is a clockwork fuze which provides increased safety as compared with the older chemical delay fuzes. The fuze employs two-stage arming; air travel plus impact are necessary to complete arming. The functioning delay does not commence until impact.

The Mk 346 is sensitive to impact angle and velocity. Impact at high speeds on hard targets can damage the timer. As bomb size increases, higher impact velocities can be tolerated. Impact angles of less than 15° on any type of target or low impact velocities on water targets will fail to arm the fuze. The delivery restrictions outlined in the preceding table will ensure 90% fuze operability. For absolute maximum operability, delivery in the retarded mode is recommended. Failure to observe the Mk 81/82 restrictions can reduce fuze reliability to about 60%.

The fuze contains an anti-removal device which deters removal of the fuze from the bomb after it has armed. The delay setting dial cannot be observed once the fuze has been installed in the bomb.

A Mk 3, 4, or 5 arming assembly is used to provide arming action to the fuze. These assemblies consist of an arming vane, a drive mechanism, and a drive shaft and may be used with either conical or Snakeye fins. The Mod 0 and Mod 1 arming assemblies are speed governed; the Mod 2 is direct drive. This accounts for the variation in arming times as shown above.

PREFLIGHT CHECKS

Fuze will be difficult to observe. Check arming wire rigging, condition of arming vane, and removal of warning tags. The Mod 2 arming assembly has DIRECT DRIVE stencilled on the hub of the fuze drive. A steel nose plug should be installed in the nose of the bomb to lessen the probability of weapon breakup on impact.

WARNING

A red and black band in the observation window indicates that first stage arming has occurred. Timer may be running.

ARMING AND FUNCTIONING DELAYS	
ARMING	With Governed Arming Assembly (Mod 0/1) 1.5 to 2.0 seconds (unretarded) plus impact 1.5 to 4.0 seconds (retarded) plus impact **NOTE** At high speed release, retardation causes fuze drive to lose speed thus increasing the arming time. – With Direct Drive Arming Assembly (Mod 2) Less than 1 second plus impact
FUNCTIONING (Preflight Selected)	30 minutes to 33 hours (15 min increments)

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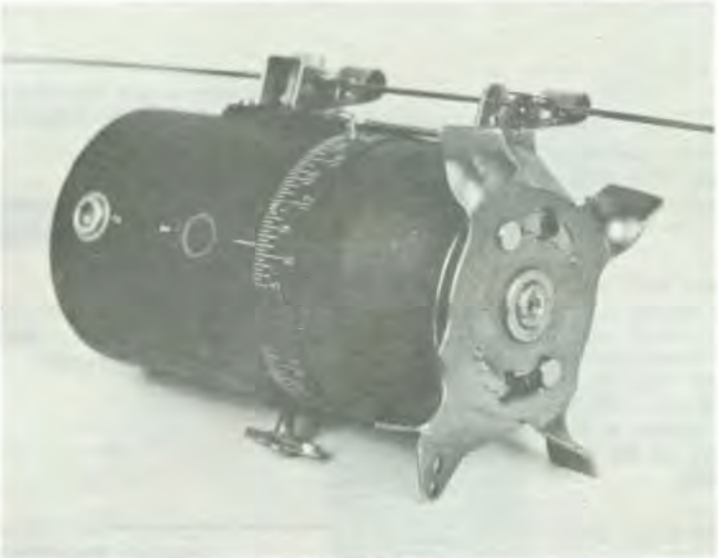
Figure 2–7 (C) (Sheet 6)

Mechanical Fuzes

M907E1/E2 TIME FUZE



M907E2

CHARACTERISTICS

Type . . . . Mechanical time (airburst)
Location . . . . Nose
Limit speeds
Max carriage . . . . 600 KIAS CBU-24/29/49
Max release . . . . 600 KIAS CBU-24/29/49
Min release . . . . 175 KIAS
Inflight options . . . . None
Authorized bombs . . . . CBU-24/29/49-1B, -1B Mod, -A/B, -C/B

ARMING AND FUNCTIONING DELAYS	
ARMING	Arming delay is 40% to 60% of the functioning delay.
FUNCTIONING	Preflight selected M907E1 – 4 to 92 seconds M907E2 – 3 to 92 seconds

DESCRIPTION

M907E1/E2 series fuzes provide an airburst capability for dispenser or cannister type weapons. Functioning accuracy is ±1 second at settings below 45 seconds and ±1.5 seconds at all settings above 45 seconds. Both the arming and functioning delay times begin simultaneously upon release.

M907 fuzes will not arm reliably at speeds less than 175 KIAS. If released in loft delivery, the trajectory airspeed of the bomb must not fall below 175 knots during the arming portion of travel or a dud will result.

PREFLIGHT CHECKS

Assure that the proper delay is set and lock screw is tight. Check arming wire rigging, Fahnestock clips, removal of fuze warning tags, and fuze condition. Ensure that arming vane is securely attached.

WARNING

An apperture in the body of the fuze (marked with the numeral 2) is covered with an aluminum foil seal. If brass plunger (slider assembly) protrudes through the foil the fuze is armed. Foil may be missing, but as long as slider assembly does not protrude from fuze body the fuze is safe.

Fuze does not require impact for detonation and must not be used in any HE bomb.

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Figure 2-7 (C) (Sheet 7)

Mechanical Fuzes

MK 339 MOD 0 TIME FUZE

CHARACTERISTICS

Type	Mechanical time (Airburst)
Location	Nose
Limit speeds	
Max carriage	No fuze imposed limitations
Max delivery	No fuze imposed limitations
Min delivery	225 KIAS
Inflight options	None
Authorized Bombs	Mk 20 Mod 0 (Rockeye II), CBU 24/B

ARMING AND FUNCTIONING DELAYS	
Arming – 1.1 seconds	
Functioning – 1.2 to 50 seconds (0.1 sec increments) Preflight selected	
FUNCTION DELAY –	±0.1 second for settings from 1.2 to 10 seconds
TOLERANCE	1% of all settings over 10 seconds.

DESCRIPTION

The Mk 339 is a mechanical time fuze designed to provide an airburst capability for cluster and cannister weapons. It is currently authorized for use only with Rockeye II. The fuze has provisions for preflight setting of a primary and an option function delay. Either of these functioning delays may be set from 1.2 to 50 seconds. However, when installed in Rockeye II only the option time setting can be used and currently approved tactics dictate the use of only a 4.0- or 1.2-second functioning delay.

Rockeye II is shipped in an all-up condition with a Mk 339 fuze installed and with a primary wire and safety wire with a warning tag installed. The option arming wire is removed at the depot thereby preselecting the option delay setting. The fuze is shipped with the option delay set at 4 seconds and the primary set at 0. The option delay may be reset to 1.2 second if required by tactical conditions. Settings are made on 2 dials which appear in a window in the side of the fuze. Primary dial is black; option dial is silver. The dials will not be visible when installed in ROCKEYE.

At release, withdrawal of the primary arming wire unlocks the arming vane, starts the timer and selects the option delay. The arming and functioning delays commence simultaneously at release The timer functions with an accuracy of plus or minus 1/2%.

WARNING

Fuze does not require impact to function and should not be used in any HE bomb.

PREFLIGHT CHECKS

WARNING

If red-tipped plunger protrudes into plastic bubble on side of fuze, the fuze is armed and should be considered dangerous. This bubble is visible through an observation window in Rockeye nose fairing.

Only the arming vane will be clearly visible. Check rigging of primary arming wire and removal of safety tag. No Fahnestock clips are used and arming wire should extend only 1/2 inch beyond arming vane clamp.

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Figure 2-7 (C) (Sheet 8)

release bombs over water or soft ground, at low airspeeds, and above the fragmentation envelope. These precautions are particularly applicable to noze fuzes due to their exposed locations. Bombs may detonate on hard targets even without a fuze installed.

Shear Safe

In most modern fuzes, the firing pin and the detonator or primer are not aligned until the fuze arms. Should an unarmed fuze shear off the bomb on impact, the weapon will remain relatively safe. This provision greatly reduces the probability of bomb detonation in the event of a landing accident.

ELECTRIC FUZES

Basic Theory of Operation

There are two basic types of electric fuzes. These are:

DC-only Preselected fuzes – M990E-1, -3 and -4

DC-only Retard Sensing fuzes – Mk 344 and Mk 376

The Mk 344/376 fuzes are being produced as eventual replacements for the M990 series.

While there are important differences between these fuzes which pilots must understand, the basic operating principles are similar. See figure 2–8.

Electric fuzes receive their operating energy from the delivery aircraft via the Fuze Function Control Set (AWW-2A), a bomb-rack cable assembly, and a cable network in the weapon. This energy is applied to the fuze during the first few inches of bomb travel after release from the bomb rack.

For each arming/functioning delay combination provided by the fuze, there will be a discrete electrical circuit or channel in the fuze. Each of these channels is designed to provide a specific electrical delay when a voltage is applied.

Preselected DC-Only Fuzes (M990 E1, E3, E4)

These are basic +300-volt dc fuzes in which a single arming/functioning delay circuit has been preselected before issue. These fuzes need only dc voltage for their operation and no delay options are available to the pilot. Inadvertent application by the pilot of an additional rf signal can cause unreliable operation and possibly dangerous arming delays.

DC-Only Retard Sensing Fuzes (Mk 344 – Mk 376)

These fuzes use a deceleration sensing device to automatically select the proper arming delay circuit for either retarded or unretarded delivery. Four different dc voltage/polarity combinations are used to provide an in-flight option of several functioning delays. Inadvertent application of RF signals to these fuzes can cause erratic arming delays.

Electric Fuze Operation

Regardless of the method used to select the delay, at completion of the required arming time the dc voltage causes rotation of a mechanical rotor in the fuze. This rotor aligns the detonator with the booster and closes all the firing circuits with the exception of the final inertia-operated impact switch. At this point, the fuze is armed and is in all respects ready to fire.

On impact, the impact switch closes and the stored dc voltage detonates the fuze after the selected functioning delay has elapsed.

Mechanical safety is provided in electric fuzes by a "gag rod" which physically prevents rotation of the rotor. This gag rod is held in place by an arming wire which is withdrawn from the fuze at weapon release. For electric fuzes, arming wire is positively connected to the bomb rack rather than to one of the bomb arming solenoids. As a result, the gag rod is always withdrawn when the weapon leaves the rack regardless of the position of the mechanical fuze arming switch in the cockpit. Thus, to assure safe jettison, the Fuze Function Control Set must be in the SAFE position to prevent any electrical energy from entering the fuze. The impact switch in electric fuzes is sensitive to shock in any direction, and not merely along the longitudinal axis of the bomb. Therefore, the probability of an early burst due to bomb-to-bomb collision after fuze arming is greater than with mechanical fuzes which require a longitudinal force.

VT Elements

VT sensing elements (figure 2–9) may be used in conjunction with electric fuzes to provide an airburst capability. With these devices, the electric fuze operates in a normal manner except that an independent source of electrical energy from the VT device bypasses the impact switch in the electric fuze and detonates the weapon at a desired burst height. In this application, the electric fuze will detonate on impact in the event the VT element has not operated. When VT elements are being used, it is suggested that the electric fuze be set for instantaneous functioning delay in order to provide the most effective backup in case of VT element failure.

Electrical Fuzes

MK 344/376 TAIL FUZE

MK 344 FUZE

CHARACTERISTICS

Type . . . . Electric-impact
Location . . . . Tail
Limit Speeds
  Max release . . . . No fuze imposed limitations
  Min release . . . . 400 KIAS (retarded mode only)
Inflight options . . . . 3 functioning delays plus airburst if used with VT element. Indirect control of arming (See discussion.)

Authorized bombs . . . . Mk 80 series, Snakeye I, and M117
Control system AWW-2A

ARMING AND FUNCTIONING DELAYS	
ARMING	Automatically selected by the fuze depending upon delivery mode. Mk 344 / Mk 376 Retarded 2.6 sec / 2.6 sec Unretarded 5.5 sec / 10.0 sec
FUNCTIONING	Cockpit selectable – 0/.015/.1 sec (plus VT option)
Arming delay tolerance . . . . –10 to +20%	

DESCRIPTION

The Mk 344 and Mk 376 fuzes are identical in all details except for the difference in arming delay times in the unretarded delivery mode. The longer arming delay (10 seconds) provided by the Mk 376 permits use of this fuze in straight and level, unretarded delivery. This mode is not authorized with the Mk 344 for safe separation reasons.

Mk 344/376 fuzes are designed as replacements for the M990 series and provide improved safety and reliability. They are initiated by dc voltages and can be controlled by the electric fuzing system (AWW-2A). Arming delays are not directly selectable by the pilot; however, a timer/decelerometer (Mk 31) integral to the fuze automatically selects a 2.6-second arming delay upon sensing weapon retardation. If retardation does not occur, the Mk 344 automatically selects a 5.5-second delay, the Mk 376 a 10-second delay. The pilot has the option of three functioning delays. Refer to table for AWW-2A cockpit settings.

The Mk 344/376 can be used in combination with the M20 or Mk 43 VT elements to provide a capability for VT initiation coupled with any one of the three delays. This mode is particularly useful for jungle penetration wherein the fuze will be initiated by VT sensing of the tree tops, but will delay detonation until bomb has penetrated the foliage. (See M20/Mk 43 illustrations for further details.)

The 400 KIAS minimum speed restriction is due to the fact that the Mk 31 decelerometer will not sense sufficient retardation at lower speeds. This could result in the selection of the longer delay and a dud. This fuze must be used with ejector racks only.

WARNING

If the arming wire is inadvertently withdrawn from the Mk 344/376 fuze prior to weapon release, the sensing device will not operate and the fuze will arm at 2.6 seconds after release, regardless of delivery mode.

A special circuit is included in these fuzes to prevent the potentially dangerous situation in which the bomb fails to retard, ricochets, and then detonates on subsequent impact. The "dudding circuit" will dud the bomb on initial impact provided impact occurs between 2.5 and 5.5 seconds (10 seconds for Mk 376) after release and the Snakeye fins have not operated. See Minimum Safe Arming Times and Speeds table.

WARNING

Do not make level release of the Mk 344 at altitudes above 400 feet AGL. If the Snakeye fins malfunction, time of fall will be sufficient to permit 5.5-second arming and aircraft may be within fragmentation envelope. The Mk 376 is the preferred fuze for all level releases, either retarded or unretarded.

PREFLIGHT CHECKS

The installed fuze is difficult to observe. Identifying decals are provided with each fuze to be affixed to the after bomb body as fuze is installed. Assure that electric fuzing cable is connected and arming wire is rigged as prescribed in Airborne Weapon/Store Loading Manual.

AWW-2A SETTINGS			
MK 344/376 MOD 0 FUZES (DC only retard sensing)			
FUNCTION KNOB	ARMING DELAY	FIRING DELAY	INTERLOCK OVERRIDE
Set to desired voltage/ polarity: +300 – INST +195 – INST -300 – 0.1 -195 – 0.015	These three switches are inoperative with FUNCTION knob settings shown. Arming delays are automatically selected as follows: Retarded / Unretarded Mk-344 2.6 / 5.5 Mk-376 2.6 / 10.0		

CAUTION

Inadvertent application of an rf signal may cause unreliable or erratic arming delays.

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Figure 2-8 (C) (Sheet 1)

Electrical Fuzes

M990E-1/E-3/E-4 TAIL FUZE

CHARACTERISTICS

Type . . . . Electric-impact
Location . . . . Tail
Limit speeds . . . . No fuze imposed restrictions
Inflight options . . . . None
Authorized bombs . . . . . All Mk 80 series (LD only), M117
Control system AWW-2A

ARMING AND FUNCTIONING DELAYS			
	E1	E3	E4
ARMING	5.5	10	5.5
FUNCTION	.050	0	0
Arming Tolerance	−10 to +20%		

AWW-2A/2B OPTION SELECTOR SETTINGS			
FUNCTION KNOB	ARMING DELAY KNOB	FIRING DELAY KNOB	INTERLOCK OVERRIDE SWITCH
1. Set to position +300 only.	1. These 3 knobs are inoperative with FUNCTION knob setting shown in column 1. 2. Arming and functioning delays are preselected. See specific fuze for available delays.		

CAUTION

The application of an improper dc voltage or of an rf signal to a dc only fuze can cause unreliable or erratic arming delays.

DESCRIPTION

The M990E-1/E-3/E-4 are electric tail fuzes for use in unretarded Mk 80 series and M117 bombs. These fuzes operate on dc voltage only and provide no inflight options of arming or functioning delays. The 5.5-second arming time provided by the E-1 and E-4 is for use in dive delivery; the 10-second delay of the E3 is for level delivery.

About one out of 1,000 M990E series fuzes will detonate immediately upon arming. This increases to 4 out of 100 when used with VT sensing elements. This condition and the increased hazards of bomb-to-bomb collisions at high speed release demand extreme care in selection of arming times. For minimum safe arming times, refer to illustration of Minimum Safe Arming Times and Speeds.

Refer to table for cockpit settings on AWW-2A fuze function control set.

WARNING

Electric fuzes are particularly susceptible to early bursts due to bomb-to-bomb collision. When using 5.5-second arming time, employ appropriate postrelease maneuvers for maximum bomb/aircraft separation.

Use of M990 series fuzes is not authorized in the retarded mode.

CAUTION

Use caution in selecting fuze option settings with the AWW-2A fuze function control set. The application of an rf signal or a dc voltage other than +300 volts to any M990 series fuze can cause unreliable or erratic arming delays.

PREFLIGHT CHECKS

Identifying decals are provided with each fuze to be affixed to the bomb body as the fuze is installed. Assure that electric fuzing cable between rack and the bomb is connected and arming wire is rigged as prescribed in Airborne Weapons/Stores Loading Manual.

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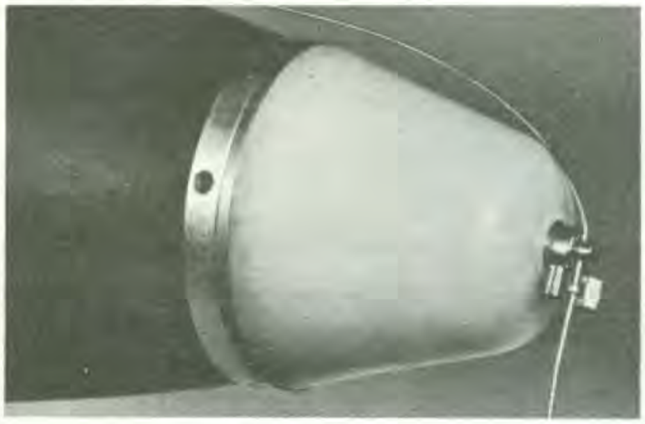
Figure 2–8 (C) (Sheet 2)

Sensing Elements

M20/20A1 SENSING ELEMENT



CHARACTERISTICS

Type	VT sensing element
Location	Nose
Color/markings	M20 Tan, M20A1 Dark red
Inflight options (See table.)	With M990 series fuzes: VT (INST) or non-VT With Mk 344/376 fuzes: VT (INST), VT with delay, or non-VT
Impact angle	45° or greater. Burst height decreases as angle decreases
Burst height:	
High setting	100 to 160 feet
Low setting	20 to 60 feet
Max carriage and release speeds	No M20/20A1 imposed limitations
Min release altitude	2,000 ft AGL
Authorized bombs	Mk 80 LD series and M117

DESCRIPTION

The M20/20A1 is a proximity sensing device which provides an airburst capability for electrically fuzed nonretarded bombs. It employs a forward-looking sensing lobe designed for the steep-angle/high speed impacts common to free-fall weapons. If used with retarded weapons or released below 2,000 feet AGL, a surface burst may result. The M20 and M20A1 are functionally identical.

Electrical energy for operating the sensing element is provided by a battery integral to the M20/20A1. This battery is mechanically initiated by the withdrawal of the arming wire from the nose of the M20 at weapon release. The battery can also be initiated electrically (with the arming wire still in place) by application of an rf energy signal. However, the use of rf signals with any of the current electric tail fuzes is not authorized and, as a result, the M20/20A1 must always be initiated mechanically when VT operation is desired.

WARNING

Use care in selecting fuze option with the fuze function control set (AWW-2A). If the weapon is dropped with the M20 arming wire in place for intended non-VT operation, the VT sensing element can be electrically initiated by the inadvertent application of an rf signal. Under such a condition, the sensing signal can be reflected by the arming wire and cause the bomb to detonate at arming.

The M20 contains no explosive elements. Its only function is to provide an electric firing signal to the electric tail fuze. It cannot detonate the bomb until completion of the arming delay of the particular tail fuze which is installed.

In the event that the M20 fails to operate, the tail fuze will serve as a backup on impact. For most effective backup operation it is recommended that the tail fuze be set for INST functioning.

Release altitude must be sufficient for tail fuze to arm at least 50 feet above desired burst height setting. Do not use M20 in retarded mode.

WARNING

For normal delivery, do not release unretarded bombs closer than 200 milliseconds from the same rack or 100 milliseconds from different racks with M20 activated. Mutual interference between VT elements in bombs in close proximity can cause early bursts.

Observe minimum fuze arming times shown in Minimum Safe Arming Times and Speeds illustration.

PREFLIGHT CHECKS

Ensure that proper VT element is installed and all warning tags removed. Check that an arming wire is rigged in the nose and only one Fahnestock clip is attached.

Check for desired setting of the HI-LO switch.

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Figure 2-9 (C) (Sheet 1)

Sensing Elements

M20/20A1 SENSING ELEMENT

AWW-2A SETTINGS

M990 PRESELECT FUZES (DC ONLY); M990 E-1, E-3, AND E-4			
FUNCTION KNOB	ARMING DELAY KNOB	FIRING DELAY KNOB	INTERLOCK OVERRIDE SWITCH
Set to +300 only M20 must be mechanically initiated to obtain VT mode.	These three switches are inoperative with FUNCTION knob setting shown. Arming and functioning delays are preselected as follows: Fuze / Arming Delay / Functioning Delay (Backup Only) M990 E-1 / 5.5 / 0.050 E-3 / 10.0 / 0.000 E-4 / 5.5 / 0.000		

MK 344/376 FUZES			
FUNCTION KNOB	ARMING DELAY KNOB	FIRING DELAY KNOB	INTERLOCK OVERRIDE SWITCH
M20 must be mechanically initiated to obtain VT option. When so initiated, weapon will function in VT mode with delay indicated below. Set FUNCTION knob to desired voltage/polarity: +300 INST +195 INST -300 0.1 -195 0.015	These three knobs are inoperative with FUNCTION knob settings shown. Arming delays are automatically selected as follows: / Retarded / Unretarded Mk 344 / 2.6 / 5.5 Mk 376 / 2.6 / 10.0		

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Figure 2-9 (U) (Sheet 2)

Sensing Elements

MK 43 TARGET DETECTING DEVICE (VT ELEMENT)

CHARACTERISTICS

Type	VT sensing element
Location	Nose
Color/markings	Dark green
Inflight options (See table.)	
With Mk 344/376 fuze	VT (INST), VT with delay, or non-VT
With M990 series fuze	VT (INST)
Impact angle	0° to 90° (optimum between 10° and 60°)
Burst height	16 feet (nominal). Decreases slightly as impact angle increases.
Limit speeds	No Mk 43 imposed limitations
Authorized bombs	Mk 80 LD series, SNAKEYE I and M117

DESCRIPTION

The Mk 43 is a proximity sensing device which provides an airburst capability for electrically fuzed bombs. It employs a side-looking sensing lobe designed primarily for the shallow angle/low speed impacts common to retarded weapons. It can be used with low drag weapons but burst heights will be slightly lower than nominal.

Mk 43 can be initiated either mechanically by withdrawal of the arming wire, or electrically by application of +300 volts. (See table.) The arming wire is an alternate means of initiation and is not a safing device. The Mk 43 can be electrically initiated with the arming wire in place.

WARNING

On all releases in which the VT element is to be actuated either mechanically or electrically, the arming wire (if one is rigged) must be withdrawn from the Mk 43 for safety reasons. If the arming wire is dropped with a weapon in which the VT element has been electrically actuated, the sensing signal can be reflected by the arming wire and detonate the bomb at fuze arming.

The Mk 43 contains no explosive components. Its only function is to provide an electric firing signal to the electric tail fuze. It cannot detonate the weapon until completion of the arming delay of the particular tail fuze which is installed.

When the Mk 43 is used with an M990 series electric tail fuze, *an arming wire is neither required nor should be rigged to the Mk 43.* The M990 requires +300 volts for operation and this voltage will also actuate the Mk 43. As a result, a non-VT option is not available with the Mk 43/M990 combination.

When the Mk 43 is used with the Mk 344/376 fuze, options of non-VT, VT with delay, and VT (INST) are available. Only the VT with delay option requires that an arming wire be rigged to the Mk 43. (See Mk 344/376 fuze.) For all other options, *an arming wire is neither required nor should be rigged to the Mk 43.* (See WARNING.)

In the event the Mk 43 fails to operate, the tail fuze will serve as a backup on impact. In such cases the selected functioning delay of the tail fuze will operate normally. For most effective backup operations, it is recommended that the tail fuze be set for INST functioning.

Release altitude must be sufficient for the tail fuze to arm at least 50 feet AGL.

WARNING

For normal delivery, do not release bombs from the same or different racks at closer than 60 milliseconds unretarded or 200 milliseconds retarded with Mk 43 activated. Mutual interference between VT elements in bombs in close proximity can cause early bursts.

Observe minimum fuze arming times listed in illustration of Minimum Safe Arming Times and Speeds.

PREFLIGHT CHECKS

Assure that the proper VT element is installed. Check that either an arming wire or a safety clip is rigged in the nose and all warning tags are removed.

When an arming wire is used, only one Fahnestock clip is attached.

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Figure 2-9 (C) (Sheet 3)

Sensing Elements

MK 43 TARGET DETECTING DEVICE

AWW-2A OPTION FOR SELECTOR SETTINGS

M990 PRESELECT FUZES (DC ONLY): M990E-1, E-3, AND E-4			
FUNCTION KNOB	ARMING DELAY KNOB	FIRING DELAY KNOB	INTERLOCK OVERRIDE SWITCH
Set to +300 only. Non-VT option not available with Mk 43/M990. +300 setting will initiate the Mk 43.	These three knobs are inoperative with FUNCTION knob setting shown in column 1. Arming and functioning delays are preselected as follows: Fuze / Arming Delay / Functioning Delay (Backup Only) M990E-1 / 5.5 / 0.50 E-3 / 10.0 / 0.00 E-4 / 5.5 / 0.00		

MK 344/376 FUZES (DC Only Retard Sensing)			
FUNCTION KNOB	ARMING DELAY KNOB	FIRING DELAY KNOB	INTERLOCK OVERRIDE SWITCH
Setting: / Option: +300 / VT/INST +195 / NonVT/INST -300* / VT/.1 delay -195* / VT/.015 delay *With these two settings, Mk 43 must be mechanically initiated to obtain 'VT with delay' mode.	These three knobs are inoperative with FUNCTION knob settings shown in column 1. Arming delay is automatically selected as follows: / Retarded / Unretarded Mk 344 / 2.6 / 5.5 Mk 376 / 2.6 / 10.0		

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Figure 2–9 (U) (Sheet 4)

Sensing Elements

DESTRUCTOR MK 36 (DST) ARMING AND FIRING SYSTEM

MK 30 ARMING DEVICE

MK 42 FIRING MECHANISM

CHARACTERISTICS

Type	Magnetic influence
Location	Nose and tail wells
Color/markings	
Nose device	Green
Tail mechanism	Black with gold flange
Limit speeds	
Max carriage	475 KIAS
Max delivery	525 KIAS (Retard mode only)
Min delivery	175 KIAS
Inflight options	None
Authorized weapons	Mk 36 DST (Mk 82 Snakeye)

ARMING DELAYS (Preflight Selected)
Mk 30 Arming device 2/4/6/8/10/12/14/16/18 (Only 2-second setting authorized)
ARMING TOLERANCE 1.7 to 2.2 seconds at 2-second setting
Mk 42 Firing Mechanism Delays are of higher classification. See NAVORD OP 3529

DESCRIPTION

The Destructor Arming and Firing System (Modification Kit Mk 75) is designed to convert a Mk 82 Snakeye bomb to a Destructor which will provide a magnetic influence firing capability against shallow water or land targets. The system includes a mechanically operated Mk 30 arming device and a magnetic influence Mk 42 firing mechanism which are installed in the nose and tail wells respectively.

To prevent impact damage and excessive penetration, the Destructor is restricted to the retarded delivery mode only.

The Mk 30 arming device is a M904E2 mechanical nose fuze which has been modified to serve only an arm/safe function. It is not intended to detonate on impact at the low impact velocities common to retarded delivery. Once the Mk 30 nose arming device has been armed by the required air travel, an electric firing signal from the Mk 42 firing mechanism in the tail well is required to detonate the weapon. If the Mk 30 has not been armed, an electric firing signal from the Mk 42 will initiate an explosive train but will not fire the main booster charge and the weapon will dud.

The Mk 42 is armed after a specific preflight selected delay by a self-contained electrolytic timer. The arming delays are of a higher classification and are contained in NAVORD OP 3529. Once armed, the Mk 42 is triggered by the movement of any target which causes a change in the magnetic field of the weapon. Power for the firing signal is provided by a battery integral to the Mk 42 and no electrical connections to the aircraft are necessary.

Four arming wires are rigged to the weapon. The Mk 30 in the nose and the tail fin release band are connected to the bomb arming solenoids. Two additional arming wires connect the tail fin with the Mk 30 in the nose and the Mk 42 in the tail. This prevents arming of either element unless the tail fins are open.

In the event of retard fin malfunction, the weapon may detonate on high velocity impact with hard surfaces.

See NAVORD OP 3529 for more detailed information.

PREFLIGHT CHECKS

Check that Mk 30 is set for 2-second arming delay. Stop screw must not be installed in the Mk 30 at the 2-second setting. Assure that setscrew which locks the Mk 30 in the nose well is either flush with the after edge of the setscrew hole or that rubber insert protrudes from the top of the setscrew. This ensures watertight integrity. A special watertight plug must also be installed in the cable well in place of standard shipping plug. Check arming vane, arming wire rigging, Fahnestock clips, and removal of warning tags.

WARNING

If observation window in the Mk 30 shows full red at any setting or if a white stripe shows at any setting other than 6 or 18 seconds, the arming device is armed or partially armed and must not be used.

If the arming wire is withdrawn from the Mk 42 firing mechanism either intentionally or accidentally, the Mk 42 will begin operation at the end of the preset functioning delay. This will result in a dud weapon if the Mk 30 arming device is SAFE or in a full scale detonation if the Mk 30 is armed. Notify EOD immediately of any improper handling or rigging of the weapon.

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Figure 2-9 (C) (Sheet 5)

Delivery Options

Fuzes in the M990 series are not authorized for retarded delivery. When M990 fuzes are used in Snakeye bombs and an option of retarded or unretarded delivery is required, a mechanical fuze must be installed in the nose for use in the retard mode. Mk 344/376 electric fuzes permit an option of retarded or unretarded delivery. See section on RETARDED VERSUS UNRETARDED DELIVERY. For more detailed technical information on electric fuzes, refer to NAVAIR 11-5A-17.

Arming Wires

Loss of an arming wire from a mechanical fuze will allow the fuze to arm while the weapon is still on the bomb rack. When the weapon is released, it can detonate dangerously close to the aircraft if subjected to bomb-to-bomb or bomb-to-aircraft collision.

Electric fuzes use the arming wire as a mechanical backup safety device to guard against stray voltage and will not arm upon withdrawal of the arming wire unless also charged by a voltage from the delivery aircraft at weapon release. VT elements (Mk 43 and M20) use arming wires as an alternate means of initiation and not as a safing device.

A proper preflight check can minimize the possibility of arming wire failure. Most mechanical fuze and VT element arming wire installations are simple to check. Electric fuzes in the tail well are more difficult to observe.

One of the most common causes of arming-wire loss from mechanical fuzes is faulty installation of the Fahnestock clips which hold the arming wire in the fuze. When properly installed, these clips will hold the arming wire securely at all carriage speeds up to the maximum authorized. Fahnestock clips are slipped over the free end of the arming wire and are snugged up against the arming vane. If they are missing or loose, the airstream may blow the arming wire free of the arming vane and permit the fuze to arm. If they are not snug against the arming vane, it is possible for them to whiplash in the airstream. This can result in a sheared arming wire.

Assure that there is no excess slack in the arming wire. An excessively long arming wire can be dangerous. It should closely follow the contour of the bomb body but should exert no strain on the bomb arming solenoid. The arming wire should extend through the arming vane no more than 3 to 4 inches.

Check that all warning tags and safety pins have been removed from the fuze and that desired delays or options have been selected.

For specific data on arming wire installation for all fuzes, refer to the Airborne Weapons/Stores Loading Manual.

CARRIAGE AND DELIVERY SPEED RESTRICTIONS

Each fuze illustration lists maximum carriage and delivery speeds. These are fuze-imposed restrictions only. There may be further restrictions due to bomb rack or weapon limitations. In no case should these limitations be exceeded.

Carriage speed limitations are usually imposed by the arming wires, but in certain cases, are the result of vibrations which occur in the bomb structure. Delivery speeds are imposed by the aerodynamic characteristics of the fuze. In certain fuzes, higher-than-authorized delivery speeds will destroy the arming vane or cause erratic or faulty arming. In general, both maximum carriage and delivery speeds are determined by safety considerations but, in certain cases, reliability is the governing factor.

Release speed limits are normally higher than the carriage speed restrictions. These higher speeds are authorized on the assumption that they will be experienced for only brief periods during each mission. The cumulative time spent at the maximum delivery speed should not exceed 15 minutes.

If maximum delivery or carriage speeds are exceeded, the fuzes may be armed or completely unreliable and should be dropped as soon as practicable. They should not be returned to a field or carrier.

Note that certain fuzes require a lower release speed than carriage speed (Mk 347 and Mk 346). In these cases, excessive release speeds can reduce fuze reliability, can cause a bypassing of the desired functioning delay time, or can result in excessive penetration of the weapon. Excessive penetration is undesirable because it minimizes the blast and cratering effect of the weapon. It becomes a major problem with low drag weapons fuzed for functioning delays of 50 milliseconds or more when released from high altitudes or at high speeds against soft targets. Excessive release speeds can also cause weapon breakup or deflagration of bombs fuzed for the longer functioning delays.

EARLY BURSTS

It is possible for a fuze to detonate immediately upon arming or at some time after arming but before that intended. This is known as an "early burst" and can result from fuze malfunction, bomb-to-bomb or bomb-to-aircraft collision, or from mutual interference between bombs with VT elements installed.

Early burst probability is highest in electric fuzes. The rate expected is about one out of one-thousand with the M990 E series or Mk 344/376 fuzes. When a VT element is used for initiation, the early burst probability for the combination increases significantly and may occur in about four out of every one hundred releases.

Early bursts can also occur with mechanical fuzes. Accurate test data are not available, but the probability of early burst with mechanical nose fuzes is estimated to be about one in ten-thousand. This can result from bomb-to-bomb collision and can also be caused by mechanical malfunction. Most mechanical fuzes require longitudinal impact and are therefore less susceptible than electric fuzes to detonation from bomb-to-bomb collisions. Careful observance of installation procedures will keep the possibility of mechanical malfunction to a minimum.

An early burst does not present a hazardous situation if fuzes and arming delays are selected with careful consideration of the type of bomb and delivery mode involved.

FUZE SAFETY AND RELIABILITY CONSIDERATIONS

Fuzes have two basic functions. The first is to maintain the weapon in the safest possible condition until the instant that detonation is desired. The second is to assure reliable and timely detonation of the weapon. Achievement of these two goals requires carefully balanced compromise and it is important that delivery pilots understand the implications of this relationship. Two distinct factors must be considered to assure maximum safety in weapon delivery. They are "safe-escape distance" and "safe-separation time."

Safe-Escape Distance

Safe-escape distance is the minimum acceptable distance, measured in feet, between the aircraft and the bomb at the time of intended detonation. Except for bombs fuzed to airburst, intended detonation is usually considered to occur at impact. As a general prudential rule, the functioning delay settings provided by the fuze should not be relied upon in computing safe-escape distances. Under conditions such as high-velocity impact on hard targets, a bomb can detonate immediately on impact regardless of the functioning delay set in the fuze. Safe-escape distance is an important factor in determining minimum release altitude.

Safe-Separation Time

Safe-separation time is the minimum acceptable separation, measured in seconds, between the aircraft and the weapon at the instant the fuze arms. This separation is necessary to protect the delivery aircraft from fragmentation damage in the event of an early burst. The minimum safe-separation time is dependent upon such obvious factors as delivery maneuver, speed, size of the bomb, and size of the aircraft. A factor not so obvious is release altitude. Due to reduced air density, an early burst at high altitude will produce a larger fragmentation envelope than at lower altitudes.

Minimum Arming Time

A factor which must be considered in determining the minimum safe separation time is the early burst probability of the specific fuze being employed. For example, if a fuze has a relatively high probability of early burst, it is mandatory that the safe-separation time be meticulously observed. Conversely, if a fuze has no tendency to early burst, there is no requirement to observe any safe-separation limits in the delivery tactics. Unfortunately, there are no fuzes which will assure a zero probability of early burst.

As a consequence, minimum arming times with various weapons and delivery maneuvers have been established. They are based upon a combination of safe-separation limits and early burst probability. The product of these two factors will determine whether the risk of fragmentation damage to the aircraft is within acceptable limits. Figure 2-10 indicates the minimum safe arming times to be observed when using Mk 344/376 electric fuzes and M904E mechanical fuzes in various authorized bombs. Data is presented for retarded and unretarded delivery under various types of delivery tactics.

Minimum Release Altitude

In addition to the limits imposed by bomb fragmentation and terrain clearance, minimum release altitudes are also imposed by the fuze. Very simply, the fuze must be released at a sufficient distance above ground level to permit arming. This is a straightforward computation; however, pilots must take into consideration the tolerances or variations in arming times for each specific fuze. As an example, arming delay times for M990E series fuzes can vary from −10% to +20% of the nominal specified arming time. Thus, a nominal 5.5-second arming delay could range anywhere from 4.9 to 6.6 seconds and to assure detonation, at least 6.6 seconds time of fall must be allowed.

Retarded Versus Unretarded Delivery

Minimum arming times and safe escape distances are considerably lower for retarded delivery than for unretarded delivery. For a fuze to be compatible with both types of delivery, it must permit selection of the proper arming time for each type of delivery and also contain a self-dudding capability in the event the weapon fails to retard. Without these safeguards, an early burst at the short arming times used with retarded delivery would very likely result in damage to the delivery aircraft if the Snakeye fins did not open. Similarly, a Snakeye fin failure during a low level, high speed release could result in the bomb impacting and detonating directly beneath the aircraft with disastrous results.

M990 series electric fuzes do not contain these safeguards and are not authorized for retarded delivery. Mechanical nose fuzes may be used in the retard mode but they must be interconnected with the Snakeye fin by an additional arming wire so that the fuze will remain safe in the event the fins fail to open. Should the fins open but then separate from the weapon, the bomb will usually tumble, thus increasing the arming time or dudding the nose fuze as well as increasing the separation distance from the aircraft.

The only fuzes which will permit an in-flight option of retarded or unretarded delivery are the Mk 344 and Mk

Minimum Safe Arming Times and Speeds

TACTIC		MIN REL SPEED (KTAS)	MINIMUM SAFE ARMING TIMES (SECONDS) NON-VT MODE 81	82	83	84	117	VT-MODE (See Note 1.) 81	82	83	84	117
DIVE-TOSS	Any Stik Length	400	4.0	4.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Dive Unretarded with 4g Pullup (See Note 2.)	Single Release or Zero Stik Salvo (100 ms or less)	350	5.5	5.5	5.5	5.5	5.5	5.5	5.5	10	10	5.5
		450	4.0							5.5	5.5	
		over 45° dive	5.5							5.5	10	
	Multiple Release (1-second stik)	350	5.5	5.5	5.5	6.0	5.5	10	10	10	10	10
		450			5.5		5.5	5.5	5.5			
		over 45° dive			6.0		6.0	10	10			
	Multiple Release (2-second stik)	350	5.5	6.0	8.0	8.0	6.0	10	10	10	10	10
		450	5.5	6.0			6.0					
		over 45° dive	6.0	8.0			8.0					
Level Unretarded with Straight Ahead Recovery	0 to 5,000 ft (MSL)	350	8.0	8.0	8.0	10	8.0	10	10	10	10	10
		450	5.5			8.0						
	6,000 to 10,000 ft (MSL)	350	8.0	8.0	10	10	8.0	10	10	10	NA	10
		450			8.0						10	
	Over 10,000 ft (MSL)	350	8.0	8.0	10	10	10	10	10	NA	NA	NA
		450					8.0			10		10

INSTRUCTIONS FOR USE OF CHART

a. Determine minimum safe arming time for the type of delivery, release speed, and weapon to be used. These times will result in not more than a 10% probability of aircraft receiving a fragment hit in the event of an early burst. Use of arming times as little as 1 second shorter than those listed can increase hit probability to 100%.

b. The arming times available with current fuzes are listed below for ready cross reference:

Fuze	Arming Delays
Mk 344	2.6-ret., 5.5-unret.
Mk 376	2.6-ret., 10.0-unret.
M904E2/E3	2,4,6,8,10,12,14,16,18
M990 E1	5.5
M990 E3	10.0
M990 E4	5.5

c. In all cases, refer to appropriate Sight Angle Charts to be sure that the planned release altitude will provide sufficient time-of-fall to permit the fuze to arm.

d. Observe minimum release intervals prescribed in the External Stores Limitation Charts to minimize probability of bomb-to-bomb collisions.

Retarded Dive or Level with 4g Pullup (See Note 2.)	Multiple Release Mk 81/82 (1-second stik)	M 990 series fuzes not authorized in retarded mode. 2-second arming delay may be safely used with M904 series fuzes only if fuze and Snakeye fin are interconnected with an arming wire and release speed is at least 450 KTAS. Mk 344/376 fuzes automatically select 2.6-second arming delay upon sensing retardation provided release speed is 400 KIAS or greater.

NOTES

1. Refer to M20 or Mk 43 illustrations for minimum release interval when delivery is in the VT mode.
2. Arming times are computed on the basis that aircraft will be established in a 4g pullup within 2 seconds after release of the specified stick length.

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Figure 2-10 (U)

376. Both fuzes provide safe arming times for retarded delivery. In addition, the Mk 344 provides safe arming delay for unretarded dive delivery; the Mk 376 provides safe delay for unretarded straight and level delivery. Both of these fuzes contain a special circuit which ensures increased safety in the event of Snakeye fin failure.

If Mk 344/376 fuzes are not available and a pilot option of retard or unretarded delivery is required, it is necessary to employ dual fuzing. For the longer delay required for unretarded releases, a M990 series fuze is installed in the tail. A mechanical nose fuze, rigged as noted above, is used for the short delay required for the retarded option. For retarded delivery, the AWW-2A Fuze Function Control Set must be set to SAFE.

Dual Fuzing

Dual fuzing may be employed either as a means of providing an in-flight option of arming times or to increase reliability. See section on Retarded Versus Unretarded Delivery for an example of a dual fuzing option.

As a method of increasing reliability, a nose and a tail fuze with essentially the same arming and functioning delays may be installed. Both fuzes are released armed and the probability of a dud is reduced. This procedure is normally used with firebombs with two fuzes of the identical type. With the current inventory of fuzes, the only combination which would reasonably serve this purpose with GP bombs would be an electric tail fuze and an M904E2/3 nose fuze. In view of the high reliability of both of these fuzes and the added effort required to install two fuzes, the advantage of the dual fuzing for this purpose alone is questionable unless near 100% reliability is an absolute tactical necessity.

SUMMARY

Delivery of weapons with an in-flight option of delivery modes will be safer and more effective if the following points are understood:

a. Operations with retarded weapons present a special hazard due to the possibility of Snakeye fin malfunction or pilot error.

b. When Snakeye weapons are inadvertently released unretarded or the fins fail to open properly, the bomb is, for all intents and purposes, unretarded. Under these conditions, the bomb will follow closely beneath the aircraft for a considerable period of time. With the bomb fuzed for arming times normal to retarded delivery, an unacceptable safe separation hazard will exist and a very critical safe escape situation will occur at impact.

c. Use of the M990 series electric fuzes in the retarded mode creates an unacceptable risk. The Mk 344/376 are the only electric fuzes which can be safely delivered in the retard mode.

d. Short arming times (2 seconds) with mechanical fuzes, while potentially dangerous, are acceptable in the retarded mode due to lower probability of early burst. In addition, complete separation of a Snakeye fin from the bomb will usually cause the bomb to tumble and thus increase the arming time of a mechanical fuze.

e. Longer arming times (5.5 seconds or greater) and proper delivery maneuvers are required in most cases for safe unretarded dive delivery.

f. For straight-and-level unretarded releases, a minimum arming delay time of 8 seconds is necessary to provide safe separation.

FUZE SELECTION

The conditions outlined above combine to make the task of selection and use of fuzes quite complex. With any given fuze, safe-separation times will vary greatly with the size and type of bomb, altitude and speed of release, and delivery maneuver. For these reasons, not all fuze-bomb combinations are safe under all conditions. The characteristics of each fuze and its companion bomb must be carefully studied and fully understood. See figure 2–11.

REFERENCES

For a more detailed study of bomb fuzes and their uses refer to the following:

Aircraft rockets	NAVAIR 11-85-5 (OP 2210/2626)
Arming wire installation	NAVAIR 01-4AA-75
Details of bombs and accessories	NAVAIR 11-5A-17
Details of fuzes and accessories	NAVAIR 11-5A-17 (OP 2216 Part 2)
Loading instructions	NAVAIR 01-45AA-75
Crew preflight	Stores Reliability Cards*

*NAVAIR 01-45HH-75-2 series, NAVAIR 01-45HH-75-3 series, NAVAIR 01-45HH-75-14 series

All data deleted from page 2–58D.

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MINIMUM AUTHCRIZED ARMING TIMES AND SPEEDS FOR F8 AIRCRAFT

The arming times listed below are the minimum authorized for the combination of fuzes, bombs, release speeds and delivery tactics indicated. These arming times are based upon the following safety criteria:

1. THE PROBABILITY OF A FRAGMENT HIT ON THE DELIVERY AIRCRAFT IN THE EVENT OF AN EARLY BURST AT FUZE ARMING WILL NOT EXCEED 1 IN 10,

and

2. THE OVERALL PROBABILITY OF A FRAGMENT HIT PER EACH BOMB DROPPED WILL NOT EXCEED 1 IN 10,000.

Any deviation from these arming times must be approved by the OTC. See figure 2 for the method of computing fragment hit probabilities.

TACTIC		MIN REL SPEED (KTAS)	M904 E2 FUZES					MK 344/376 and M990 E (NON-VT)					VT MODE See Note 1				
			81	82	83	84	117	81	82	83	84	117	81	82	83	84	117
DIVE-TOSS	Any Stik Length	400	4.0	4.0	6.0	6.0	6.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
DIVE UNRETARDED with 4g pull-up See Note 2	Single Release or Zero Stik Salvo (100 ms or less)	350	6.0	6.0	6.0	6.0	6.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	10	10	5.5
		450	4.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5.5	5.5	↓
		Over 45° Dive	6.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10	↓
	Multiple Release (1 second Stik)	350	6.0	6.0	6.0	6.0	6.0	5.5	5.5	5.5	10	5.5	10	10	10	10	10
		450	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5.5	5.5	↓	↓	↓
		Over 45° Dive	↓	↓	↓	↓	↓	↓	↓	10	↓	10	10	10	↓	↓	↓
	Multiple Release (2 second Stik)	350	6.0	6.0	8.0	8.0	6.0	5.5	10	10	10	10	10	10	10	10	10
		450	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
		Over 45° Dive	↓	8.0	↓	↓	8.0	10	↓	↓	↓	↓	↓	↓	↓	↓	↓
LEVEL-UNRETARDED with Straight Ahead Recovery See Note 3	0 to 5000 ft. (MSL)	350	8.0	8.0	8.0	10	8.0	10	10	10	10	10	10	10	10	10	10
		450	6.0	↓	↓	8.0	↓	5.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
	6000 to 10,000 ft. (MSL)	350	8.0	8.0	10	10	8.0	10	10	10	NA	10	10	10	10	NA	10
		450	↓	↓	8.0	↓	↓	↓	↓	↓	10	↓	↓	↓	↓	10	↓
	10,000 ft to 15,000	350	8.0	8.0	10	10	10	10	10	10	10	10	10	10	NA	NA	NA
		450	↓	↓	↓	↓	8.0	↓	↓	↓	↓	↓	↓	↓	10	↓	10

RETARDED Dive or Level with 4g pull-up See Note 2	Multiple Release Mk 81/82 (1 second Stik)	M 990 series fuzes not authorized in retarded mode. 2 second arming delay may be safely used with M904 series fuzes only if fuze and Snakeye fin are interconnected with an arming wire and release speed is at least 450 KTAS. Mk 344/376 fuzes automatically select 2.6 second arming delay upon sensing retardation provided release speed is 400 KIAS or greater.
JETCONLABS	Multiple Release	Use the same arming delay times listed under DIVE UNRETARDED for the stik length, release speed and weapon to be delivered. Minimum safe arming times are based on recovery by Half-Cuban-Eight manuever.

INSTRUCTIONS FOR USE OF CHART

A. Determine minimum authorized arming time for the type of delivery, release speed and weapon to be used.

B. The arming times available with current fuzes are listed below for ready cross reference:

FUZE	ARMING DELAYS
Mk 344	2.6-Ret., 5.5-Unret.
Mk 376	2.6-Ret., 10.0-Unret.
M904E2/E3	2,4,6,8,10,12,14,16,18
M990 E1	5.5
M990 E3	10.0
M990 E4	5.5

C. In all cases, refer to appropriate bomb tables to be sure that the planned release altitude will provide sufficient time-of-fall to permit the fuze to arm.

D. Observe minimum release intervals prescribed in the External Stores Limitation Charts to minimize probability of bomb-to-bomb collisions.

E. In those cases marked "NA", no safe arming delay time is available.

NOTES:

1. Refer to M20 or Mk 43 Summary Sheets for minimum release interval when delivery is in the VT mode.
2. Arming times are computed on the basis that aircraft will be established in a 4g pull-up within two seconds after release of the specified stik length.
3. A sharp climbing manuever initiated immediately after last bomb released will reduce the probability of a fragment hit.

FIGURE 1

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COMPUTATION OF PROBABILITIES OF FRAGMENT HITS FROM EARLY BURSTS

The OTC may approve deviations to the Minimum Authorized Arming Times prescribed in figure 1 when the tactical advantage to be realized by use of shorter arming times will justify the added risk which will result. Deviations should be approved only when the prescribed arming times will substantially limit or degrade mission effectiveness. It is recommended that deviations be approved only when using M904E2/3 mechanical nose fuzes. The very low probability of early burst of this series fuze may permit use of lower arming times under certain tactical situations without increasing the overall risk above that warranted by the mission involved. In any case, it must be recognized that an early burst at low arming times will not only increase the probability of a fragment hit but will also increase the severity of damage in the event of a hit.

WARNING

The Minimum Authorized Arming Times prescribed in figure 1 are computed on the basis that the probability of a fragment hit on the delivery aircraft in the event of an early burst ($P_{H/EB}$) must not exceed 1 in 10 (.10) and, in addition, the overall probability of a fragment hit per each bomb dropped (P_H) must not exceed 1 in 10,000 (.0001).

When deviations to this safety criteria are necessary, latitude may be exercised in accepting higher values of $P_{H/EB}$ but the established limit of P_H of 1 in 10,000 must not be exceeded.

The method of computing fragment hit probabilities is as follows:

1. To compute the probability of a fragment hit per each bomb dropped (P_H), it is necessary that the early burst probability of the fuze being used (P_{EB}) be multiplied by the probability of a fragment hit in the event of an early burst ($P_{H/EB}$). This relationship is shown in the following formula;

$$P_H = P_{EB} \times P_{H/EB}$$

2. The estimated probability of an early burst (P_{EB}) of current fuzes is as follows:

FUZE	PROBABILITY OF EARLY BURST (P_{EB})	
M904E2/3	1 in 100,000	(.00001)
MK 344/376	1 in 1,000	(.001)
M990 E series	1 in 1,000	(.001)
MK 43/M20 VT elements	3 in 100	(.03)

NOTE

The above data are derived from range testing as updated by ordnance expenditure and incident reports.

3. The probability of the delivery aircraft receiving at least one fragment hit in the event of an early burst at arming ($P_{H/EB}$) for various arming times, bombs and delivery tactics is as follows:

TACTIC		MIN REL SPEED (KTAS)	PROBABILITY OF FRAGMENT HIT IN EVENT OF EARLY BURST ($P_{H/EB}$) F8 AIRCRAFT																			
			MK 81				MK 82				MK 83				MK 84				M 117			
			4	5.5	6	8	4	5.5	6	8	4	5.5	6	8	4	5.5	6	8	4	5.5	6	8
DIVE-TOSS	Any Stik Length	400	.04	.00	.00	.00	.09	.00	.00	.00	.27	.00	.00	.00	.47	.00	.00	.00	.21	.00	.00	.00
DIVE UNRETARDED with 4g pull-up	Single Release or Zero Stik Salvo (100 ms or less)	350	.20	.00	.00	.00	.46	.00	.00	.00	.78	.00	.00	.00	.97	.01	.00	.00	.73	.00	.00	.00
		450	.10	↓	↓	↓	.35	↓	↓	↓	.71	↓	↓	↓	.93	.00	↓	↓	.64	↓	↓	↓
		Over 45° Dive	.29	↓	↓	↓	.57	↓	↓	↓	.90	↓	↓	↓	.99	.01	↓	↓	.91	↓	↓	↓
	Multiple Release (1 second Stik)	350	.98	.01	.00	.00	1.00	.02	.00	.00	1.00	.09	.01	.00	1.00	.19	.02	.00	1.00	.05	.00	.00
		450	.99	.00	↓	↓	↓	.00	↓	↓	↓	.06	.00	↓	↓	.12	.01	↓	↓	.03	↓	↓
		Over 45° Dive	1.00	.01	↓	↓	↓	.04	↓	↓	↓	.19	.01	↓	↓	.34	.02	↓	↓	.15	.01	↓
	Multiple Release (2 second Stik)	350	1.00	.10	.01	.00	1.00	.30	.04	.00	1.00	.57	.14	.00	1.00	.82	.27	.00	1.00	.52	.11	.00
		450	↓	.08	.01	↓	↓	.25	.02	↓	↓	.53	.11	↓	↓	.78	.21	↓	↓	.44	.05	↓
		Over 45° Dive	↓	.56	.07	↓	↓	.77	.23	↓	↓	.98	.44	↓	↓	1.00	.69	↓	↓	.95	.41	↓
LEVEL UNRETARDED with Straight Ahead Recovery	0 to 5000 ft. (MSL)	350	1.00	.34	.16	.00	1.00	.69	.43	.01	1.00	.99	.75	.07	1.00	1.00	.94	.14	1.00	.95	.76	.02
		450	.99	.11	.04	↓	↓	.43	.18	.00	↓	.96	.61	.01	↓	.99	.84	.02	↓	.67	.32	.00
	6000 to 10,000 ft. (MSL)	350	1.00	.76	.41	.01	1.00	.92	.68	.04	1.00	1.00	.98	.16	1.00	1.00	1.00	.29	1.00	.99	.92	.10
		450	↓	.29	.14	.00	↓	.68	.44	.01	↓	.99	.80	.08	↓	↓	.96	.15	↓	.93	.53	[illegible]
	10,000 ft to 15,000	350	1.00	.90	.65	.04	1.00	.97	.85	.12	1.00	1.00	1.00	.27	1.00	1.00	1.00	.47	1.00	1.00	.96	.21
		450	↓	.67	.27	.00	↓	.88	.58	.02	↓	↓	.97	.17	↓	↓	↓	.30	↓	.98	[illegible]	.03

Figure 2

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Bomb-Fuze Combinations

CAUTION

(C) This chart is intended for ready reference only. Users must refer to individual fuze Summary Sheets and Minimum Safe Arming Time chart for limitations and restrictions on specific combinations. Safe usage of most fuzes depends upon type of delivery and arming times selected.

FUZE		GENERAL USE STORES							COMMENTS
		LDGP					Retard		
Nose Fuzes	Type	Mk 81	Mk 82	Mk 83	Mk 84	M 117	Mk 81	Mk 82	
Mk 347	M	SP	SP	X	X	X	SP	SP	Low speed, retarded delivery
M904E2/E3	M	P	P	P	P	P	P	P	
M1A1 Fuze Extension (Daisycutter)	M	SP	SP	SP	SP	X	X	X	Use only with fuzes set for INST functioning delay.
VT Elements									
M20/20A1	E	SP	SP	SP	SP	SP	O	O	These VT elements are compatible with and must be used with any of the current electric tail fuzes.
Mk 43	E	SP	SP	SP	SP	SP	SP	SP	
Tail Fuzes									
Mk 344	E	P	P	P	P	P	P	P	For dive delivery – retarded or unretarded
Mk 376	E	P	P	P	P	P	P	P	For retarded dive or unretarded level delivery.
Mk 346	M	SP	SP	SP	O	O	SP	SP	Long delay
M990E-1/E-3/E-4	E	A	A	A	A	A	O	O	Not authorized for retarded delivery

FUZE			SPECIAL PURPOSE STORES				
			CBU	Fire Bomb		Rockeye	Dst
Special Use	Location	Type	24/29/49 /B,/B Mod A/B,C/B	Mk 77-2	Mk 77-4	Mk 20	Mk 36
AN-M 173A1	N/T/S	M	O	P	A	O	O
M918	S	M	O	O	P	O	O
Mk 339	N	M	O	O	O	P	O
M904E2/E3	N	M	O	O	O	O	O
M907E1/E2	N	M	P	O	O	O	O
Mk 30 arming device Mk 42 firing mechanism	N T	M E	O	O	O	O	P

KEY TO SYMBOLS

Fuze Type and Location
- M – Mechanical
- E – Electric
- N – Nose
- T – Tail
- S – Side

Bomb-Fuze Combinations
- P – Preferred usage
- A – Alternate usage
- SP – Special purpose
- X – Physically compatible but not tested for this application
- O – Either not physically or functionally compatible

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Figure 2-11 (C)

ROCKET FUZES

CLASSIFICATION

Rocket fuzes are classified according to their location in the warhead, the type of action required to arm the fuze and the method of detonation. With the exception of the Mk 191 fuze which is installed and sealed in the base of the Mk 24 Zuni warhead, all current aircraft rocket fuzes are nose mounted.

FUZE ARMING METHODS

Acceleration

All current 2.75- and 5.0-inch FFARS use a combination acceleration plus time for arming. The acceleration (set-back) created upon rocket firing causes a weight within the fuze to move aft and initiate the arming cycle. These fuzes also incorporate a timing gear train which provides a constant arming distance regardless of variations in rocket thrust. (40g's of acceleration for about 1 second are required to arm the fuze. These fuzes do not utilize arming wires and the pilot has no control over fuze operation.) The variations in arming distance shown in the tables are due to manufacturing tolerances and temperature effects on the mechanism.

Motor Burnout (Creep)

In order to provide additional safety in nonimpact type fuzes (VT and time), a special feature is included which maintains the fuze in a safe condition until rocket motor thrust ceases. At the end of the acceleration period, a spring-loaded mechanism causes the weight to shift forward and complete the arming cycle. This feature is similar to creep used in older fuzes. In creep mechanisms, the normal deceleration caused by aerodynamic drag completes the arming cycle rather than the more positive spring action used in the newer fuzes.

FUZE FUNCTIONING METHODS

Three methods are used to initiate detonation of the 2.75- and 5.0-inch rocket fuzes. They are impact, VT, and mechanical time.

Impact

Impact fuzes are designed to detonate on impact either instantaneously or after a short delay. Due to the high velocity of aircraft rockets, the functioning delays used in rockets are much shorter than those in bomb fuzes. Many rocket fuzes are relatively insensitive and will not detonate on impact with water. Impact nose fuzes are designated as point detonating (PD), and base impact fuzes as base detonating (BD).

VT Fuze

The Mk 93 (M414A1) is the only VT fuze now available for use in jet aircraft. It is installed only in Zuni warheads. The fuze utilizes a small radio transmitter/receiver similar to those in VT bomb fuzes for ranging on the target and initiating detonation. The sensitivity of the VT element has been reduced to preclude mutual interference between rockets when ripple fired. As a result, the fuze will not sense aircraft targets and is to be used only in the air-to-ground mode. Due to the orientation of the sensing lobe pattern, proper ranging requires an impact angle between 20 and 40 degrees. The insensitivity of the VT element and the motor burnout feature provide adequate safe-separation from the firing aircraft.

Mechanical Time

The Mk 193 is the only aircraft rocket fuze now available for jet aircraft which will provide a timed air-burst. It is installed only in the Mk 33 flare head in the Zuni rocket. This fuze uses a simple clockwork timer to initiate detonation and incorporates the motor burnout feature. The time delay commences at rocket firing.

ASSEMBLY PROCEDURES

2.75 FFAR

All 2.75 rockets currently in use are shipped with the rocket body, warhead and fuze completely assembled. These rockets are delivered to the using activity loaded in the appropriate launcher pod. The launcher is sealed with metallic foil as a protection against RAD-HAZ. As a result, pilots will rarely have the opportunity to observe or inspect a 2.75 rocket.

5.0 FFAR (Zuni)

The 5.0-inch Zuni rocket is delivered with the rocket body, warhead and fuze disassembled. The only exception is the Mk 24 warhead which has a base fuze installed and sealed at the depot. Various combinations of warheads and fuzes are assembled by the user.

WARHEAD/FUZE COMBINATIONS

Figure 2–12 lists the authorized fuze/warhead combinations and essential data relating to their use.

PREFLIGHT OF ORDNANCE AND HARDWARE

The following ordnance preflight items should be checked by the pilot during the walk-around inspection. For more detailed information on preflight items, consult NAVAIR 01-45HHC-75, Weapons/Stores Loading Manual, Applicable Conventional Weapons Loadings Checklist, and Stores Reliability Cards (SRC).

CAUTION

Prior to any ordnance preflight ensure that all cockpit armament switches are in the OFF and SAFE position.

WING PYLONS AND AERO 7A OR 7A-1 ER (Applies to All Ordnance Carried)

1. Safety pin	INSTALLED
2. SEAR indicator	BLACK MARKS IN LINE
3. Ejector foot	BACKED OFF STORE TO FIRST DETENT
4. Tripe-multiple rack fire mode switch	AS DESIRED (Single or dual)
5. Fuzing switch	AS APPROPRIATE—(MECHANICAL OR ELECTRICAL) (BOMBS only)

ORDNANCE LOADED DIRECTLY ON AERO 7A OR 7A-1 (In Addition to Wing Pylon and AERO 7A Preflight)

Bombs

1. Security	AERO 7A-1 sway braces — TIGHT
2. Fuzing	Mechanical – ARMING WIRES PROPERLY ROUTED BETWEEN FUZES AND NOSE/TAIL SOLENOID
	Electrical — ELECTRICAL ARMING PLUG WITH WAFER SWITCH SEATED INTO BOMB
3. Snakeye fin	Non-retarded – FIN RELEASE BAND INSTALLED AND SAFETIED
	Retarded – FIN RELEASE WIRE ROUTED FROM PYLON SOLENOID TO FIN RELEASE BAND FASTENER. FUZE ARMING WIRE FROM FORWARD PART OF A FIN BLADE TO MECHANICAL FUZE. FIN RELEASE WIRES SHOULD BE ROUTED THROUGH GUIDE TUBE. (Fuze arms only with open tail fin.)

Rockets:

1. Security	AERO 7A-1 – SWAY BRACES TIGHT
2. Safety devices	INSTALLED/POSITIONED TO SAFE
3. Launcher fire mode switch	AS DESIRED (Single or ripple)

MER OR TER PREFLIGHT (In Addition to Pylon and AERO 7A-1 Preflight)

1. Safety pin(s)	INSTALLED IN MER/TER TAIL CONE AND EACH LOADED STATION.
2. Security	AERO 7A-1 sway braces TIGHT on MER/TER. MER/TER sway braces TIGHT on store.
3. MER/TER release mode switch	AS DESIRED (Single or Dual setting)
4. MER/TER pylon switch	BOMBS or ROCKETS
5. MER/TER empty station hooks	OPEN
6. Fuzing	Mechanical – ARMING WIRES PROPERLY ROUTED FROM MER/TER SOLENOID TO EACH FUZE
	Electrical – ELECTRICAL ARMING PLUG SEATED INTO EACH BOMB*
7. Snakeye fin	AS DESIRED NON-RETARDED – FIN RELEASE BAND INSTALLED AND SAFETIED

*On racks with Mk 39 receptacle, the Mk 122 arming safety switch coaxial cable and lanyard must be connected to each bomb rack.

Rocket Fuze/Warhead Combinations

FUZE LOCATION/TYPE	WARHEAD TYPE	FUZE ARMING	FUZE FUNCTIONING	REMARKS
5.0" FFAR (ZUNI)				
Mk 93-0 (M414A1) Nose-VT	Mk 24 HE Mk 32 ATAP Mk 34 WP Smoke Mk 63 AP	Acceleration + Time + Burnout 1,000 ft	VT (Impact Backup) 20-60 ft burst height	20° to 40° impact angle required for air burst. Can be ripple fired.
Mk 188-0 Nose-Impact	Mk 24 HE Mk 32 ATAP Mk 34 WP Smoke	Acceleration + Time 400-800 ft	Impact (PD) Inst	To be replaced by Mk 352.
Mk 191-1 Base-Impact	Mk 24 HE	Acceleration + Time 475-670 ft	Impact (BD) 0.005 sec delay	Not reliable on water targets.
Mk 193-0 Nose-Time	Mk 33 Flare	Acceleration + Time + Burnout 1,000 ft	Mechanical Time 15 (+2, -1,) sec delay	No impact backup.
Mk 352 Nose-Impact	Same as Mk 188	Acceleration + Time 660-1,180 ft	Impact (PD) Inst	To replace Mk 188. Requires BBU 15B adapter for use in Zuni.
2.75" FFAR				
Mk 176-1 Nose-Impact	Mk 1 HE	Acceleration + Time 400-1,350 ft	Impact (PD) 0.0003 sec delay	See note.
Mk 178-1/2 Nose-Impact	Mk 1 HE	Acceleration + Time 400-1,350 ft	Impact (PD) Inst	See note.
Mk 181-0 Nose-Impact	Mk 5 ATAP (Shaped Charge)	Acceleration + Time 330-660 ft	Impact (PD) Inst	See note. Shaped charge must impact between 30° and 90° of surface to be penetrated.
M 427 Mk 352 Nose-Impact	Mk 1 HE Mk 64 GP Mk 67 Smoke M 151 GP M 156 Smoke	Acceleration + Time 660-1,180	Impact (PD) Inst	Will detonate on water. Mk 352 more reliable than M427 for shallow angle impacts

AZ-308-03-70

NOTE

Will not detonate on impact with water. Will not detonate at impact angles less than 10 to 15 degrees.

Figure 2-12 (U)

	RETARDED – FIN RELEASE WIRE ROUTED FROM MER/TER SOLENOID TO FIN RELEASE BAND FASTENER. FUZE ARMING WIRE ROUTED FROM FORWARD PART OF A FIN BLADE TO MECHANICAL FUZE. FIN RELEASE WIRE SHOULD BE ROUTED THROUGH GUIDE TUBE. (Fuze arms only with open tail fin.)
8. Rocket Launcher	RADHAZ – PIN INSTALLED. FIRE MODE SWITCH – Single or ripple.

MBR PREFLIGHT (In Addition to Pylon and AERO 7A-1 Preflight)

1. Safety pin	INSTALLED IN EACH MBR LOADING STATION
2. Security	AERO 7A-1 Sway Braces TIGHT on MBR. MBR Sway Braces – TIGHT on STORE.
3. MBR release mode selector	AS DESIRED (Single or intervalometer setting)
4. Fuzing	Mechanical – ARMING WIRES PROPERLY ROUTED FROM MBR SOLENOID TO FUZES
	Electrical – ELECTRICAL ARMING PLUG SEATED INTO EACH BOMB
5. Snakeye fin	AS DESIRED
	NON-RETARDED – TRUNK LATCH BAND INSTALLED AND SAFETIED. RETARDED – FIN RELEASE WIRE ROUTED FROM MBR SOLENOID TO FIN RELEASE BAND FASTENER. FUZE ARMING WIRE ROUTED FROM FORWARD PART OF A FIN BLADE TO MECHANICAL FUZE. FIN RELEASE WIRES SHOULD BE ROUTED THROUGH GUIDE TUBE. (Fuze is armed only with open tail fin.)

PMBR PREFLIGHT (In Addition to Pylon and AERO 7A-1 Preflight)

1. Arm safe switch	ARMED
2. Practice bomb or MK 24 Flare Security	SLIGHTLY LESS THAN RIGID
3. Intervalometer	POSITION 1
4. Fuzing (Mk 24 Flare)	ARMING LANYARD PROPERLY ROUTED. EJECTION AND IGNITION DELAY SET AS DESIRED.
5. Rocket ripple switch	AS DESIRED
6. Electrical lead	CONNECTED TO PMBR

FUSELAGE STATIONS PREFLIGHT

Zuni Rockets

1. Safety pins	INSTALLED ON EACH LAU-33A/A, -35A/A
2. Rocket launcher fire mode	AS DESIRED (Single or ripple)
3. Launcher positions	LAU-33A/A ON ALL STATIONS EXCEPT LOWER LEFT FUSELAGE STATION LAU-35A/A ONLY ON LOWER LEFT FUSELAGE STATION

Sidewinder — AIM-9B, AIM-9C, AIM-9D Preflight on Fuselage Stations

1. Safety pin — (LAU-7A or AERO-3A) INSTALLED

WARNING

When using LAU-7A launcher do not rotate safety pin after Sidewinder is loaded due to possible missile release during catapult launch.

2. Coolant air bottle — (LAU-7A ONLY) — GREEN AREA (3,000–3,500 psi, AIM-9D only)
3. Launchers — ALL SIDEWINDERS ON LAU-7A. AIM-9B ONLY ON AERO-3A.
4. Missile security — LAUNCHER RAIL STOPS ON BOTH SIDES OF MISSILE LUGS.
5. G and C section covers — REMOVED
6. Canard fins — PROPER MOVEMENT
7. Missile — NO EVIDENCE OF DAMAGE
8. Rollerons — CAGED and FREE ROLLING
9. Non-propulsion unit — REMOVED
10. G and C colored number — (AIM-9C only) MUST MATCH COLOR OF CRYSTAL OSCILLATOR ON STARBOARD CONSOLE OF COCKPIT

NAVIGATION

The navigation procedures recommended in this manual are not intended to cover all aspects and techniques possible in mission planning. The conventional attack mission may be conducted utilizing available navigation aids or dead reckoning or a combination of both.

The use of navigational aids such as TACAN and UHF vectoring by GCI sites, ship and forward air controllers is encouraged but should be backed with good dead reckoning navigation. The discussion presented here will deal with DR planning. Climb schedule, drag index, time/radius, and range constants charts are found in this section. Other cruise control data may be obtained from the REST computer and the NATOPS Flight Manual.

CHARTS

Large scale charts (1:1,000,000) are best suited for high altitude DR navigation. Area coverage is sufficient to permit reuse of the chart although the target and route may have changed.

Charts with greater detail, such as Pilotage Charts (1:500,000 scale) are considered best for low level DR navigation.

Aeronautical Approach Charts (1:250,000 scale) or Army Map Service Charts (1:50,000 scale) should be used for target area detail and close air support missions.

Accurate detailed maps are not available for some areas of the world. In such cases, a good sense of dead-reckoning is essential.

Intelligence and weather briefings should be obtained before selecting the exact route to be followed. The appropriate charts providing coverage between the home base and the target should be assembled so that the entire route may be seen.

Coastal Penetration

In most cases a coastal penetration will be required. Enemy defenses, inland terrain, and prominent or peculiar coastal landmarks influence entry point selection. The aircraft radar may be used when EMCON is not a factor and a radar prominent coastal feature, such as a bay or promontory, is available. To escape enemy detection, coastal penetration should be at minimum altitude, high speed, and on a course perpendicular to the coastline. A careful study should be made of the coastline for several miles either side of the selected penetration point (ten percent of the overwater distance) and a contingency plan formulated in case the exact penetration point is missed. The selected penetration point should be easy to recognize by its geographical features. Such features as rivers and mountain chains can be used to funnel the flight onto the planned course.

Check Point Selection

Selection of check points will vary according to flight altitude and conditions of the terrain over which the flight will pass. At higher altitudes, such features as large lakes, rivers, towns, and distinctive mountain ranges rising from relatively flat surrounding terrain provide excellent navigation check points. At low altitude, check points should be selected that have some vertical development or a well-defined horizontal development perpendicular to the course, such as a river, railroad, or highway. Consideration must be given to seasonal changes that alter the appearance of natural check points. In winter, check points may be obliterated by snow cover, and in the spring, rivers may overflow their normal banks and conceal terrain features. An easily recognized, well-defined initial (or approach) point near the target may be necessary to help find the target. The retirement course from the target should consider the same factors as the inbound flight. Care must be taken to avoid those areas overflown while inbound as enemy defenses have been alerted.

Although check points should be selected with care to ensure accurate navigation, they should not be relied upon completely, Flying a planned time and heading is paramount and if at the end of a particular leg the selected check point cannot be found, it is recommended to turn at the planned time, take up the new course, and then attempt to correct back on course.

Chart Preparation

The following technique for marking charts is recommended:

a. Enclose check points in circles and the target in a triangle.

b. Connect succeeding check points with a straight line.

c. Enter magnetic heading, distance, and preplanned flight time between check points.

d. Note bingo fuel and time at each position where a bingo might be necessary.

e. Enter information, such as enemy defenses, divert fields, friendly forces, alternate targets and attack airspeed, altitude, dive angle, and armament switch reminders as necessary. A uniform and neat marking system will aid in exchanging charts between pilots. A flight log should be completed for a quick reference to other essential information.

Heading changes should be started at check points. The distance travelled during turns may be determined from the coin turn chart (figure 2–13). The edge of the selected coin should be placed on the course at the check point. The turn is then traced around the coin, and the new course is plotted directly to the new check point.

Charts may be prepared in various ways. Large charts can be accordian folded similar to the Flight Information Publications Charts. Low level charts should be cut in strips which show an area about 15 miles either side of course and 15 miles beyond a turning point. This strip can be accordion folded to kneeboard size or placed on a strip roller.

CRUISE CONTROL

GENERAL

The cruise control charts are designed to provide a quick method for determining the data needed when planning an attack mission profile. The data are presented in the following four types of charts and tables:

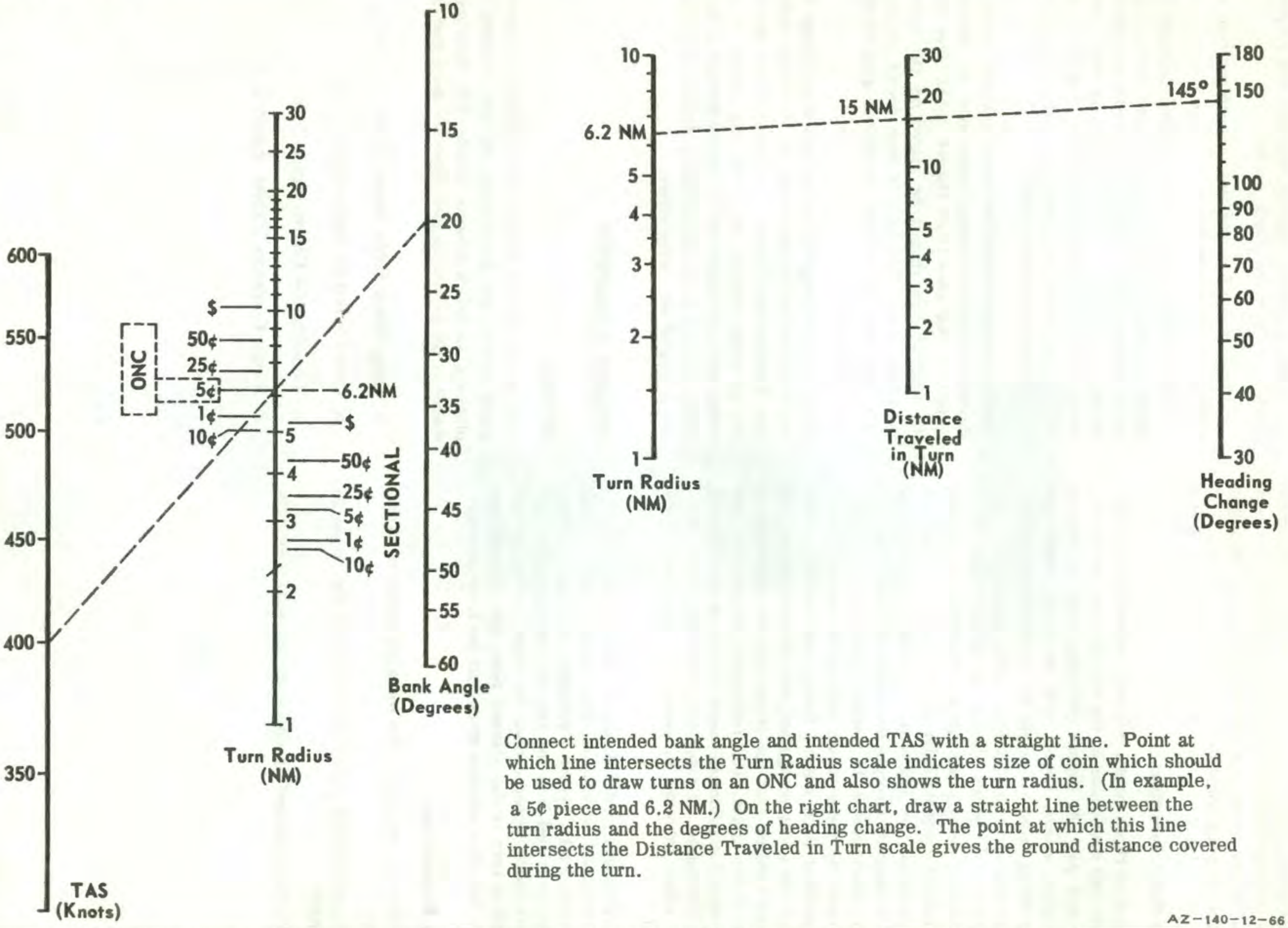
a. Drag Index Table, figure 2–14

b. Climb Schedule Table, figure 2–15

c. Time/Radius Charts, figure 2–16

d. Range Constants Tables, figure 2–17

Turn Chart



Connect intended bank angle and intended TAS with a straight line. Point at which line intersects the Turn Radius scale indicates size of coin which should be used to draw turns on an ONC and also shows the turn radius. (In example, a 5¢ piece and 6.2 NM.) On the right chart, draw a straight line between the turn radius and the degrees of heading change. The point at which this line intersects the Distance Traveled in Turn scale gives the ground distance covered during the turn.

Figure 2–13

Drag Index

STORE	WEIGHT LB		INDIVIDUAL STORE DRAG
MK 24 Mod 3/4 Parachute Flare	27		6.3
MK 45 Mod 0 Parachute Flare	28		6.3
MK 76 Practice Bomb	24		1.5
MK 77 Fire Bomb	MOD 4	520	12.5
	MOD 2	520	9.5
MK 79 Fire Bomb	MOD 1	912	8.1
MK 81 LDGP Bomb	260		4.4
MK 81 Snakeye I GP Bomb	301		6.5
MK 82 LDGP Bomb	527		6.9
MK Snakeye I GP Bomb, MK 124 Practice, MK 36 Destructor	571		8.8
MK 83 LDGP Bomb	985		9.3
MK 84 LDGP Bomb	1970		13.9
MK 86 Practice Bomb	217		4.1
MK 87 Practice Bomb	333		6.8
MK 88 Practice Bomb	783		9.3
MK 89 Practice Bomb, Mods 0 and 1	57		0.7
M117A1	823		12.5
MK 20 Rockeye	460		15.5
CBU-24, -29, -49 Series	830		17
AERO 6A, 6A-1, 6A-2 Rocket Launcher*	F	148	1.3
	E	21	6.3
AERO 7D Rocket Launcher*	F	431	2.5
	E	95	13.0

STORE		WEIGHT LB	INDIVIDUAL STORE DRAG
LAU-3A/A Rocket Launcher*	F	417	2.5
	E	81	13.0
LAU-10A/A Rocket Launcher	E	105	12.5
Nose Cone on, Tail Cone off	F	533	8.3
Nose and Tail Cones off			
MK 32 Mod 0 Head on Rockets	F	533	19.5
MK 24 Mod 0 Head on Rockets	F	533	32.5
LAU-32A/A Rocket Launcher*	F	168	1.3
	E	47	6.3
LAU-32B/A Rocket Launcher*	F	168	1.3
	E	47	6.3
LAU-33A/A and -35A/A Rocket Launcher	E	48	6.8
MK 32 Mod 0 Head on Rockets	F	262	8.5
MK 24 Mod 0 Head on Rockets	F	262	14.0
LAU-56/A Rocket Launcher*	F	168	1.3
	E	47	6.3
LAU 60/A Rocket Launcher*	F	473	2.5
	E	79	13.0
LAU-61/A	F	542	6.5
	E	133	13.0
LAU-68/A	F	217	2.5
	E	67	6.5
LAU-69/A	F	506	6.5
	E	98	13.0
AIM-9B Missile		158	5.0
AIM-9C Missile		210	5.0
AIM-9D Missile		189	5.0

NOTE

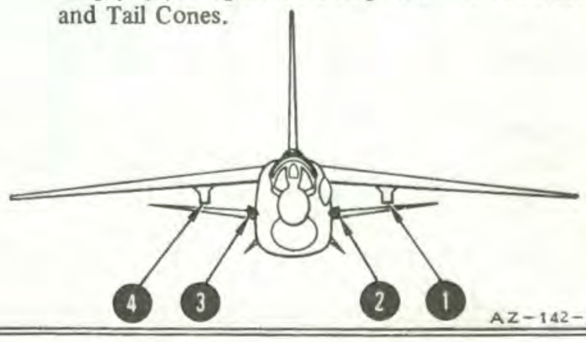
The drag index of the clean airplane is zero.

Individual store drag x number of stores to be carried + suspension equipment drag = drag index.

Drag numbers for single stores are slightly conservative. Interference drag between multiple stores has been considered.

*Empty (E) Drag Index Computed Without Nose and Tail Cones.

	SUSPENSION EQUIPMENT	DRAG PER STATION				
		WGT/STA	1	2	3	4
CONVEN STORES	Wing Pylon and Aero 7A-1 EBR	227	10.5			10.5
	Wing Pylon, Aero 7A-1 ER and MBR	386	23.0			23.0
	Wing Pylon, Aero 7A-1 ER and MER	450	23.0			23.0
	Wing Pylon, Aero 7A-1 ER and TER	332	20.5			20.5
	Wing Pylon and Aero 7A-1 ER and PMBR	314	18.0			18.0
AIM-9	Single Fuselage Pylon and LAU-7/A Launchers	103		2.5	2.5	
	Dual Fuselage Pylon and LAU-7/A Launcher	252		7.5	7.5	
	Single Fuselage Pylon and AERO 3A Launcher	62		2.5	2.5	
	Dual Fuselage Pylon and Aero 3A Launchers	168		7.5	7.5	



AZ-142-03-69

Figure 2–14

Climb Schedules

MILITARY POWER

Date: November 1966
Data Basis: Flight Tests

ENGINE: J57-P20A
ICAO STANDARD DAY

Fuel Grade: JP-5
Fuel Density: 6.8 Lb/Gal

DRAG INDEX

ALTITUDE	0			15			34			60		
	KCAS	KTAS	MACH	KCAS	KTAS	MACH	KCAS	KTAS	MACH	KCAS	KTAS	MACH
S.L.	480	480	.73	480	480	.73	480	480	.73	431	431	.65
5,000	450	480	.74	450	480	.74	450	480	.74	403	431	.66
10,000	421	480	.75	421	480	.75	421	480	.75	379	431	.68
15,000	392	480	.77	392	480	.77	392	480	.77	351	431	.69
20,000	363	480	.78	363	480	.78	363	480	.78	323	431	.70
25,000	337	480	.80	337	480	.80	337	480	.80	299	431	.72
30,000	312	480	.82	312	480	.82	312	480	.82	272	431	.73
35,000	285	480	.84	285	480	.84	285	480	.84	251	431	.75
40,000	255	480	.84	255	480	.84	255	480	.84	226	431	.75
45,000	228	480	.84	228	480	.84	228	480	.84			

DRAG INDEX

ALTITUDE	83			109			136			172		
	KCAS	KTAS	MACH	KCAS	KTAS	MACH	KCAS	KTAS	MACH	KCAS	KTAS	MACH
S.L.	407	407	.62	398	398	.60	388	388	.59	371	371	.56
5,000	381	407	.63	372	398	.61	365	388	.60	347	371	.57
10,000	366	407	.64	348	398	.62	339	388	.61	323	371	.58
15,000	330	407	.65	321	398	.64	315	388	.62	300	371	.59
20,000	306	407	.66	300	398	.65	290	388	.63	278	371	.61
25,000	280	407	.68	272	398	.66	267	388	.65	257	371	.62
30,000	259	407	.69	250	398	.68	244	388	.66	235	371	.63
35,000	238	407	.71	230	398	.69	224	388	.67			
40,000	210	407	.71	203	398	.69	200	388	.67			
45,000												

DRAG INDEX

ALTITUDE	199			225			251		
	KCAS	KTAS	MACH	KCAS	KTAS	MACH	KCAS	KTAS	MACH
S.L.	362	362	.55	354	354	.54	345	345	.52
5,000	349	362	.56	330	354	.55	321	345	.53
10,000	315	362	.57	308	354	.56	300	345	.54
15,000	293	362	.58	284	354	.57	277	345	.55
20,000	270	362	.59	264	354	.58	257	345	.56
25,000	251	362	.61	244	354	.59	237	345	.57
30,000	230	362	.62	225	354	.61	218	345	.59
35,000									
40,000									
45,000									

AZ-143-1-68

Figure 2–15

Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
0	28,500 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
Clean Airplane	Clean Airplane

CAUTION

This chart is invalid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart invalid.

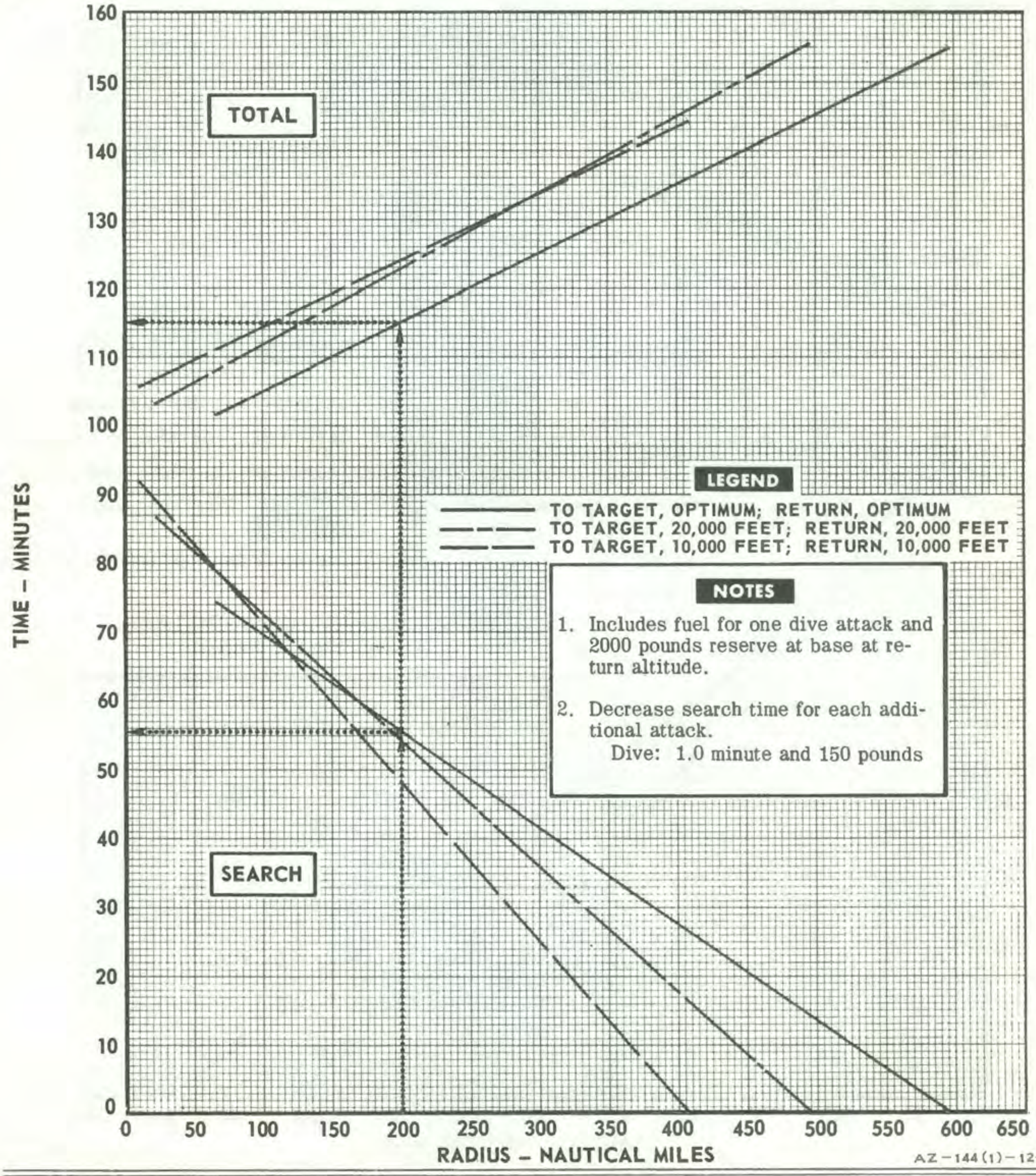


Figure 2–16 (Sheet 1)

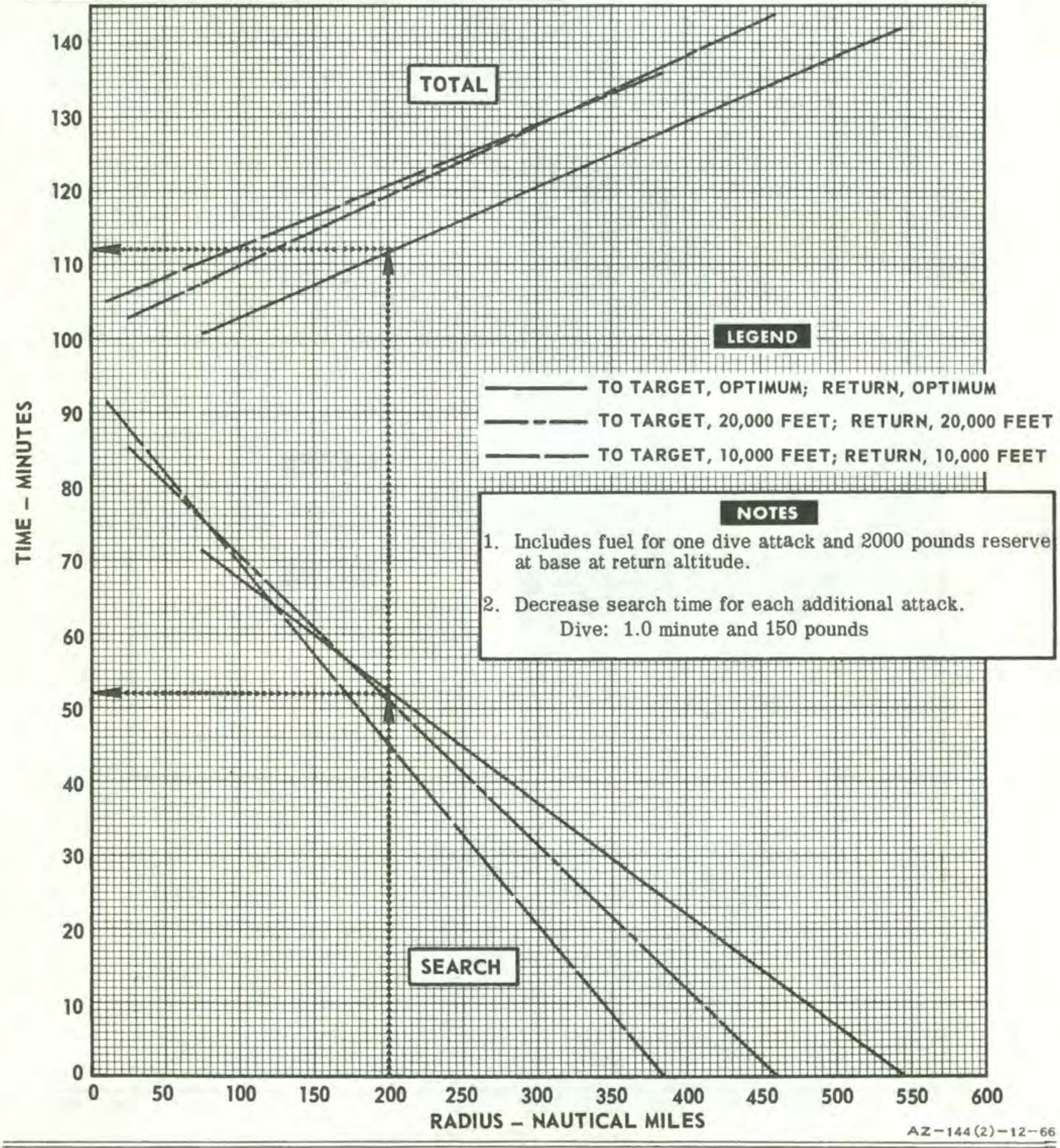
Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
15	29,100 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(2) AIM – 9C's	(2) AIM – 9C's

CAUTION

This chart is invalid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can prove this chart invalid.



NOTES

1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

Figure 2-16 (Sheet 2)

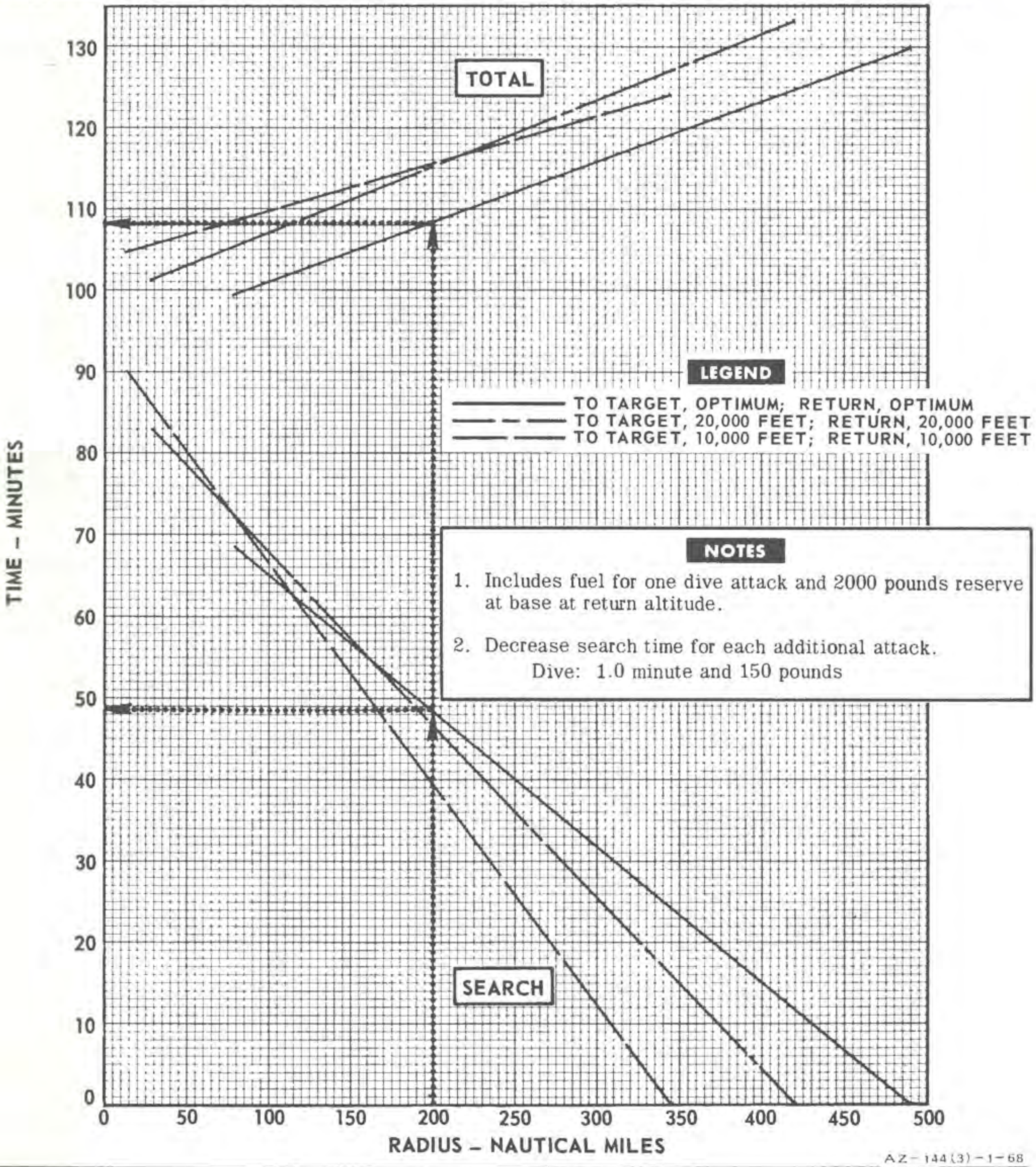
Time/Radius Chart

TAKEOFF DRAG INDEX GROSS WEIGHT	
34	29,800 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(4) AIM – 9C's	(4) AIM – 9C's

CAUTION

This chart is invalid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart invalid.



NOTES

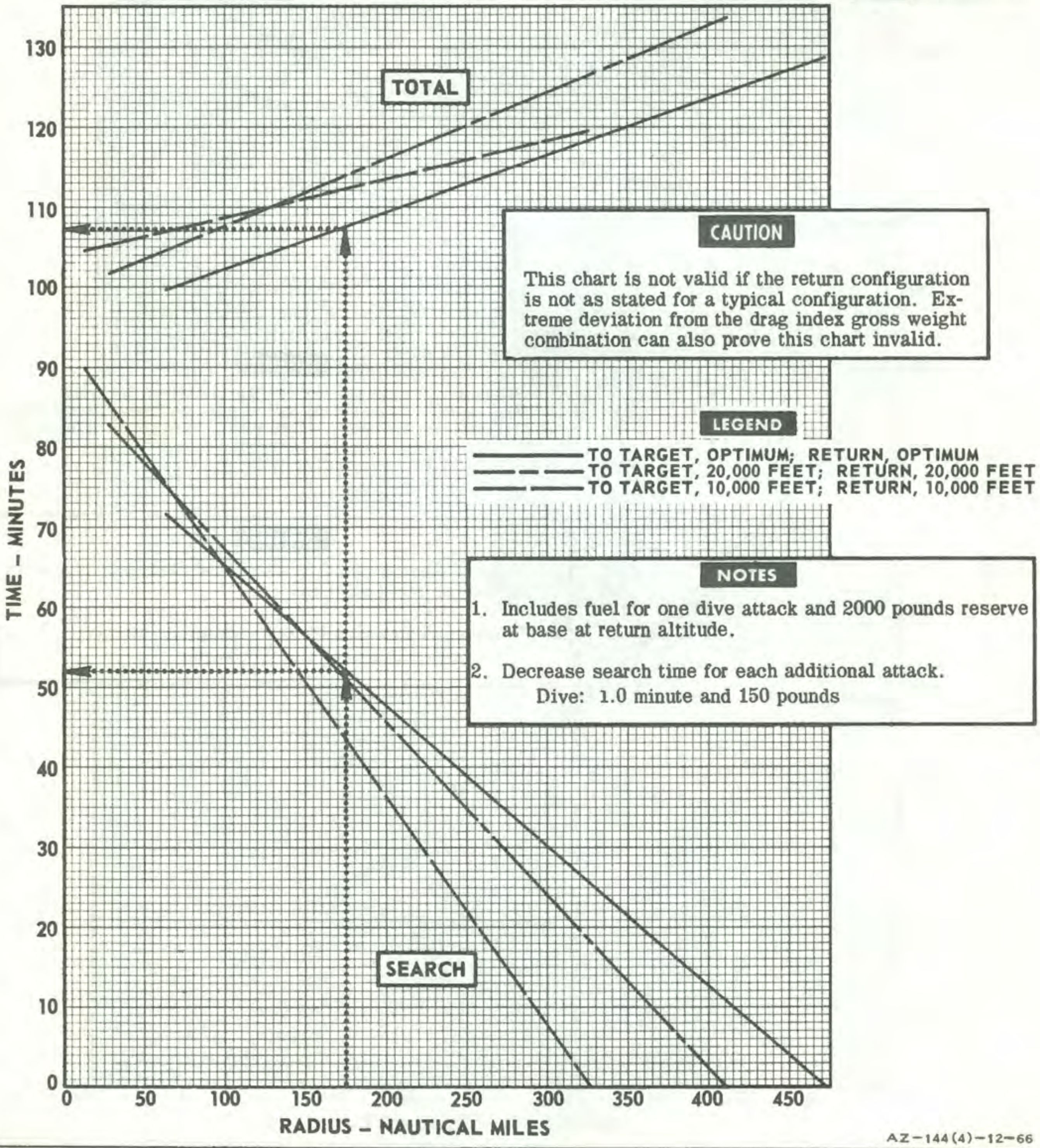
1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

Figure 2–16 (Sheet 3)

Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
60	30,740 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(2) MK 82 LD-GP Bombs (2) LAU-33/A's MK 24 Mod 0 Heads	(2) Empty Wing Pylons (2) Empty LAU-33/A's



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart invalid.

NOTES

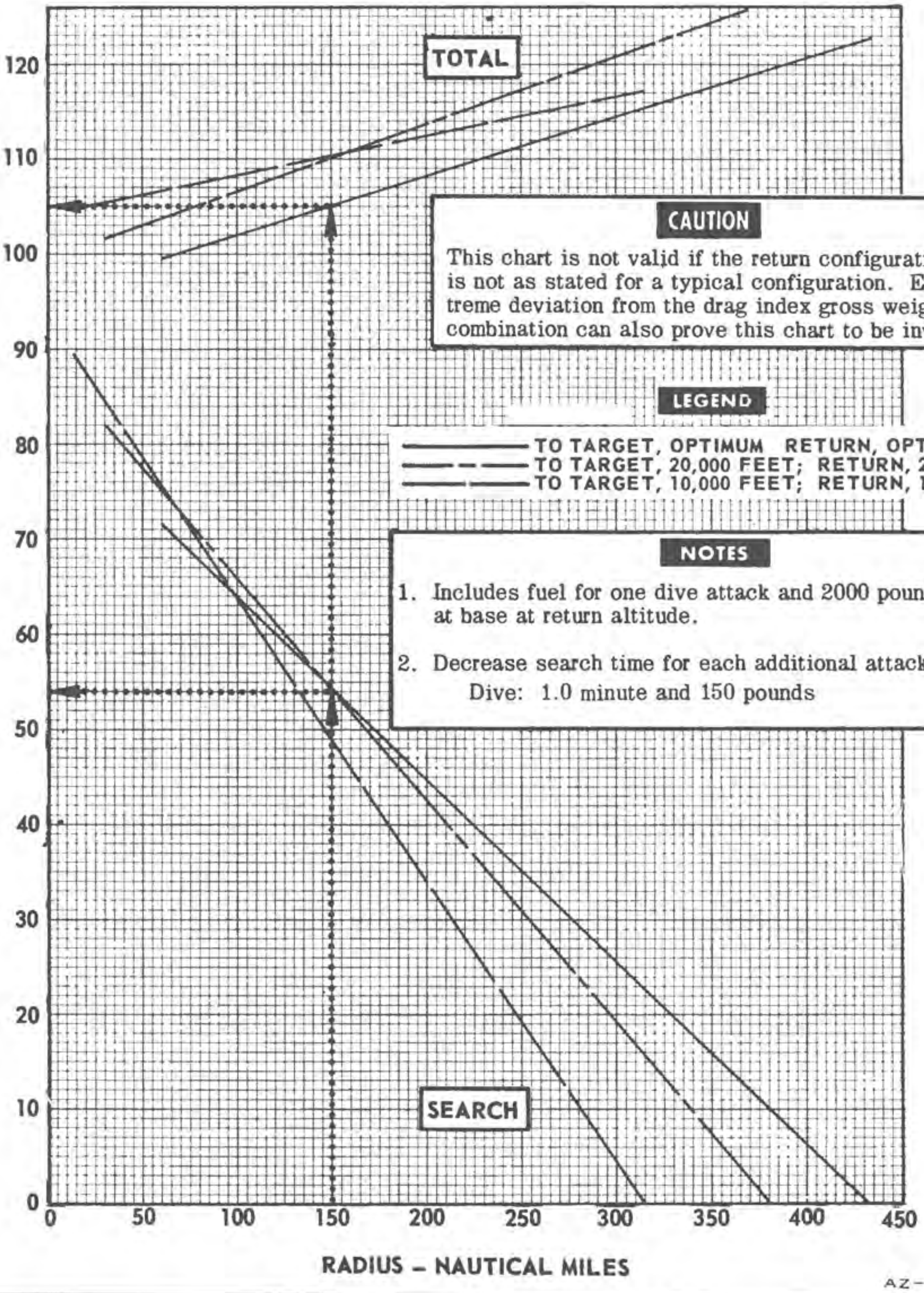
1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

Figure 2-16 (Sheet 4)

Time/Radius Chart

TAKEOFF DRAG INDEX GROSS WEIGHT	
83	31,354 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(8) MK 81 LD-GP Bombs (2) MBR's or MER's	(2) Empty MBR's or MER's



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart to be invalid.

LEGEND

- TO TARGET, OPTIMUM RETURN, OPTIMUM
- TO TARGET, 20,000 FEET; RETURN, 20,000 FEET
- TO TARGET, 10,000 FEET; RETURN, 10,000 FEET

NOTES

1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

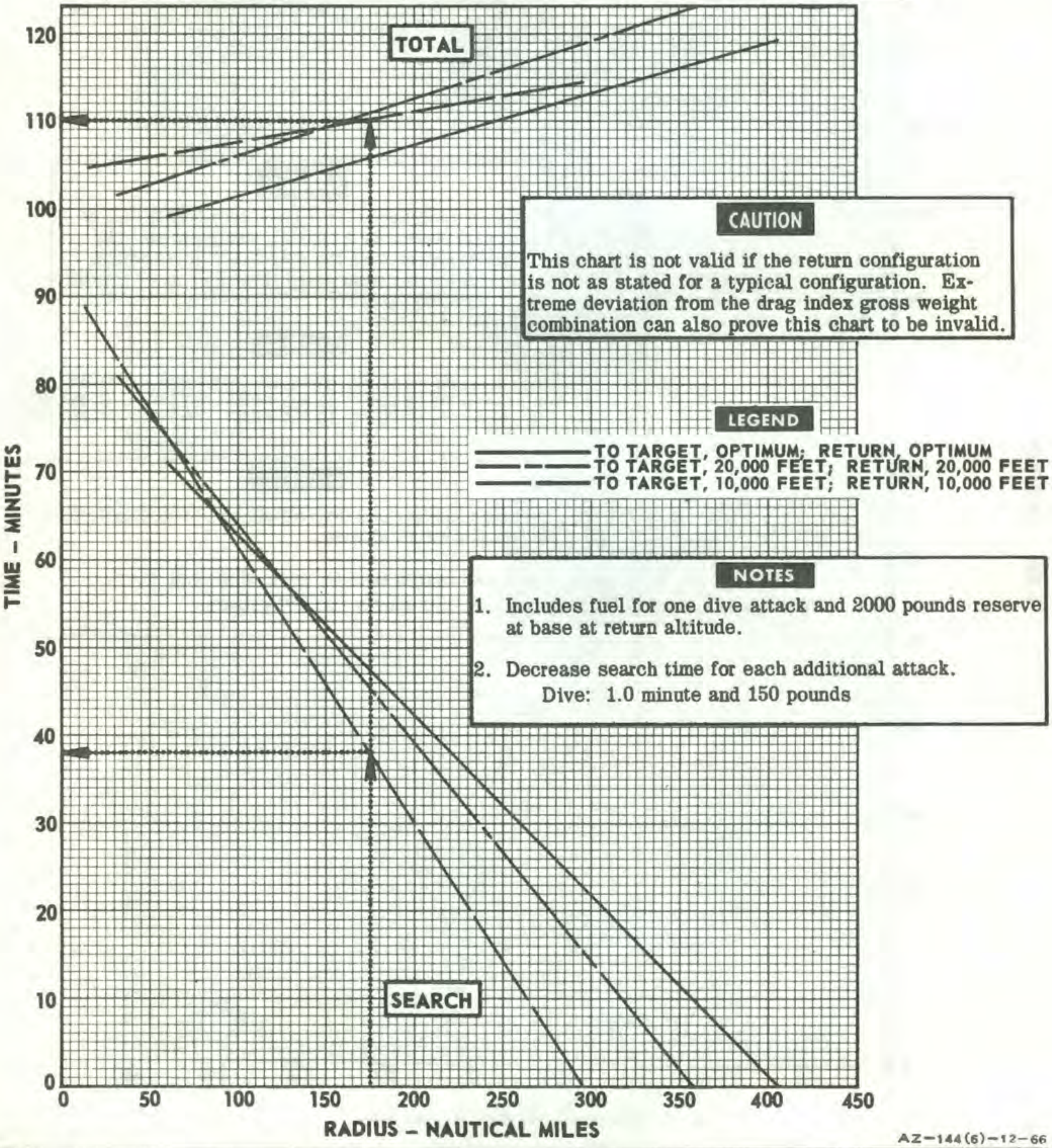
AZ-144(5)-12-6E

Figure 2-16 (Sheet 5)

Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
109	31,564 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(6) MK 81 LD-GP Bombs (2) MBR's or MER's (2) LAU-33/A's MK 24 Mod 0 Heads	(2) Empty MBR's or MER's (2) Empty LAU-33/A's



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart to be invalid.

NOTES

1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

Figure 2-16 (Sheet 6)

Time/Radius Chart

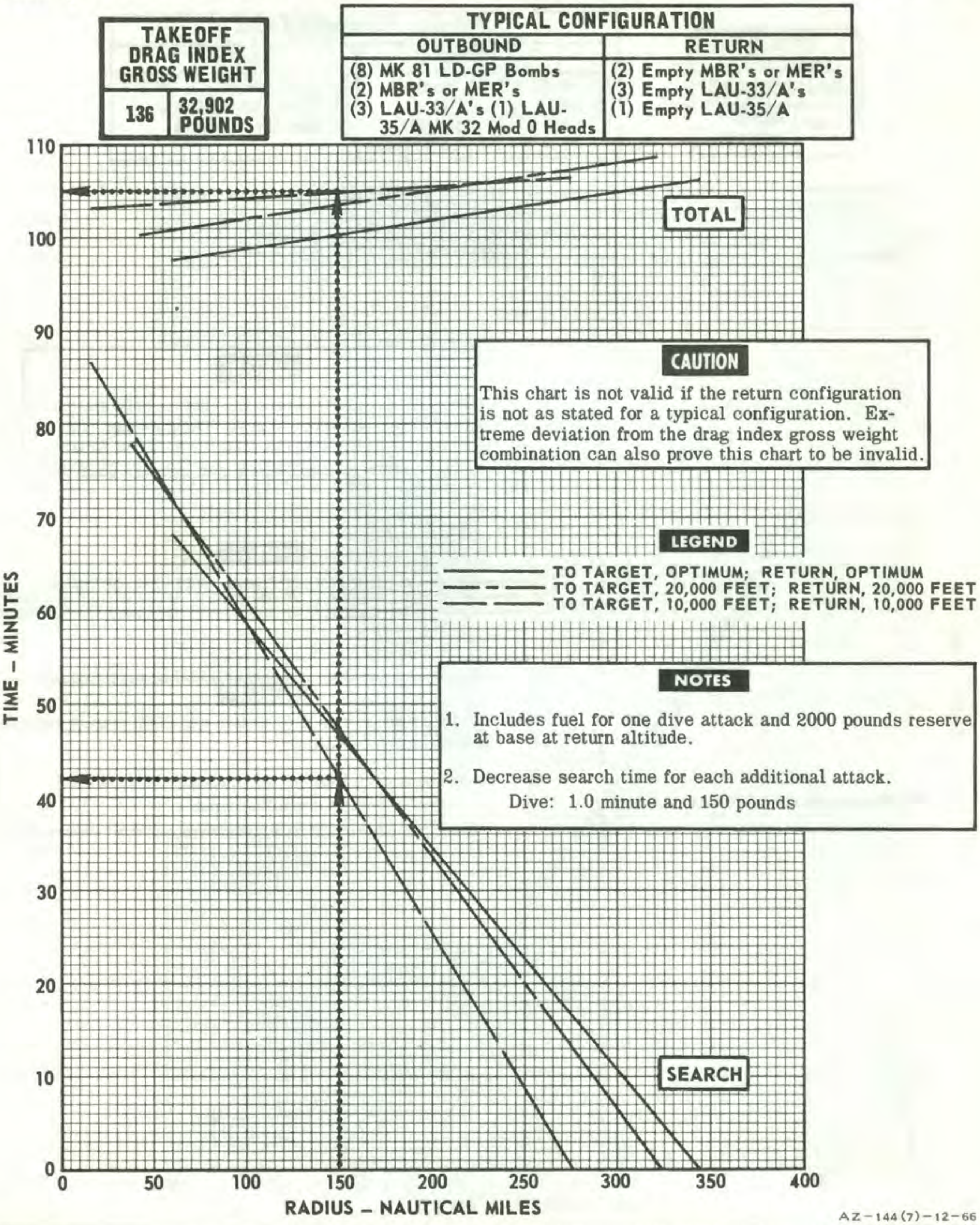


Figure 2–16 (Sheet 7)

Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
172	34,000 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	**RETURN**
(8) MK 82 LD-GP Bombs (2) MBR's or MER's (3) LAU-33/A's (1) LAU-35/A MK 24 Mod 0 Heads	(2) Empty MBR's or MER's (3) Empty LAU-33/A's (1) Empty LAU-35/A

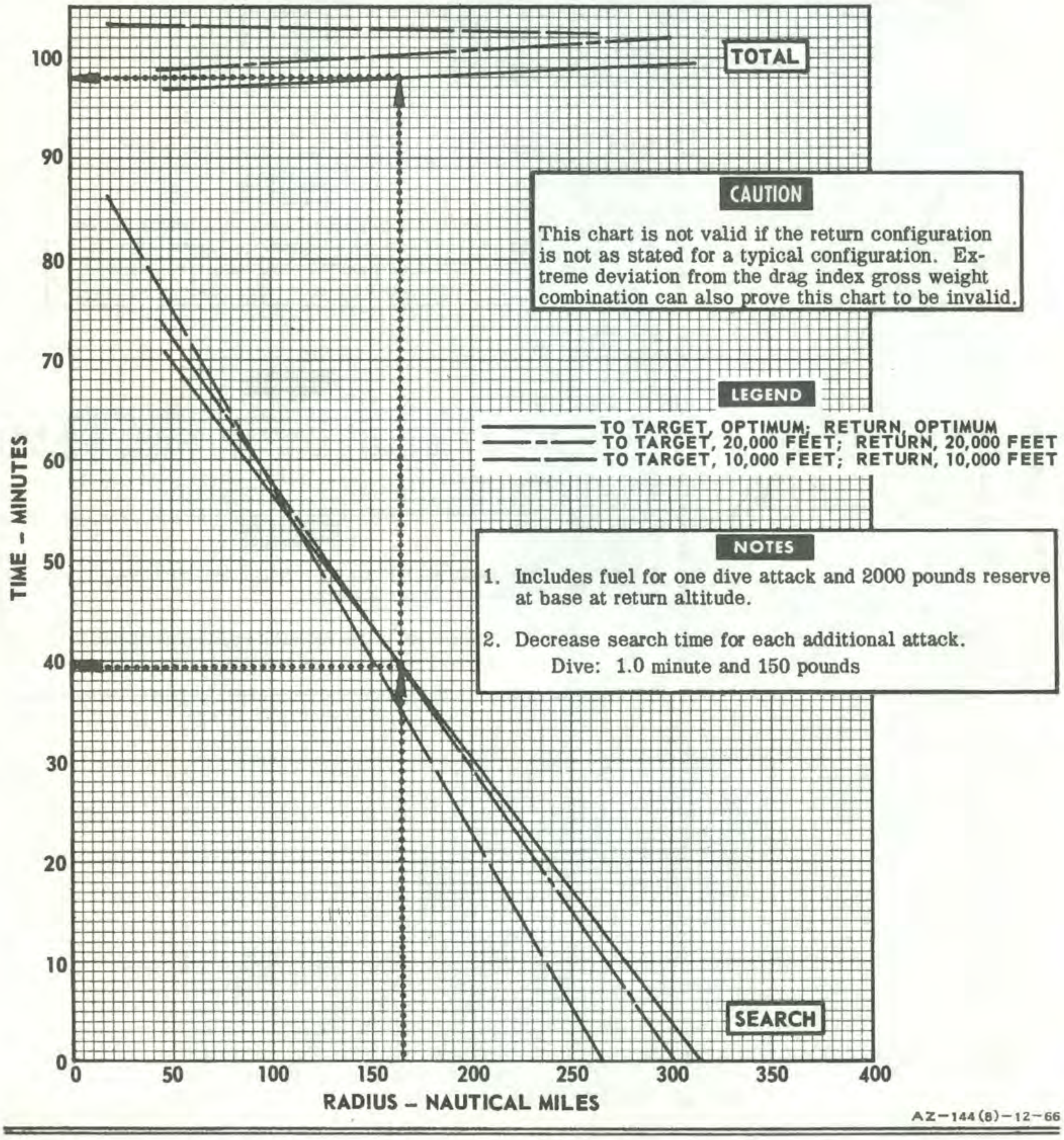
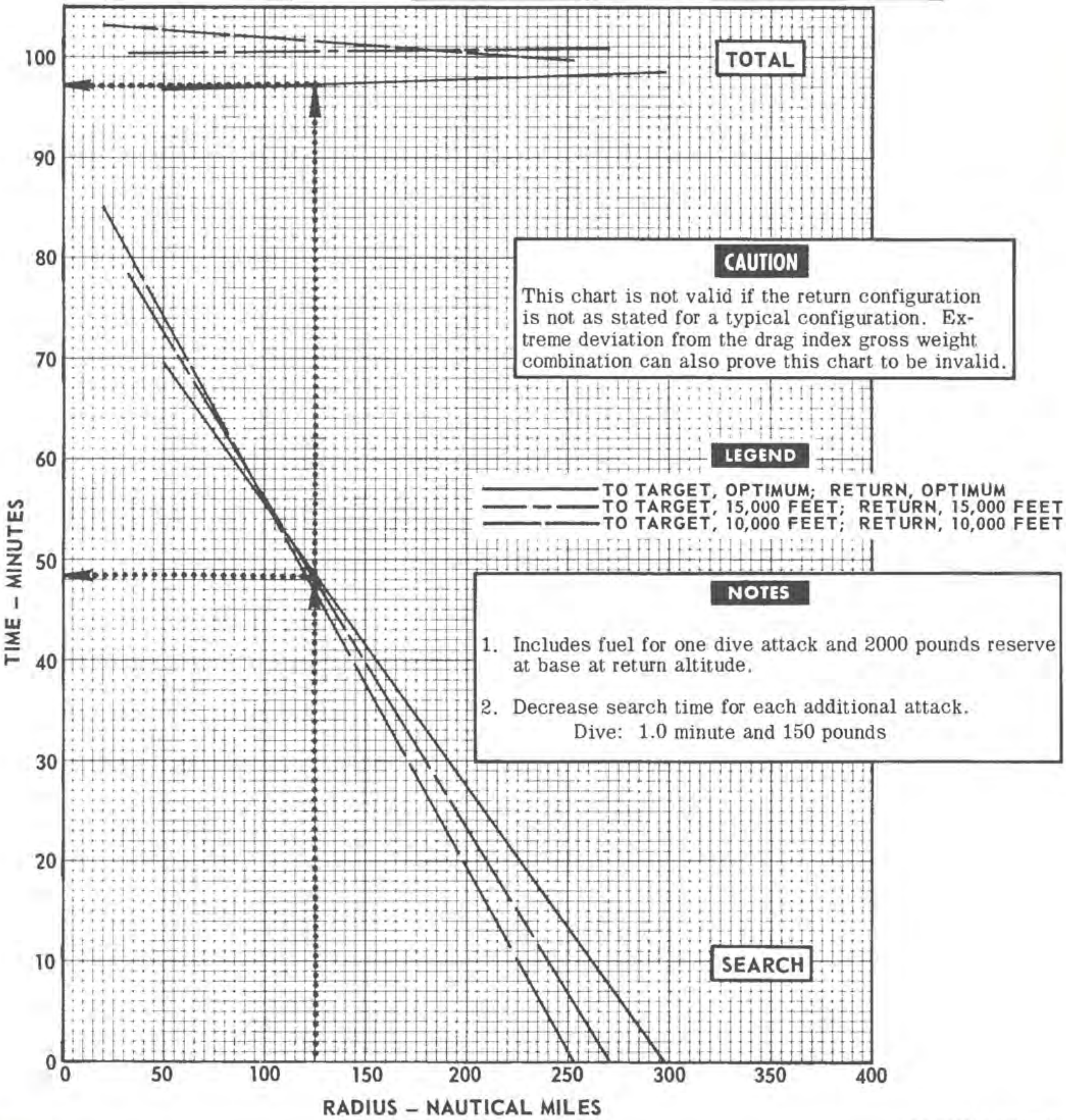


Figure 2–16 (Sheet 8)

Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
199	34,000 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(12) MK 81 Snakeye 1 GP Bombs	(2) Empty MER's
(2) MER's	(3) Empty LAU-33/A's
(3) LAU-33/A's (1) LAU-35/A MK 24 Mod 0 Heads	(1) Empty LAU-35/A



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart to be invalid.

NOTES

1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

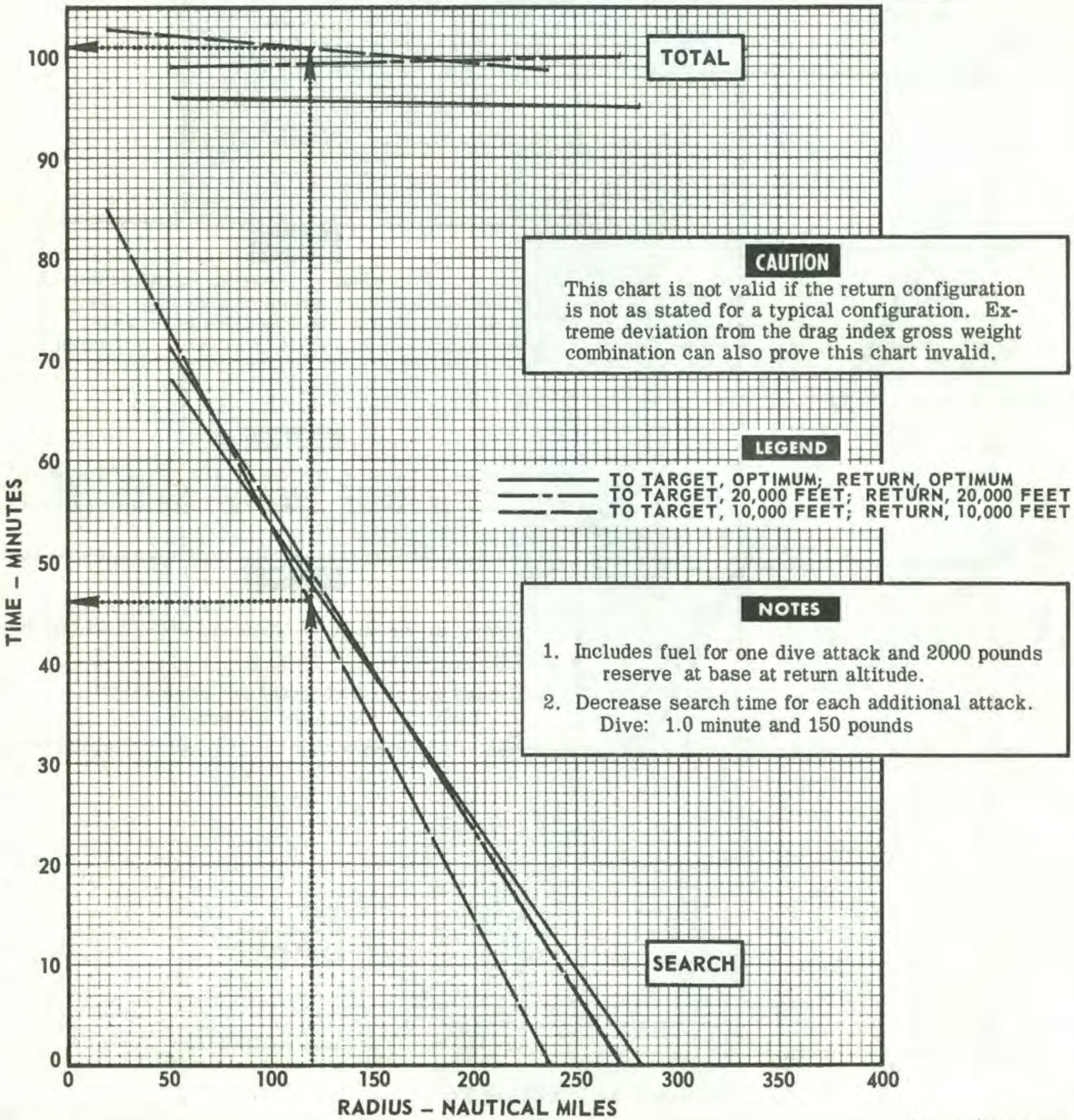
AZ-144(9)-12-66

Figure 2-16 (Sheet 9)

Time/Radius Chart

TAKEOFF DRAG INDEX GROSS WEIGHT	
225	33,100 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(4) LAU-10/A's Nose and Tail Cones Off MK 32 Mod 0 Heads (2) MER's (3) LAU-33/A's (1) LAU-35/A MK 32 Mod 0 Heads	(4) Empty LAU-10/A's (3) Empty LAU-33/A's (1) Empty LAU-35/A



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart invalid.

NOTES

1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack. Dive: 1.0 minute and 150 pounds

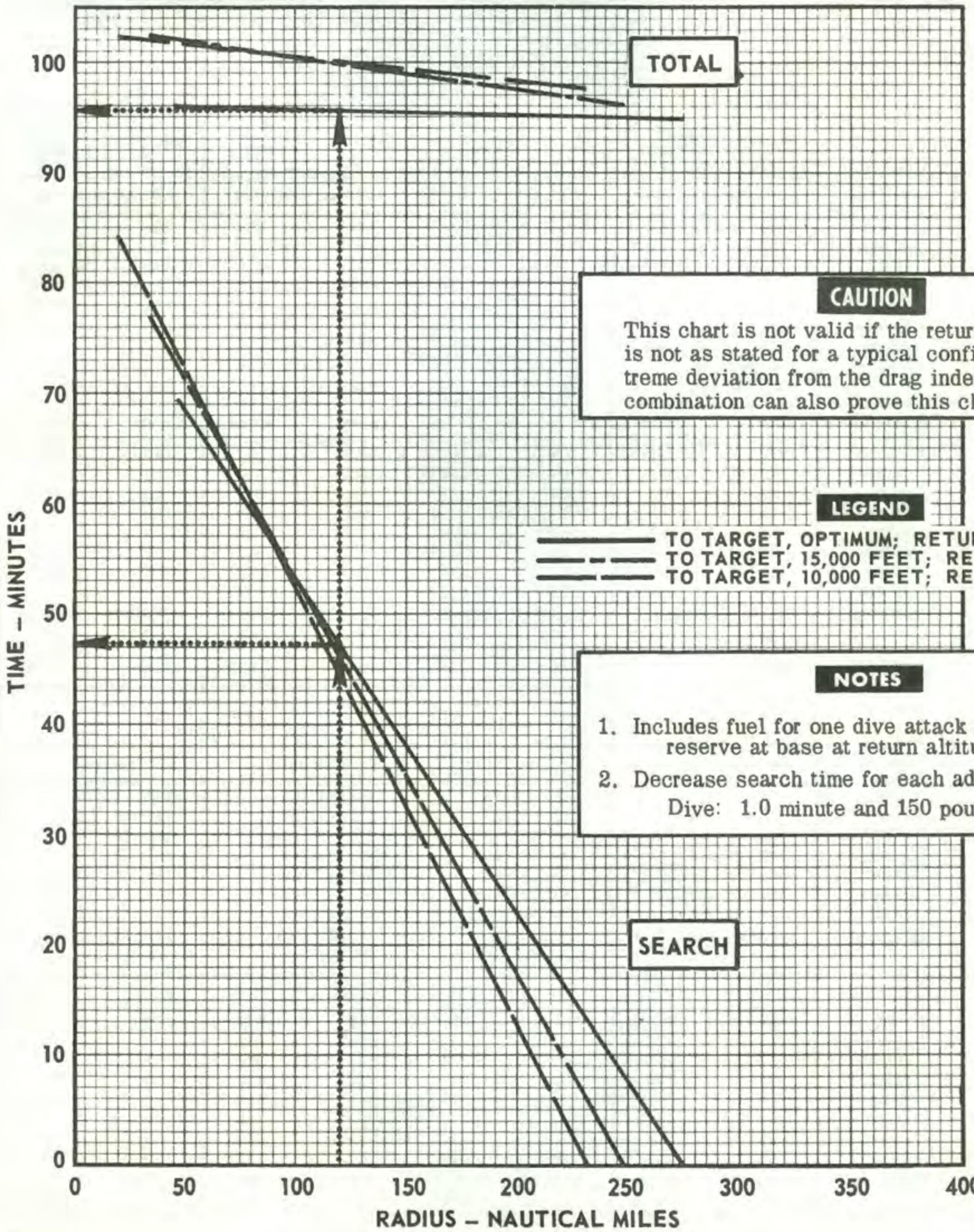
AZ-144(10)-12-66

Figure 2-16 (Sheet 10)

Time/Radius Chart

TAKEOFF DRAG INDEX	GROSS WEIGHT
251	33,100 POUNDS

TYPICAL CONFIGURATION	
OUTBOUND	RETURN
(4) LAU-10/A's Nose and Tail Cones Off MK 24 Mod 0 Heads	(4) Empty LAU-10/A's
(2) MER's	(3) Empty LAU-33/A's
(3) LAU-33/A's (1) LAU-35/A MK 24 Mod 0 Heads	(1) Empty LAU-35/A



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index gross weight combination can also prove this chart invalid.

LEGEND

- ———— TO TARGET, OPTIMUM; RETURN, OPTIMUM
- — – — TO TARGET, 15,000 FEET; RETURN, 15,000 FEET
- —— —— TO TARGET, 10,000 FEET; RETURN, 10,000 FEET

NOTES

1. Includes fuel for one dive attack and 2000 pounds reserve at base at return altitude.
2. Decrease search time for each additional attack.
   Dive: 1.0 minute and 150 pounds

AZ-144(11)-12-66

Figure 2-16 (Sheet 11)

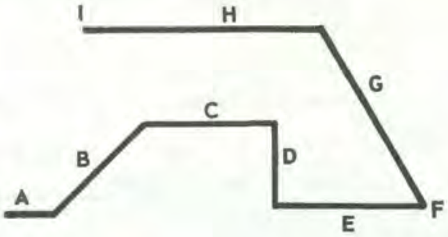
Range Constants

A. **Takeoff.**
MRT Fuel: 500 Lb
CRT Fuel: 700 Lb

D. **Descent: 4500 Ft/Min**
Fuel: 14 Lb/Min

F. **Dive: 1.0 Min/150 Lb**

I. **Reserve: 2,000 Lb**



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index/gross weight combination can also prove this chart invalid.

TAKEOFF DRAG INDEX / GROSS WEIGHT

	LEG		0 / 28,500 POUNDS	15 / 29,100 POUNDS	34 / 29,800 POUNDS	60 / 30,740 POUNDS
OUTBOUND	B CLIMB	ALTITUDE	LB NM MIN IMN	LB NM MIN IMN	LB NM MIN IMN	LB NM MIN IMN
	MILITARY POWER	5,000	100 5 0.6 0.74	100 5 0.6 0.74	130 6 0.7 0.74	120 6 0.8 0.66
		10,000	200 10 1.3 0.75	220 11 1.4 0.75	250 13 1.6 0.75	270 13 1.8 0.68
		15,000	300 16 2.0 0.77	330 18 2.3 0.77	380 20 2.5 0.77	400 20 2.8 0.69
		20,000	390 22 2.8 0.78	440 25 3.1 0.78	510 29 3.6 0.78	530 28 3.9 0.70
		25,000	490 30 3.7 0.80	550 34 4.3 0.80	640 39 4.9 0.80	680 38 5.3 0.72
		30,000	590 40 5.0 0.82	675 45 5.6 0.82	780 51 6.4 0.82	840 54 7.5 0.73
		35,000	720 53 6.6 0.84	820 60 7.5 0.84	950 69 8.6 0.84	– – –
		OPTIMUM	38,400 Ft Alt 830 66 8.3	38,300 Ft Alt 940 75 9.4	36,800 Ft Alt 1004 79 9.9	33,000 Ft Alt 940 63 8.8
	C CRUISE	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	OPTIMUM CRUISE	SL	11.0 354	11.8 350	12.2 344	13.2 355
		5,000	9.2 362	9.9 360	10.6 356	11.8 358
		10,000	7.9 376	8.5 375	9.4 374	10.4 371
		15,000	7.0 396	7.5 396	8.3 396	9.0 389
		20,000	6.3 420	6.7 420	7.4 420	7.8 413
		25,000	5.7 448	6.2 448	6.7 448	7.2 440
		30,000	5.4 478	5.8 478	6.3 478	6.8 471
		35,000	5.1 498	5.5 498	6.0 498	– –
		OPTIMUM	38,400 Ft – 40,100 Ft 5.0 500	38,300 Ft – 39,700 Ft 5.4 500	36,800 Ft – 38,200 Ft 5.9 500	33,000 Ft – 34,700 Ft 6.7 490
	E SEARCH	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	4,000 LB/HR	SL	11.0 362	11.6 345	11.9 337	13.5 296
RETURN	G CLIMB	ALTITUDE	LB NM MIN	LB NM MIN	LB NM MIN	LB NM MIN
	MILITARY POWER	5,000	80 4 0.5	90 5 0.6	100 5 0.6	100 5 0.6
		10,000	170 8 1.0	190 10 1.3	220 11 1.4	205 10 1.3
		15,000	250 13 1.6	280 15 1.9	320 17 2.1	305 15 1.9
		20,000	320 18 2.2	360 21 2.6	430 25 3.1	405 23 3.0
		25,000	400 25 3.1	450 28 3.5	530 32 4.0	505 30 3.9
		30,000	490 32 4.0	550 37 4.6	650 43 5.4	610 40 5.2
		35,000	580 42 5.3	650 47 5.9	770 56 7.0	720 52 6.7
		OPTIMUM	41,800 Ft Alt 730 61 7.6	40,800 Ft Alt 810 68 8.5	39,100 Ft Alt 900 72 9.0	38,600 Ft Alt 810 67 8.6
	H CRUISE	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	OPTIMUM CRUISE	SL	10.6 337	11.2 327	11.8 323	11.9 320
		5,000	8.8 343	9.3 338	10.1 336	10.2 332
		10,000	7.5 357	7.9 356	8.8 354	8.8 346
		15,000	6.5 376	7.0 376	7.7 376	7.6 363
		20,000	5.9 400	6.3 400	6.8 400	6.7 386
		25,000	5.3 426	5.7 426	6.2 426	6.0 417
		30,000	4.9 458	5.3 458	5.7 458	5.6 454
		35,000	4.5 490	5.0 490	5.4 490	5.3 474
		OPTIMUM	41,800 Ft – 43,800 Ft 4.3 500	40,800 Ft – 42,400 Ft 4.7 500	39,100 Ft – 40,600 Ft 5.2 500	38,600 Ft – 40,700 Ft 5.0 485

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Figure 2-17 (Sheet 1)

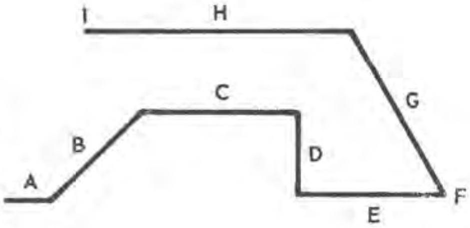
Range Constants

A. Takeoff
MRT Fuel: 500 Lb
CRT Fuel: 700 Lb

D. Descent: 4500 Ft/Min
Fuel: 14 Lb/Min

F. Dive: 1.0 Min/150 Lb

I. Reserve: 2,000 Lb



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index/gross weight combination can also prove this chart invalid.

TAKEOFF DRAG INDEX / GROSS WEIGHT

LEG			83 / 31,354 POUNDS	109 / 31,564 POUNDS	136 / 32,902 POUNDS	172 / 34,000 POUNDS
OUTBOUND	B CLIMB	ALTITUDE	LB NM MIN IMN	LB NM MIN IMN	LB NM MIN IMN	LB NM MIN IMN
	MILITARY POWER	5,000	130 6 0.9 0.63	130 6 0.9 0.61	200 8 1.2 0.60	220 8 1.3 0.57
		10,000	300 14 2.1 0.64	310 14 2.1 0.62	380 16 2.5 0.61	430 18 2.9 0.58
		15,000	440 22 3.2 0.65	480 22 3.3 0.64	540 25 3.9 0.62	660 28 4.5 0.59
		20,000	590 30 4.4 0.66	620 32 4.8 0.65	730 38 5.9 0.63	920 44 7.1 0.61
		25,000	750 43 6.3 0.68	810 46 6.9 0.66	990 55 8.5 0.65	—
		30,000	950 60 8.9 0.69	— —	—	
		35,000	— — —	— —	—	
		OPTIMUM	30,000 Ft Alt 950 60 8.9	29,300 Ft Alt 980 60 9.0	26,000 Ft Alt 1070 60 9.3	22,200 Ft Alt 990 47 7.6
	C CRUISE	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	OPTIMUM CRUISE	SL	14.0 342	14.7 329	15.6 324	16.7 319
		5,000	12.5 345	13.1 333	13.8 330	14.8 328
		10,000	11.0 358	11.7 344	12.4 342	13.3 341
		15,000	9.6 376	10.4 362	11.2 360	12.2 359
		20,000	8.7 405	9.4 387	10.2 385	11.3 385
		25,000	8.1 435	8.6 417	9.4 415	—
		30,000	7.7 465	— —	—	— —
		35,000	— —	— —	— —	
		OPTIMUM	30,000 Ft – 31,900 Ft 7.7 465	29,300 Ft – 31,200 Ft 8.0 456	26,000 Ft – 28,100 Ft 9.2 420	22,200 Ft – 24,600 Ft 10.9 405
	E SEARCH	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	4,000 LB/HR	SL	14.2 281	14.6 271	15.7 255	17.0 235
RETURN	G CLIMB	ALTITUDE	LB NM MIN	LB NM MIN	LB NM MIN	LB NM MIN
	MILITARY POWER	5,000	100 5 0.6	100 4 0.6	120 5 0.7	120 5 0.7
		10,000	205 10 1.3	210 10 1.4	240 11 1.6	240 11 1.6
		15,000	305 15 1.9	310 15 2.1	380 17 2.5	380 17 2.5
		20,000	405 23 3.0	410 22 3.1	490 24 3.5	490 24 3.5
		25,000	505 30 3.9	510 30 4.2	600 33 4.9	600 33 4.9
		30,000	610 40 5.3	620 40 5.6	720 44 6.5	720 44 6.5
		35,000	720 52 6.9	730 52 7.2	890 60 8.9	890 60 8.9
		OPTIMUM	38,400 Ft Alt 808 66 8.7	37,000 Ft Alt 800 60 8.4	35,000 Ft Alt 890 60 8.9	35,000 Ft Alt 890 60 8.9
	H CRUISE	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	OPTIMUM CRUISE	SL	12.0 317	12.7 310	13.4 318	13.4 318
		5,000	10.4 328	11.0 320	11.6 331	11.6 331
		10,000	9.0 343	9.5 335	10.1 348	10.1 348
		15,000	7.8 361	8.2 353	8.9 372	8.9 372
		20,000	6.8 384	7.2 376	8.0 407	8.0 407
		25,000	6.1 414	6.4 407	7.4 437	7.4 437
		30,000	5.7 450	5.9 438	7.0 457	7.0 457
		35,000	5.4 470	5.7 456		—
		OPTIMUM	38,400 Ft – 40,300 Ft 5.1 480	37,000 Ft – 38,700 Ft 5.6 463	35,000 Ft – 36,800 Ft 6.8 470	35,000 Ft 36,800 Ft 6.8 470

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Figure 2–17 (Sheet 2)

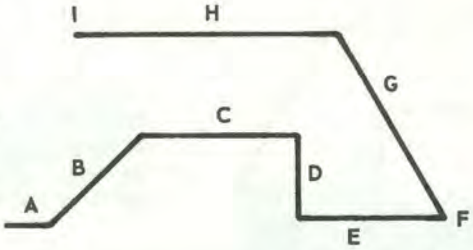
Range Constants

A. Takeoff
MRT Fuel: 500 Lb
CRT Fuel: 700 Lb

D. Descent: 4500 Ft/Min
Fuel: 14 Lb/Min

F. Dive: 1.0 Min/150 Lb

I. Reserve: 2,000 Lb



CAUTION

This chart is not valid if the return configuration is not as stated for a typical configuration. Extreme deviation from the drag index/gross weight combination can also prove this chart invalid.

TAKEOFF DRAG INDEX / GROSS WEIGHT

LEG			199 / 34,000 POUNDS	225 / 33,100 POUNDS	251 / 33,100 POUNDS	/
OUTBOUND	B CLIMB	ALTITUDE	LB NM MIN IMN	LB NM MIN IMN	LB NM MIN IMN	LB NM MIN IMN
	MILITARY POWER	5,000	240 9 1.5 0.56	240 9 1.5 0.55	260 9 1.6 0.53	
		10,000	470 19 3.1 0.57	470 19 3.2 0.56	520 20 3.5 0.54	
		15,000	740 32 5.3 0.58	740 32 5.4 0.57	800 34 5.9 0.55	
		20,000	– – –	1007 50 8.5 0.58	– – –	
		25,000	– – –	– – –	– – –	
		30,000	– – –	– – –	– – –	
		35,000	– – –	– – –	– – –	
		OPTIMUM	19,700 Ft Alt 1020 48 8.0	20,400 Ft Alt 1110 52 8.8	18,700 Ft Alt 1040 47 8.2	
	C CRUISE	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	OPTIMUM CRUISE	SL	18.5 311	19.0 314	19.6 304	
		5,000	16.0 320	16.6 325	17.2 315	
		10,000	14.4 333	15.0 337	15.5 329	
		15,000	13.1 351	13.8 357	14.2 348	
		20,000	– –	12.5 381	– –	
		25,000	– –	– –	– –	
		30,000	– –	– –	– –	
		35,000	– –	– –	– –	
		OPTIMUM	19,700 Ft – 22,900 Ft 12.0 373	20,400 Ft – 23,200 Ft 12.3 393	18,700 Ft – 21,700 Ft 12.9 373	
	E SEARCH	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	4,000 LB/HR	SL	18.3 218	19.0 211	20.0 200	
RETURN	G CLIMB	ALTITUDE	LB NM MIN	LB NM MIN	LB NM MIN	LB NM MIN
	MILITARY POWER	5,000	120 5 0.7	140 6 0.9	140 6 0.9	
		10,000	240 11 1.6	280 12 1.9	280 12 1.9	
		15,000	380 17 2.5	410 19 2.9	410 19 2.9	
		20,000	490 24 3.5	540 27 4.2	540 27 4.2	
		25,000	600 33 4.9	690 36 5.6	690 36 5.6	
		30,000	720 44 6.5	850 51 7.9	850 51 7.9	
		35,000	890 60 8.9	– – –	– – –	
		OPTIMUM	35,000 Ft Alt 890 60 8.9	32,400 Ft Alt 940 59 9.1	32,400 Ft Alt 940 59 9.1	
	H CRUISE	ALTITUDE	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS	LB/NM KTAS
	OPTIMUM CRUISE	SL	13.4 318	14.5 292	14.5 292	
		5,000	11.6 331	12.6 295	12.6 295	
		10,000	10.1 348	11.1 308	11.1 308	
		15,000	8.9 372	9.9 329	9.9 329	
		20,000	8.0 407	8.9 357	8.9 357	
		25,000	7.4 437	8.1 390	8.1 390	
		30,000	7.0 457	7.5 419	7.5 419	
		35,000	– –	– –	– –	
		OPTIMUM	35,000 Ft – 36,800 Ft 6.8 470	32,400 Ft – 34,300 Ft 7.3 433	32,400 Ft – 34,300 Ft 7.3 433	

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Figure 2–17 (Sheet 3)

ASSUMPTIONS

The following assumptions are in addition to those listed in the cruise control charts.

a. ICAO standard atmosphere

b. No wind

c. No base movement during mission

d. No fuel allowance for rendezvous

e. Time allowance for engine start, taxi, and take-off is 10 minutes

f. Clean aircraft weight (less pilot, fuel and stores) — 18,800 pounds

g. Full fuel load (JP-5) — 9,167 pounds

h. Pilot — 180 pounds

i. 20MM ammunition (500 rds) — 355 pounds

DRAG INDEX TABLE

The cruise control data are presented in accordance with the drag index system. Drag index is the sum of the drag numbers obtained from figure 2–14 and represents the true drag for the specific configuration.

CLIMB SCHEDULE CHART

The climb schedule chart (figure 2–15) provides the optimum climb speed for each altitude (5,000-foot increments) for the drag indexes listed.

TIME/RADIUS CHARTS

The time/radius charts (figure 2–16) provide the search time available in the target area at a specific range. Total mission time can also be determined. The drag indexes and altitudes listed must be closely adhered to, in order to ensure accuracy. For optimum cruise altitude, refer to the range constants tables (figure 2–17).

RANGE CONSTANTS TABLES

The range constants tables (figure 2–17) present the data necessary to compute mission fuel, time, and distance. The information is listed by drag index number. Deviations from the drag indexes listed must be interpolated in the computations.

SAMPLE PROBLEM

Known facts are:

a. Configuration outbound: Six Mk 81 Snakeye I GP bombs and two TER's

b. Distance to target: 185 nautical miles

c. Configuration return: Two TER's

Computations: (See Cruise Assumptions)

From Drag Index Table (Figure 2–14):

	Weight	*Drag*
Clean aircraft (less pilot, fuel, and stores)	18,800	0
Fuel	9,167	0
Pilot	180	0
20mm ammunition	355	0
(6) Mk 81 Snakeye I GP Bombs	1,806	39.0
(2) Wing pylons, AERO 7A-1 EBR and TER	664	41.0
TOTALS	30,972	80.0

From Time/Radius Chart (figure 2–16, sheet 5):

Search Time	48 min
Total mission time	107 min

From Range Constants Chart (figure 2–17, sheet 3):

Initial optimum cruise altitude, outbound — 30,000 feet
return — 38,400 feet

Fuel specifics — see variables on chart

From Climb Schedule Table (figure 2–15):

Recommended climb speed 407 KTAS

PART 2 — MISSIONS

GENERAL

One or a combination of the following attack missions may be assigned: Prebriefed Strike, Armed Reconnaissance, Close Air Support, and Radar Controlled Bombing. The flight may consist of any number of aircraft, depending on the importance of the mission or the amount of ordnance necessary to achieve the desired results, and may or may not require fighter escort. Factors common to all attack missions are presented in the following paragraphs.

INTELLIGENCE

An integral part of any mission is the reliable and timely acquisition of intelligence information which may include the following:

a. Direction and movement of forces and weapons into or within the area.

b. Location, arrangement and employment of enemy weapons.

c. Disposition of enemy ground forces.

d. Concentration and build-up of strategic reserves.

e. Total apparent enemy strength.

f. Conditions of communications and their capacity.

g. Good choke points such as bridges and passes.

h. Weather conditions.

NIGHT/LOW VISIBILITY CONSIDERATIONS

A mission at night or in low visibility requires that consideration be given to the following:

a. Rendezvous position for the strike force.

b. Enroute formation.

c. Precise navigation planning, utilizing DR as backup for external navigation aids.

d. Minimum altitudes above the highest terrain within 15 miles of the planned route.

CAMOUFLAGE

Enemy camouflage will vary according to tactical need and cleverness. The absence of activity or targets can indicate that the enemy is concealed. Diligent searching and careful scrutiny will often reveal evidence of concealed enemy activity, such as tire tracks, cut away brush and flashes of reflected sunlight. If intensive enemy fire is encountered, it could be assumed that the enemy is defending something of importance. Caution should be exercised if attempting to determine the location of the defended target. Be aware of possible flak traps such as isolated vehicles parked along a road.

PREBRIEFED STRIKES

A mission planned before launch to strike a specific target, such as a bridge, dam, or powerplant, is defined as a prebriefed strike. The flight proceeds to the target, attacks, and returns to the ship or base. A prebriefed strike may be assigned more than one target, but it does not involve searching for possible targets not previously briefed. When several aircraft are involved, the problem of delivering ordnance accurately while diving in a multiplane attack is more difficult than working individually. Tactics for prebriefed strikes must be flexible to take advantage of unforeseen opportunities which may improve the success of the mission. Weapons delivery in sections where the wingman flies a tight, forward tactical wing and releases on cue from the leader can be utilized. A low altitude run-in and retirement may reduce the possibility of radar detection and provides some element of surprise. However, heavily defended routes or target areas should not be crossed at low altitudes unless surprise is assured or unless the SAM threat is extremely high. The proper pop-up techniques are discussed in Part 3 of this section. The pop-up and roll-in interval should be briefed.

FAN GLIDE (WAGON WHEEL)

Attacks by individual aircraft within a flight should be made with as much dive heading difference as interval and defenses will permit. Flight patterns viewed from above will look like "wagon wheel" spokes with the target as the hub.

SECTION GLIDE

This is a low approach and pop-up attack performed in section.

ARMED RECONNAISSANCE

Armed reconnaissance is a pre-planned mission. Its primary purpose is to search out, attack, and destroy targets of opportunity along a designated route or within an assigned area. Armed reconnaissance will normally be accomplished by one or two sections of aircraft. If air supremacy has not been attained, it may be necessary to employ one section as top cover. Sufficient capability (airspeed, ordnance and fuel) for defensive purposes should be retained at all times. Airspeed, altitudes, and tactical maneuvering during armed reconnaissance missions will be influenced by aircraft configuration and enemy defenses. However, altitudes above 6,000 feet AGL will preclude detailed reconnaissance. In planning for armed reconnaissance missions, several bingo points should be preselected. A good rule of thumb for estimating enroute time and fuel is to multiply the length of the route by a factor of 1.3.

Section tactics and formation positions should be determined according to anticipated enemy air action, number of aircraft employed, intensity and capability of enemy ground weapons, type of terrain to be reconnoitered, and the configuration and armament load of the fighter reconnaissance aircraft. Formations should scissor and vary altitude along the route, especially when ground defenses are active.

When a single section is employed, the wingman may follow at a prescribed interval. He should stay offset at a slightly higher altitude, avoid the in-trail position and never cross the route at the same point as the lead aircraft. These same considerations apply for reconnaissance of general areas, except that parallel tracks may be used instead of route following. Mission effectiveness increases considerably when pilots are thoroughly familiar with the routes and areas to be reconnoitered.

The leap-frog tactic is an effective and easily performed maneuver for armed reconnaissance missions. The second element attacks a target called out by the first. During the run into the target, the first aircraft goes high and off to the side to observe the attack and to call flak. The second element pulls off the target and resumes the base reconnoiter course, thus becoming lead. The former lead element maneuvers to assume position on the new lead.

Munitions should be expended conservatively to achieve the desired degree of destruction. In all instances the second attacker must ensure proper interval and that the first attacker is clear before delivering any ordnance. If a reattack is executed, be alert for flak.

Pilots will not always be able to achieve preplanned release conditions. A high degree of skill in weapons delivery is mandatory. A pilot must possess the ability to deliver weapons from any dive angle, and within a wide range of airspeeds. He must be capable of continually analyzing the delivery maneuver and be highly proficient in "that looks about right" weapons delivery. This skill can be gained only through practical experience, provided a pilot first has a good knowledge of error analysis. Being able to deliver ordnance from any position relative to the target will permit the accurate delivery of weapons on the first attack and increases the chances of survival against heavily defended targets. Remember, the enemy will probably increase defenses along critical or frequently reconnoitered routes.

Previously mentioned night considerations and those in Part 3 of this section apply to armed reconnaissance missions. Additional factors are:

a. Formation integrity can be maintained by making maximum use of AI radar, UHF radio, Air-to-Air TACAN and ADF when feasible.

b. Normally the lead aircraft will be the hunter (flare aircraft) and the wingman the "Killer" (ordnance aircraft.

CLOSE AIR SUPPORT

The close air support mission involves an attack under the control of a ground or airborne FAC (Forward Air Controller). A specific target may be pre-briefed or assigned when airborne. Upon reporting, inform the FAC of the flight call sign, mission number, number and type of aircraft, ordnance on each aircraft, and time on station. The flight should receive the location, description and elevation of the target, surface wind, location of nearby friendlies, and desired and restricted delivery headings. No attacks should be commenced without positive radio contact and target confirmation from the controlling FAC.

If anti-aircraft fire is not a factor, any attack pattern compatible with existing weather and FAC information can be used. If weather at the target precludes attack, the FAC may assign another target. While holding, or after new target assignment, advise the FAC of updated time on station.

The FAC should give a BDA (bomb damage assessment) report after the attack as the flight departs.

GROUND RADAR CONTROLLED BOMBING

A ground radar controlled bombing mission uses ground-based radar to vector aircraft to a preselected bomb release point. This type of bombing is suitable against area targets such as airfields, petroleum storage, railroad yards and waterfronts during darkness or adverse weather.

Pilot technique involves flying a constant airspeed, altitude and heading as directed. The relatively long, straight, level delivery makes the aircraft extremely vulnerable.

PART 3 — ATTACK

The F-8 has the capability of conventional weapons delivery against ground targets. Two wing-mounted pylons provide suspension for carriage of single weapons or for carriage of the MER, TER or MBR. Specific information regarding weapon compatibility and limitations is contained in Part 1 of this section.

DIVE DELIVERY

The dive attack which can encompass dive angles of 10 to 60 degrees, is particularly well suited for delivery of free-fall and retarded bombs, rockets and 20MM ammunition. The attack will be discussed in the following sequence: entry, tracking (to include release), and recovery. See figure 2–18.

ENTRY

The desired roll-in point can be attained by one of several entry maneuvers, e.g., the pop-up entry maneuver, the level entry, and the high entry. The entry maneuver must enable the pilot to position the aircraft on the desired dive path at a distance from the release point that allows adequate time to make the minor corrections required to achieve the planned release conditions.

A pilot in a combat situation does not have the advantage of familiar landmarks to help him determine the roll-in point for a specific dive angle. He must select the proper roll-in point based upon altitude and estimated range to the target. Each pilot may have a slightly different method for determining this position, but all methods should result in achieving preselected release conditions for the weapon to be delivered.

Dive Delivery

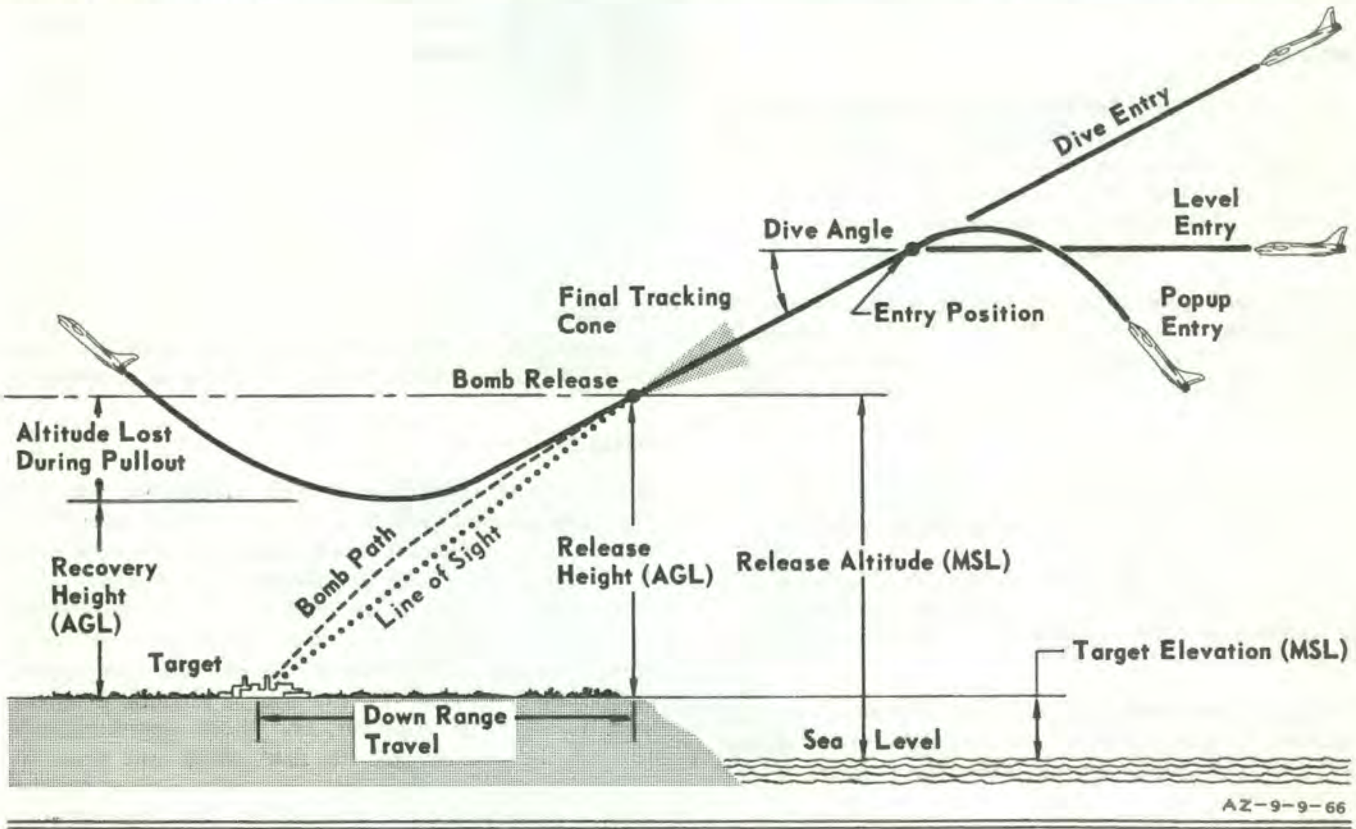


Figure 2–18

Pop-up

A pop-up (or pitch-up)is defined as a rapid climb from low altitude to a point where the aircraft is maneuvered into position for a specific weapons delivery. It may provide an element of surprise and reduce exposure time to heavy enemy ground defenses in the immediate target area.

Roll Ahead

When the final attack heading is within 30 degrees of the approach heading to the target, a roll-ahead pop-up is recommended (figure 2–19). The pull-up point is located twice the horizontal distance from the planned roll-in point to the target. During the approach to the pull-up point, an acceleration to the planned release airspeed is accomplished. At the pull-up point, a climb angle that is equal to the planned dive angle, is established on the VGI. The climb path should be slightly left or right of the target to enhance target acquisition during the climb. Approximately 1,500 feet below the planned entry altitude, the aircraft is rolled inverted and the climb continued. When the desired roll-in position is reached, the nose of the aircraft is pulled through the horizon and the gunsight pipper is placed near the target. G is relaxed, the aircraft rolled wings level and tracking begun.

Off-Set

If the final attack heading will be greater than 30 degrees from the approach heading, an offset pop-up is recommended (figure 2–20). The pull-up point will be less than twice the horizontal distance from the planned roll-in point to the target. Techniques described for the roll-ahead pop-up will apply.

When planning an attack using a low-angle dive and a low release or firing altitude, the maneuver shown in figure 2–21 is recommended. This maneuver is particularly adaptable to strafing and for retarded bombing attacks.

When higher release altitudes are desired, an increased off-set angle and steeper dive will combine to give the minimum exposure time (figures 2–22 and 2–23).

If the pilot misses the pull-up point or is too near the target to accomplish his planned pop-up maneuver, an unplanned off-set pop-up is recommended (figure 2–24).

If the target is missed and the unplanned off-set pop-up maneuver is not desirable, the reversal pop-up (figure 2–25) or the repositioning maneuver (figure 2–26) can be used.

Level Entry

When approaching the roll-in point, climb or descend to the predetermined entry altitude and establish the proper roll-in airspeed. The entry airspeed will vary with roll-in altitude and configuration. Higher speeds are desirable when attacking heavily defended targets.

The roll-in technique may be varied to meet desired release conditions. If the roll-in position appears to be too far out, a level turn should be made toward the target to intercept the desired dive angle. If the position appears to be too close to the target, an immediate nose-low roll-in will help to prevent the dive from becoming too steep. Engine power can be adjusted for a short interval to compensate for variations in roll-ins. A correct roll-in will place the aircraft in a dive about 5 degrees steeper than planned with the mil lead point short of the target. This technique will allow the pilot to devote most of his time and attention to tracking and to airspeed and altitude control.

High Entry

The high entry is used when the altitude is greater than that planned for the level or pop-entry. The descent must be carefully controlled to reach a preplanned airspeed, altitude and position.

TRACKING

To counteract the shallowing effect of a headwind, the roll-in point should be moved closer to the target. For tail-wind compensation, the opposite correction is necessary. When on the desired dive angle, the pipper is placed near the target and the wings rolled level to align the mil lead point with the aim point. This will reduce pendulum effect. After the dive is established, coordinated flight is required. An immediate correction at this time will compensate for small errors in the dive angle and will still allow sufficient time for tracking. As the dive progresses, the mil lead point is allowed to drift up to the aim point. The drift rate is controlled to allow the mil lead point to pass through the aim point at the desired release conditions.

RELEASE

Before commencing the delivery maneuver, the aircraft should be trimmed for the planned release airspeed. The pilot should concentrate on the target and the sight picture using peripheral vision to check altitude, airspeed, and trim (ball centered). Normally, one check of airspeed should be made about halfway down the dive and correction made with an appropriate power change. Two checks of altitude progress will normally be sufficient, one check approximately half way to release and the final check just prior to release. Altitude loss during the latter portion of the dive is approximately 400 to 500 feet per second. Therefore, leading the altimeter by about 500 feet will permit one second of final concentrated tracking time to ensure that the mil lead point is on the aim point and the aircraft attitude is stabilized at release.

Roll-ahead Pop-up Maneuver

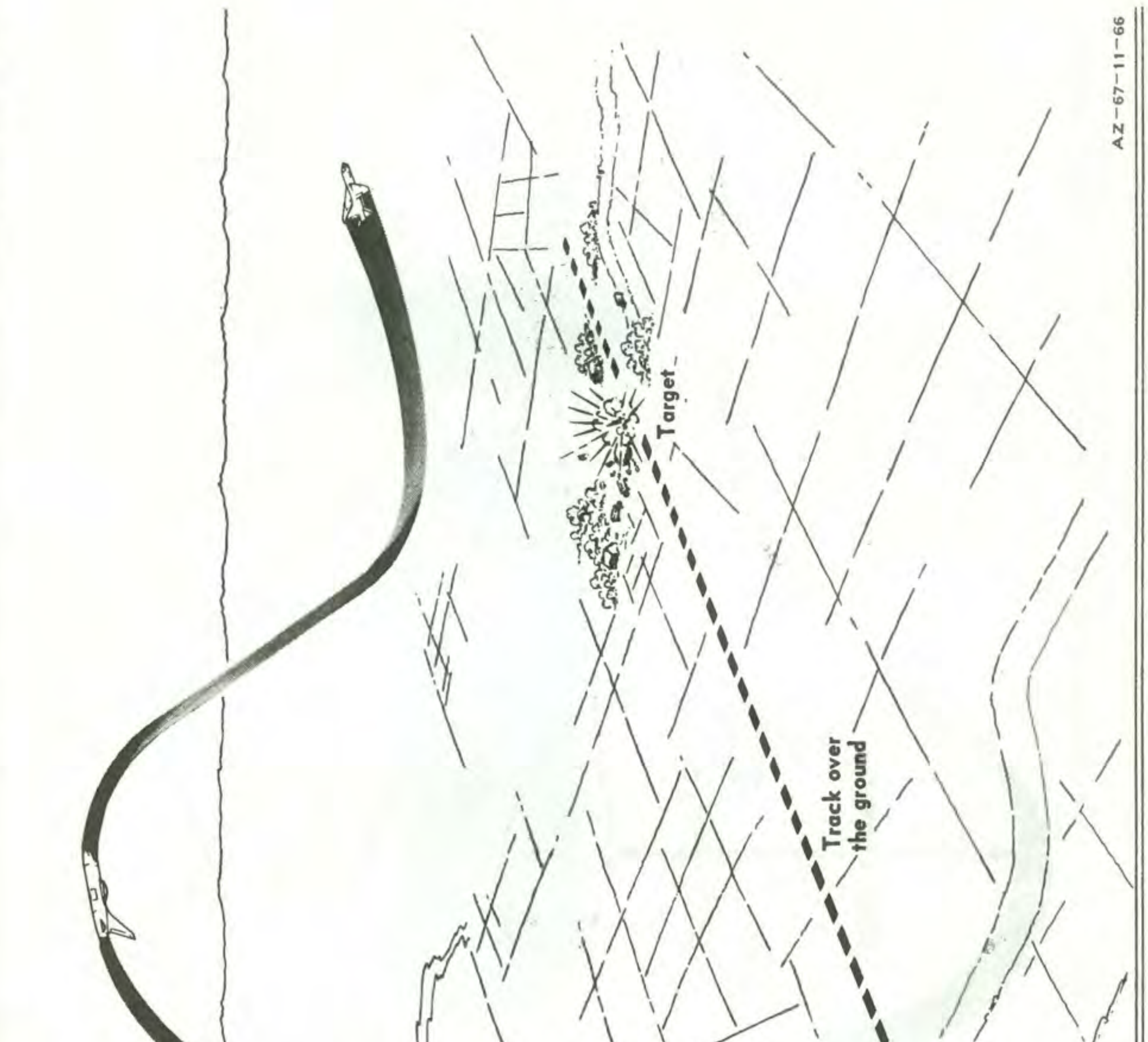


Figure 2-19

Off-Set, Pop-Up Maneuver

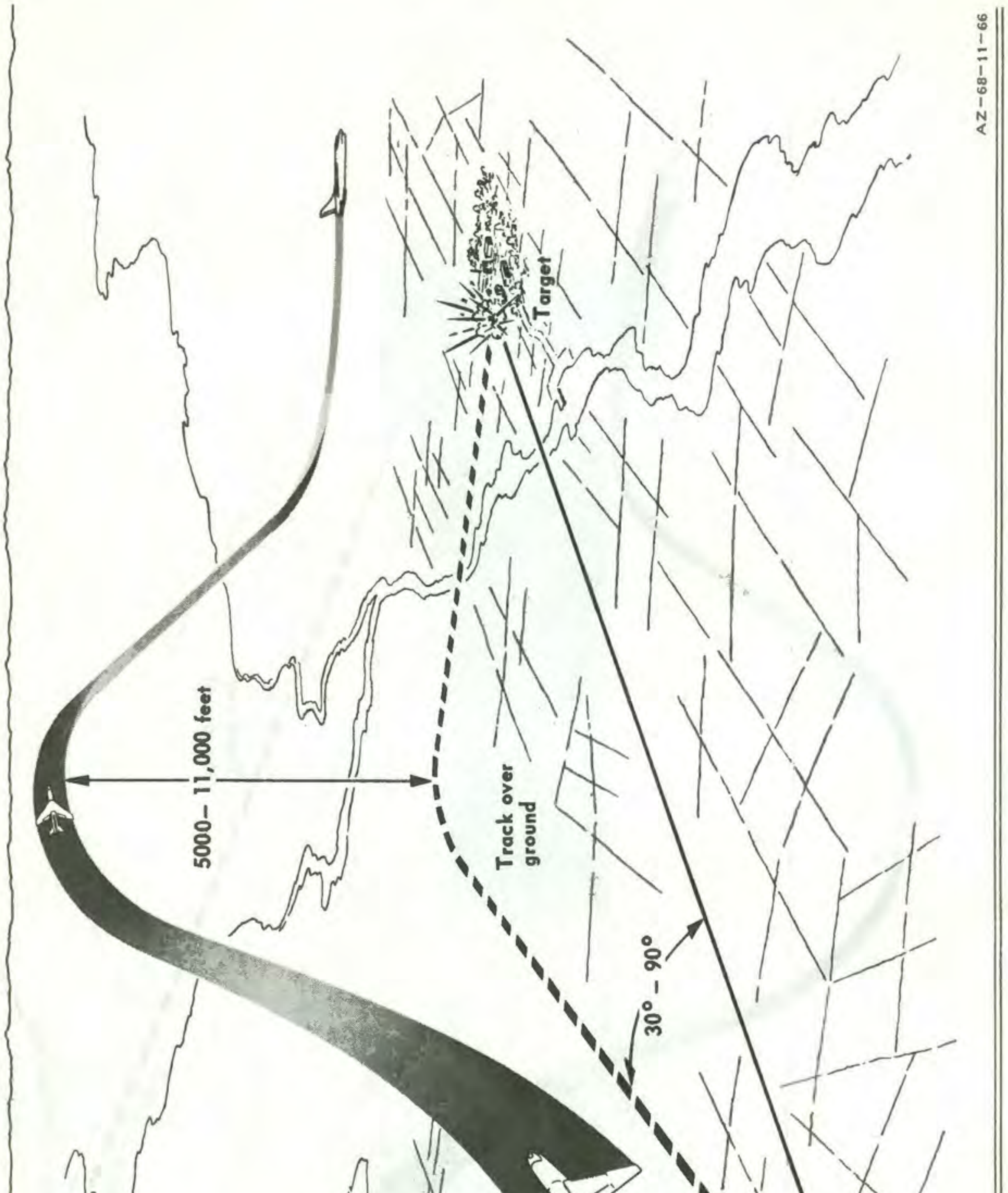


Figure 2-20

Pop-Up Low-Angle Attack

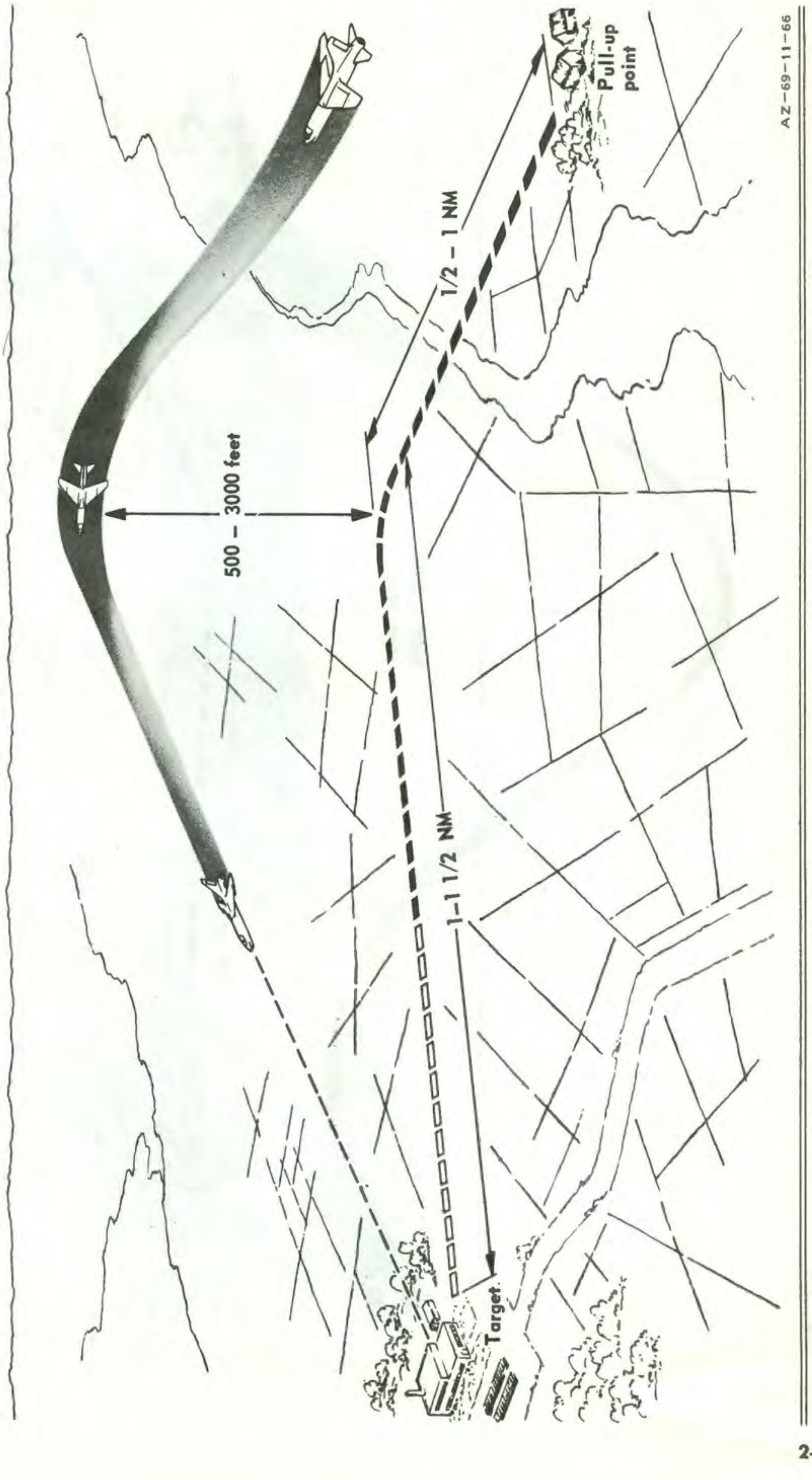


Figure 2–21

Pop-Up for Rockets or Glide Bomb

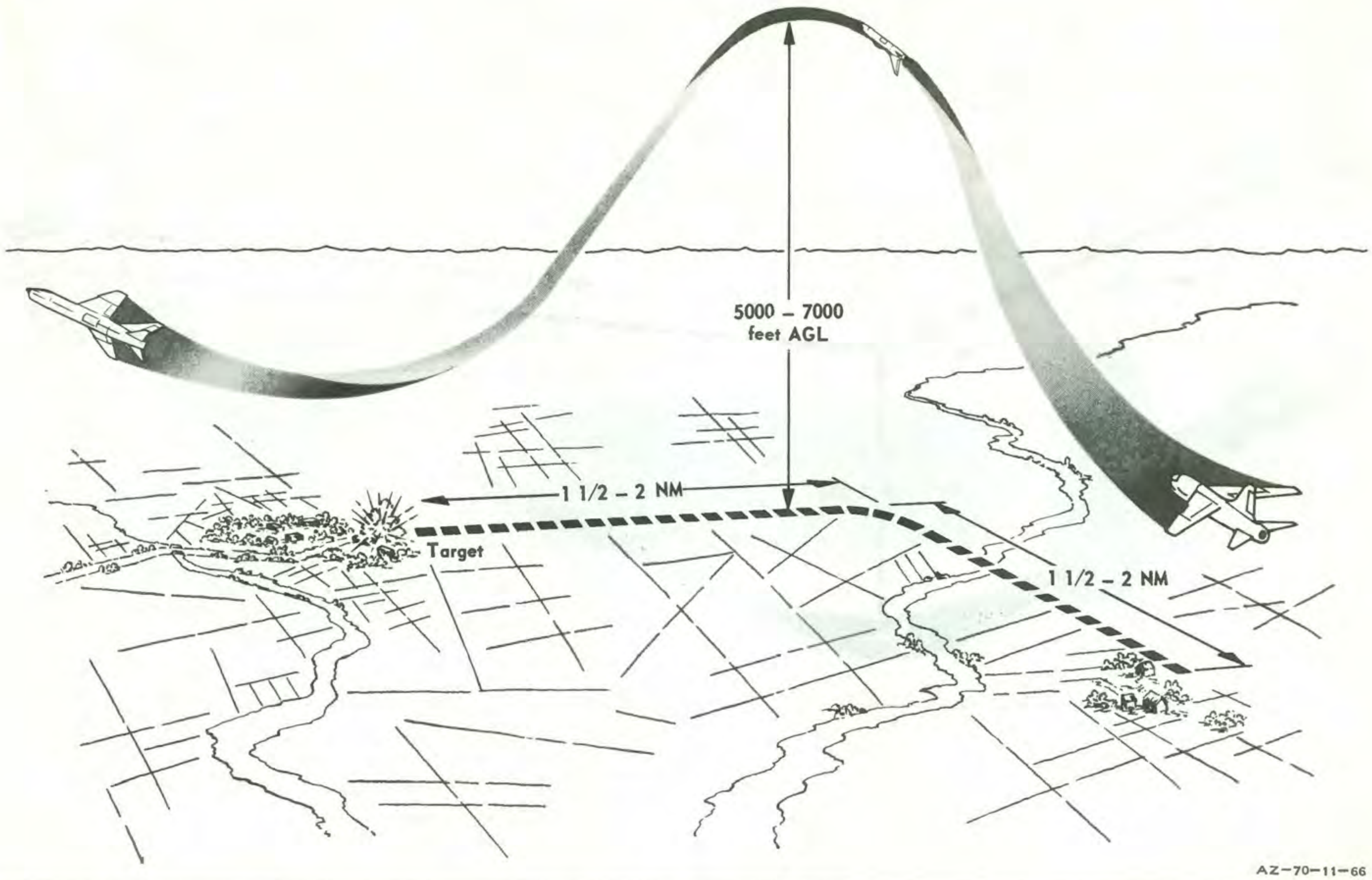


Figure 2–22

Pop-up for High-Angle Dive Bomb

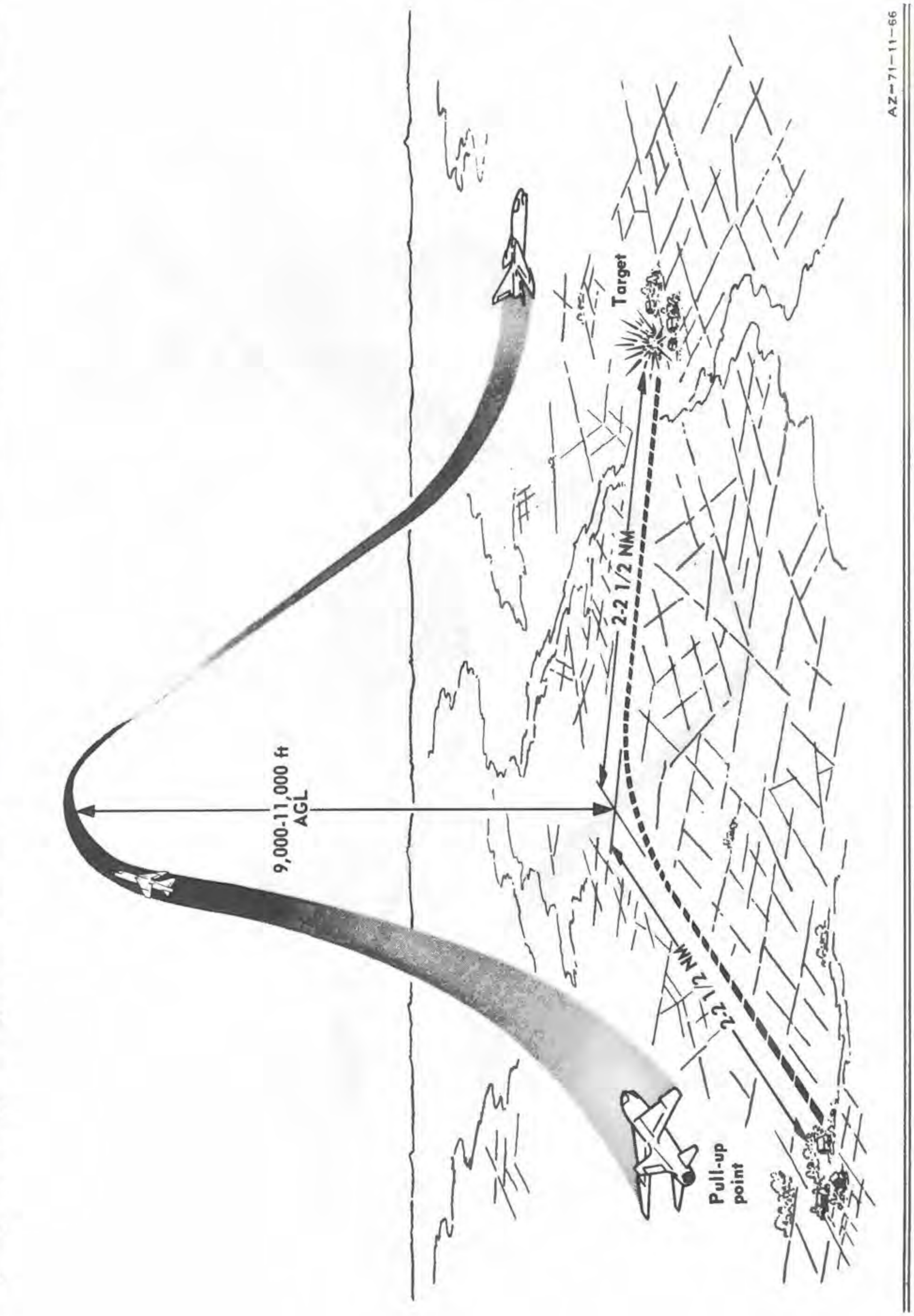


Figure 2-23

Unplanned Off-Set Pop-Up Maneuver

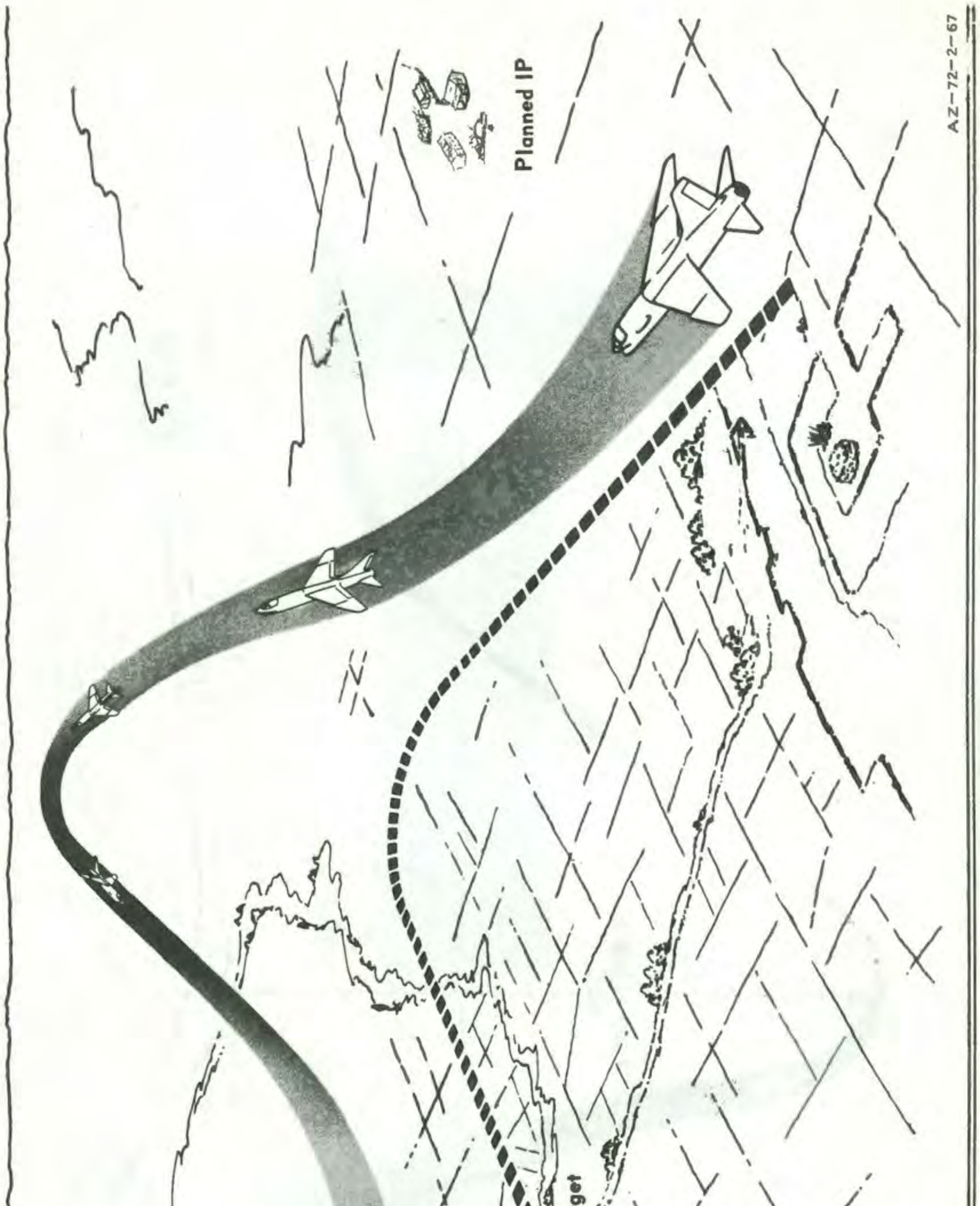


Figure 2-24

Reversal Pop-up Maneuver

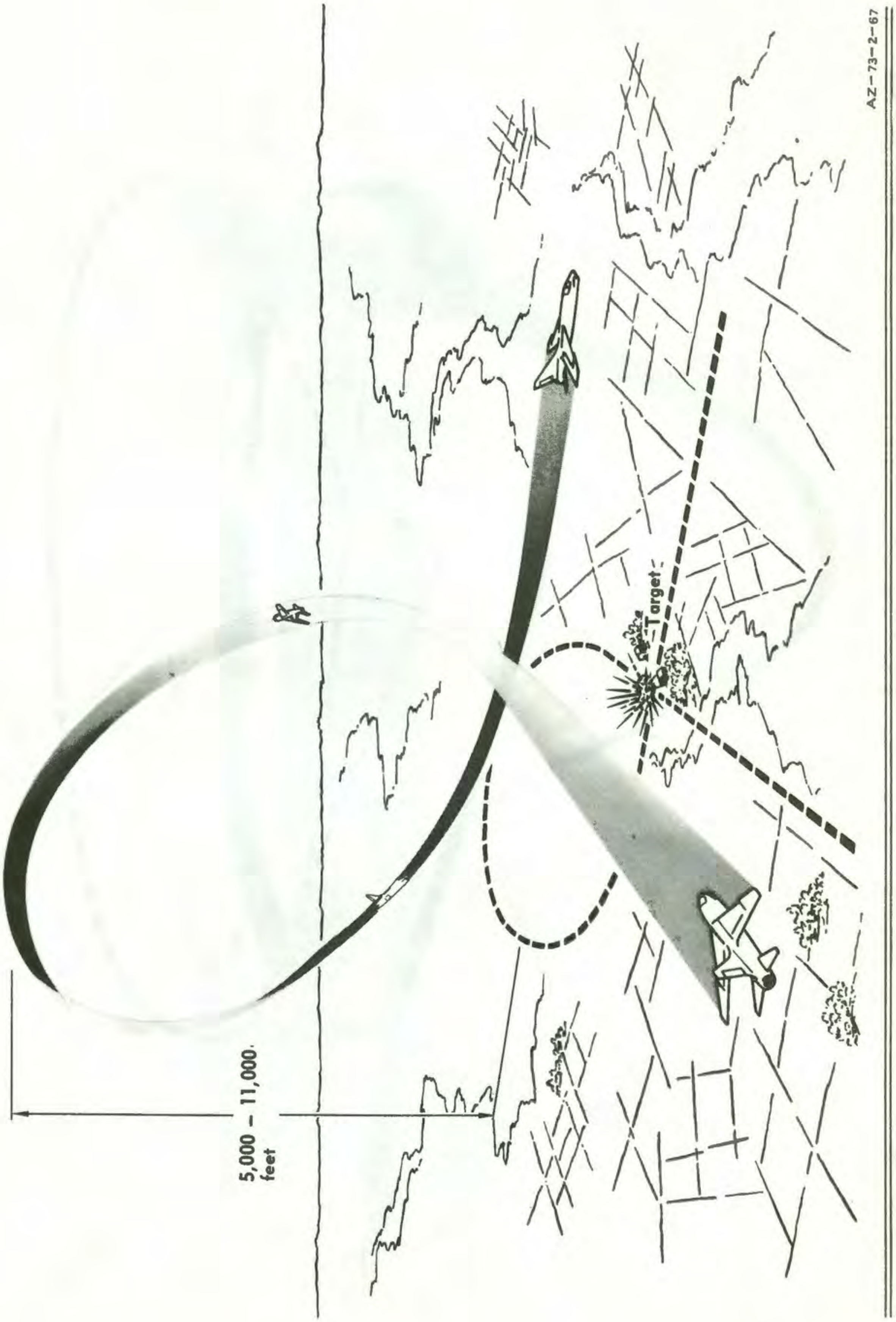


Figure 2–25

Repositioning Maneuver

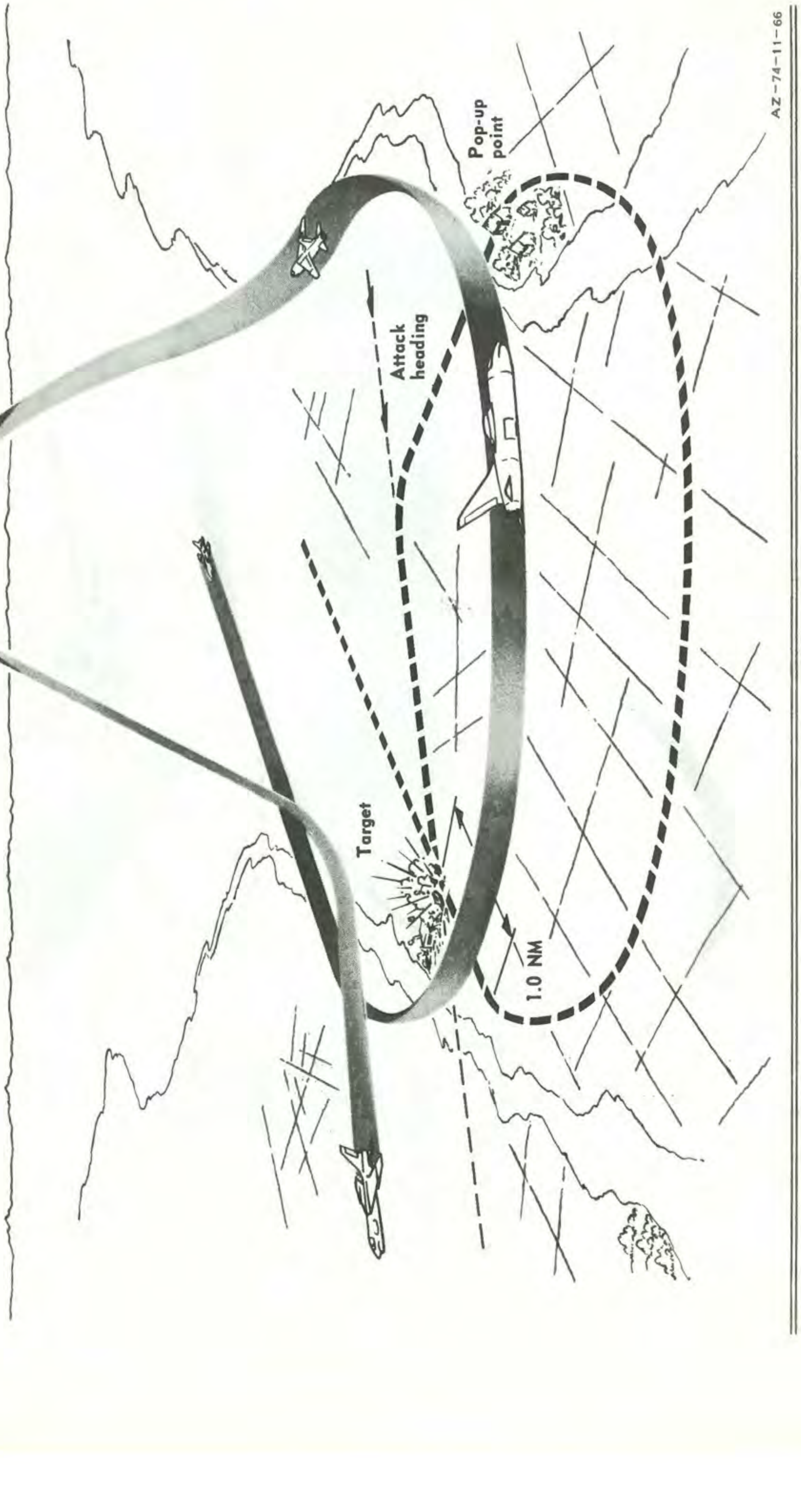


Figure 2–26

RECOVERY

WARNING

See rolling pull-out g restrictions in this section.

The three basic recovery maneuvers available to the pilot are:

a. Wings level 4g to 6g pull-up to a climbing attitude.

b. Straight away, full power, flat out recovery after a 4g to 6g level off.

c. A high g breakaway turn.

The tactical situation may dictate variations from all of these but minimum safe altitudes to escape weapon fragmentation and ricochet must be considered. Mil lead charts in Part 4 depict release unsafe areas and are based on a recovery pull-up where 4g is attained within 2 seconds after weapon release.

DELIVERY ERRORS

The factors that affect the accuracy of the dive delivery are: dive angle, release altitude, airspeed, coordinated flight, g at release, wing level attitude at release, wind and target motion. The mil lead selected for a certain weapon delivery is based on specified conditions of dive angle, release altitude, and airspeed. Corrections for deviations from these planned release conditions will be considered independently.

DIVE ANGLE ERROR

Dive angle deviations induce errors in all the planned release conditions. The sight computation, airspeed and release altitude are planned for a specific dive angle. If delivery is accomplished in a steeper dive than planned, the impact will be long. If the delivery dive is shallower than planned the opposite is true. See figure 2–27.

Dive angle corrections must be applied as soon as the initial error is recognized. One method of dive angle correction is illustrated in figure 2–28.

AIRSPEED ERROR

Mil lead is calculated for one airspeed. Release airspeed errors will change the velocity of the bomb, causing it to deviate from the planned trajectory.

If release airspeed is greater than planned, more velocity will be imparted to the weapon causing it to more closely follow the flight path of the aircraft thus causing an impact beyond the target (figure 2–29). Also, faster airspeed than planned will decrease angle of attack, causing a long impact in the same manner as does an increase in dive angle (figures 2–30 and 2–31). These two errors are cumulative.

The opposite is true of airspeeds slower than planned, the result being an impact short of the target.

RELEASE ALTITUDE ERROR

Mil lead is computed for a given altitude (slant range) and only from this range will the trajectory of the bomb intersect the sight line at the target. It should be kept in mind that the altimeter reading will lag considerably behind actual altitude in dive deliveries. If release altitude is lower than planned, slant range is decreased and the weapon will impact beyond the target and vice versa (figure 2–32).

UNCOORDINATED FLIGHT ERROR

A bomb, from the moment of release, will follow the aircraft track. If the aircraft is in a skid, the impact error will always be in the direction of the skid (figure 2–33).

If the aircraft is in a skid during gun or rocket deliveries, there will be an impact error between the aircraft track and the sight line (figure 2–34). This is the resultant of the two velocities imparted to these weapons by the initial velocity from the gun or rocket motor and the skidding velocity of the fighter. A rocket will head into the relative wind and the error will always be in the direction of the skid.

BANK ERROR

If the weapon is released in a bank with the planned mil lead reference on the target, a deflection impact error will result. See figure 2–35.

G LOADING ERRORS

An increase in g loading results in an increase in angle of attack in much the same manner as in a decrease in dive angle, thus producing a short impact. Additionally, holding increased g for any length of time will shallow the dive angle and add to the undershoot error or short impact.

Decreasing the g load from that planned will cause the opposite effects and produce an overshoot or long impact.

Dive Angle Error

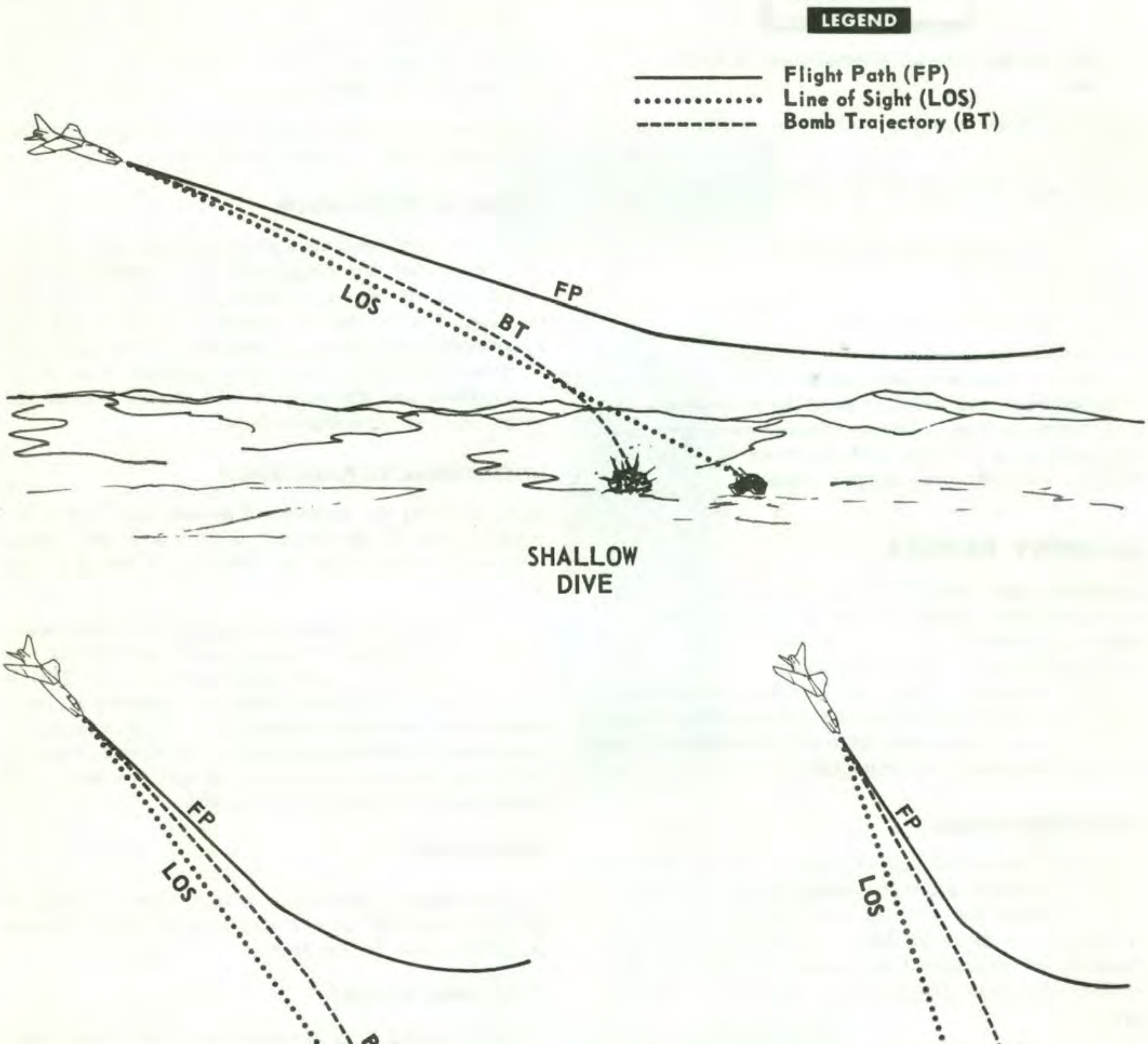


Figure 2-27

Dive Angle Corrections

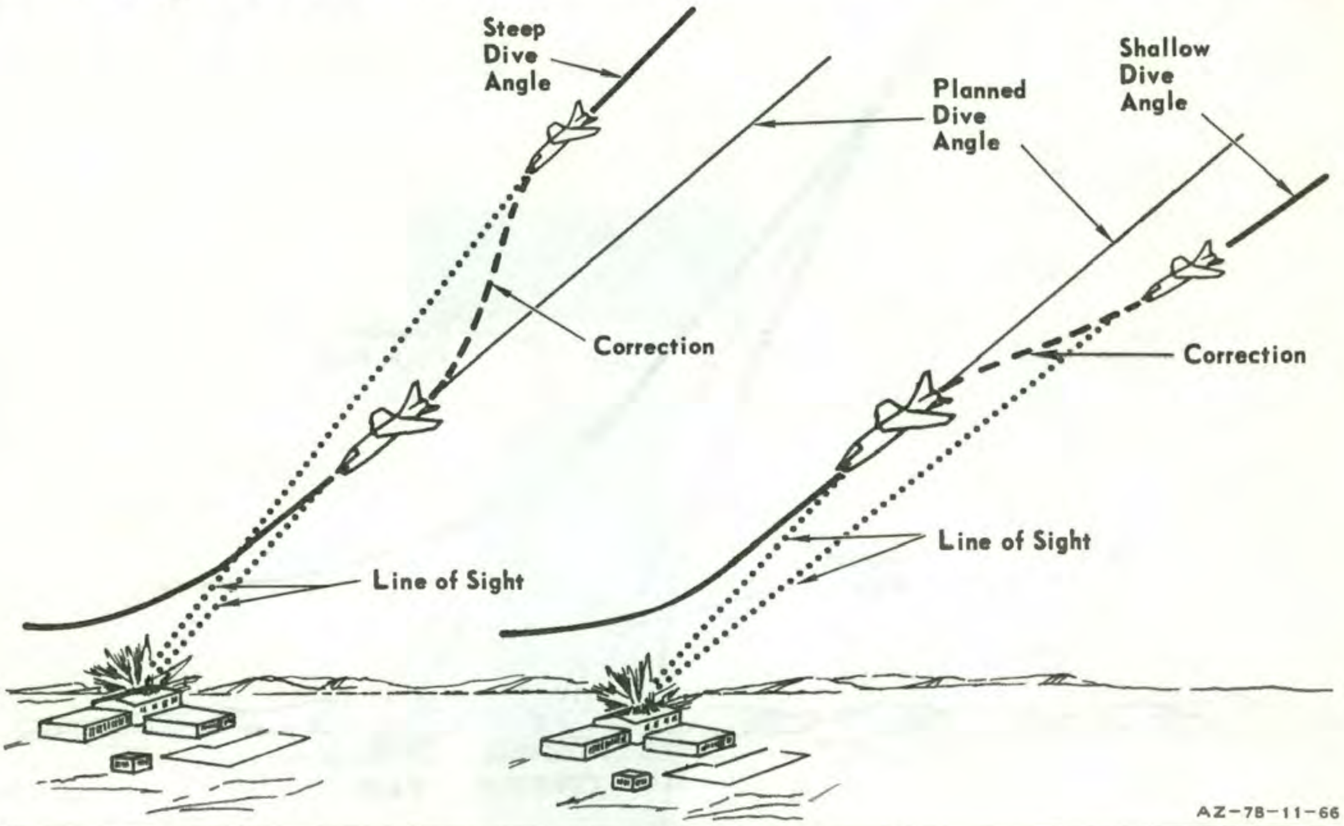


Figure 2-28

Release Airspeed Error

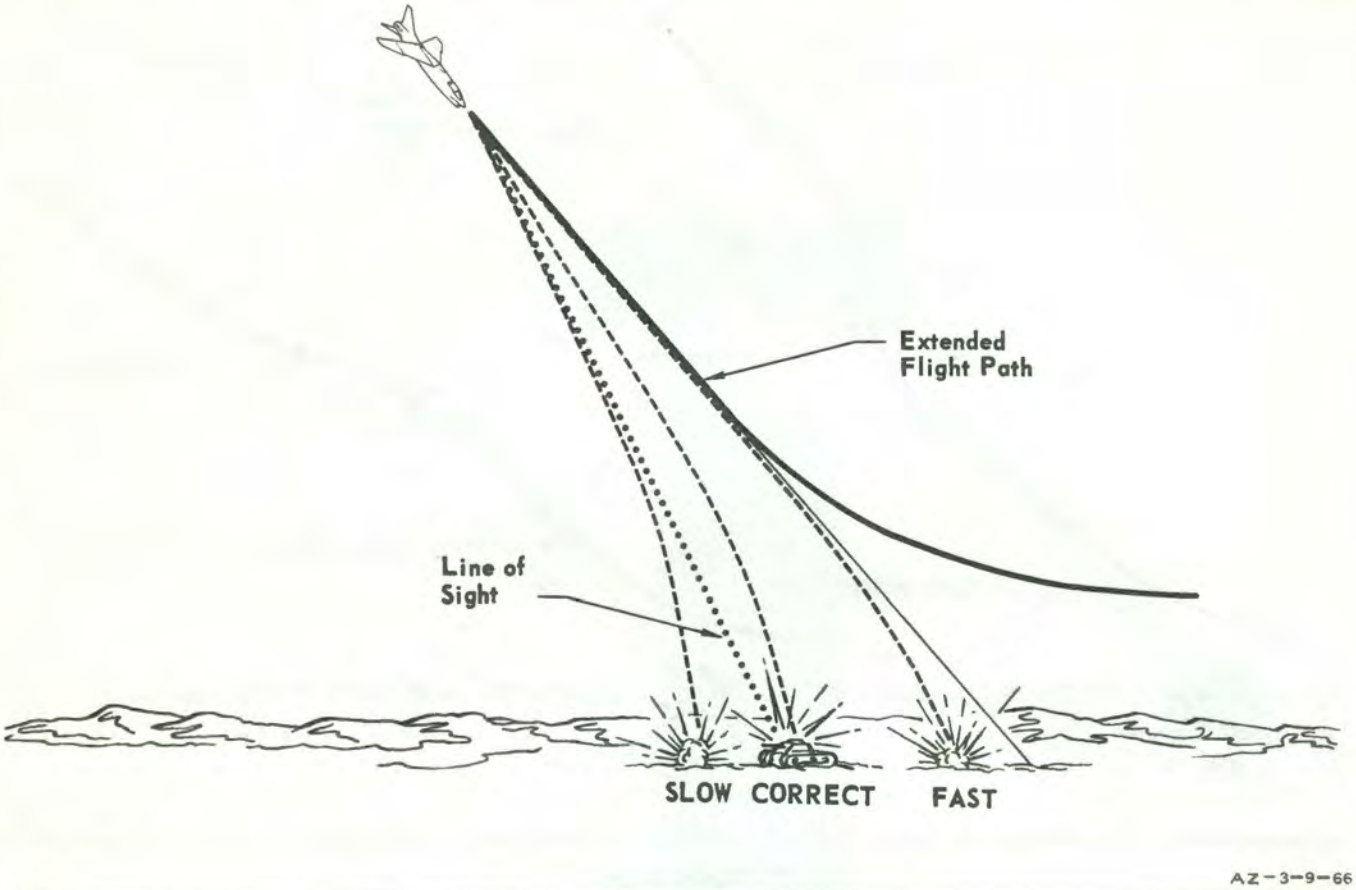
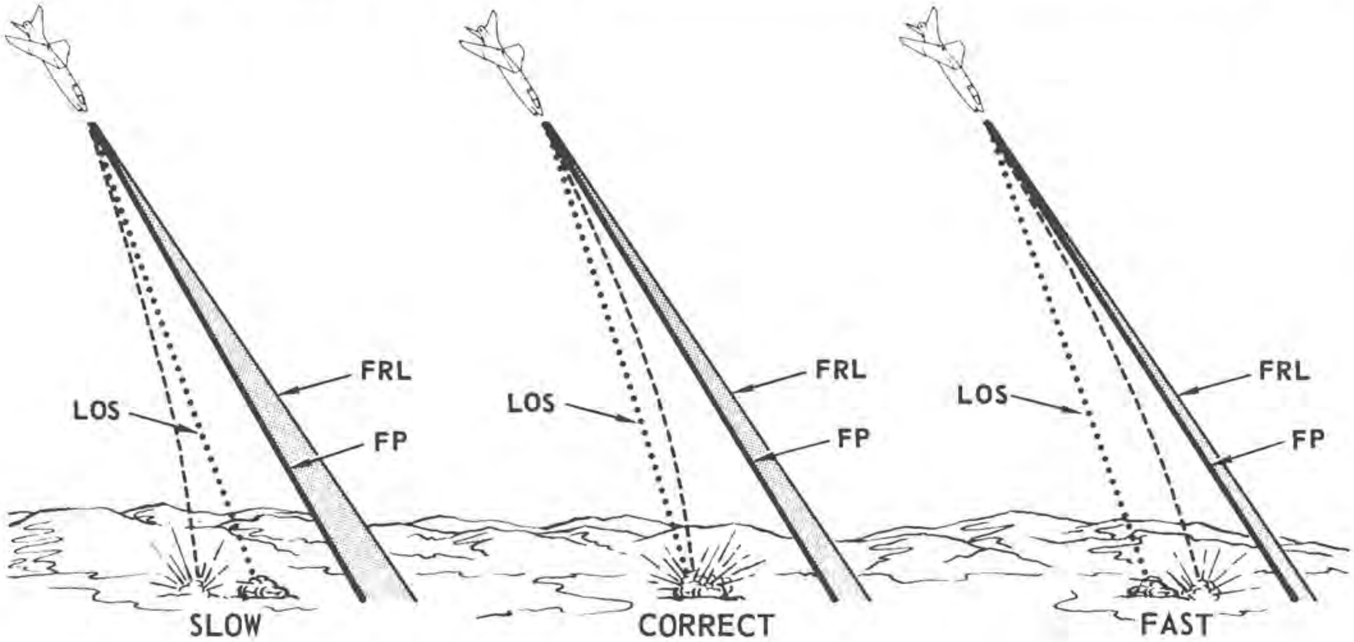


Figure 2–29

Airspeed vs Angle of Attack



NOTE

Observe the change in the angle between FRL and flight path

LEGEND

——— Flight Path (FP)
——— Fuselage Reference Line (FRL)
•••••••••••• Line of Sight (LOS)
---------- Bomb Trajectory

AZ-4-9-66

Figure 2–30

Line of Sight vs Airspeed Error

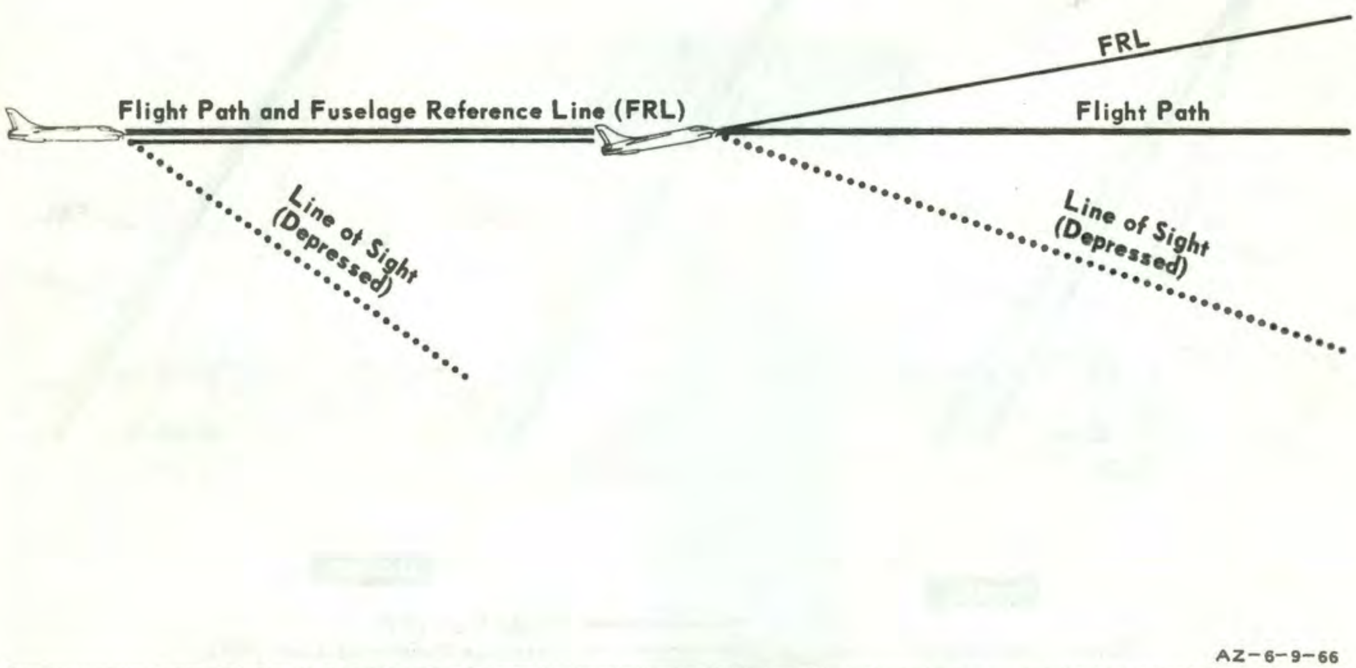


Figure 2–31

Release Altitude Error

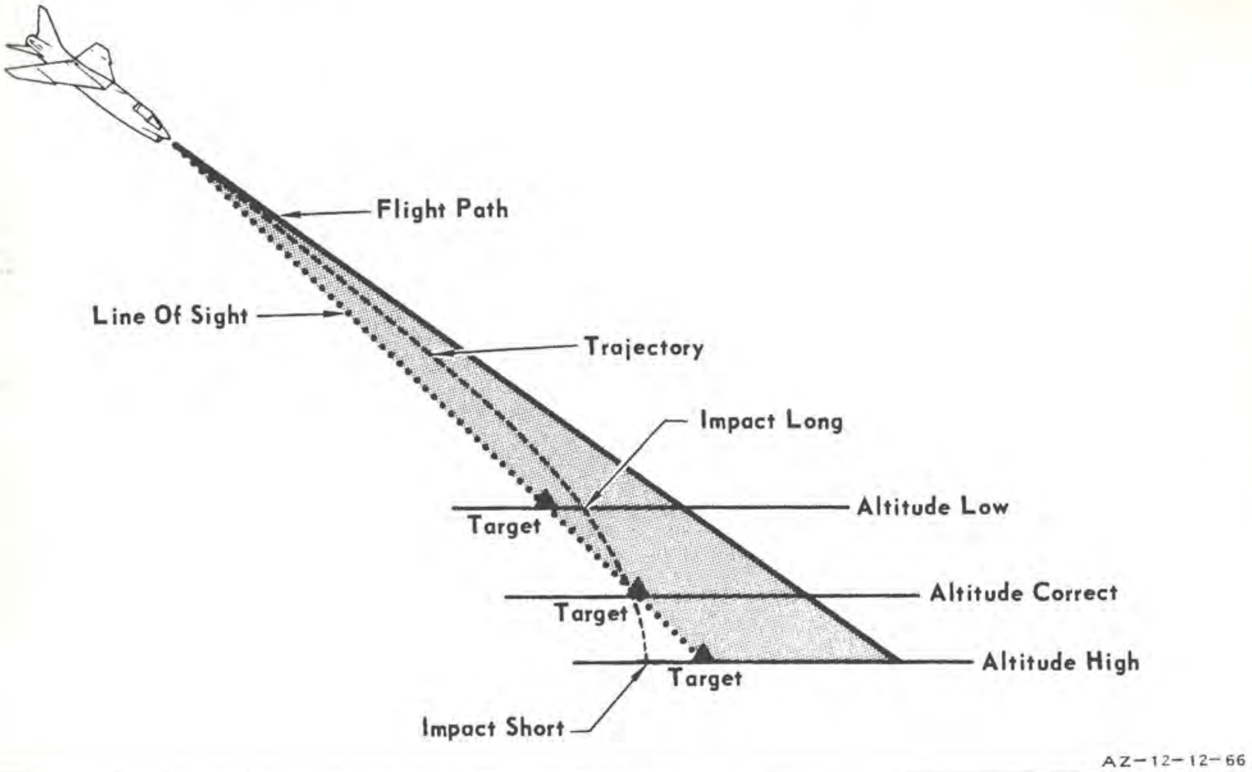


Figure 2–32

Effect of Skid on Bomb Impact

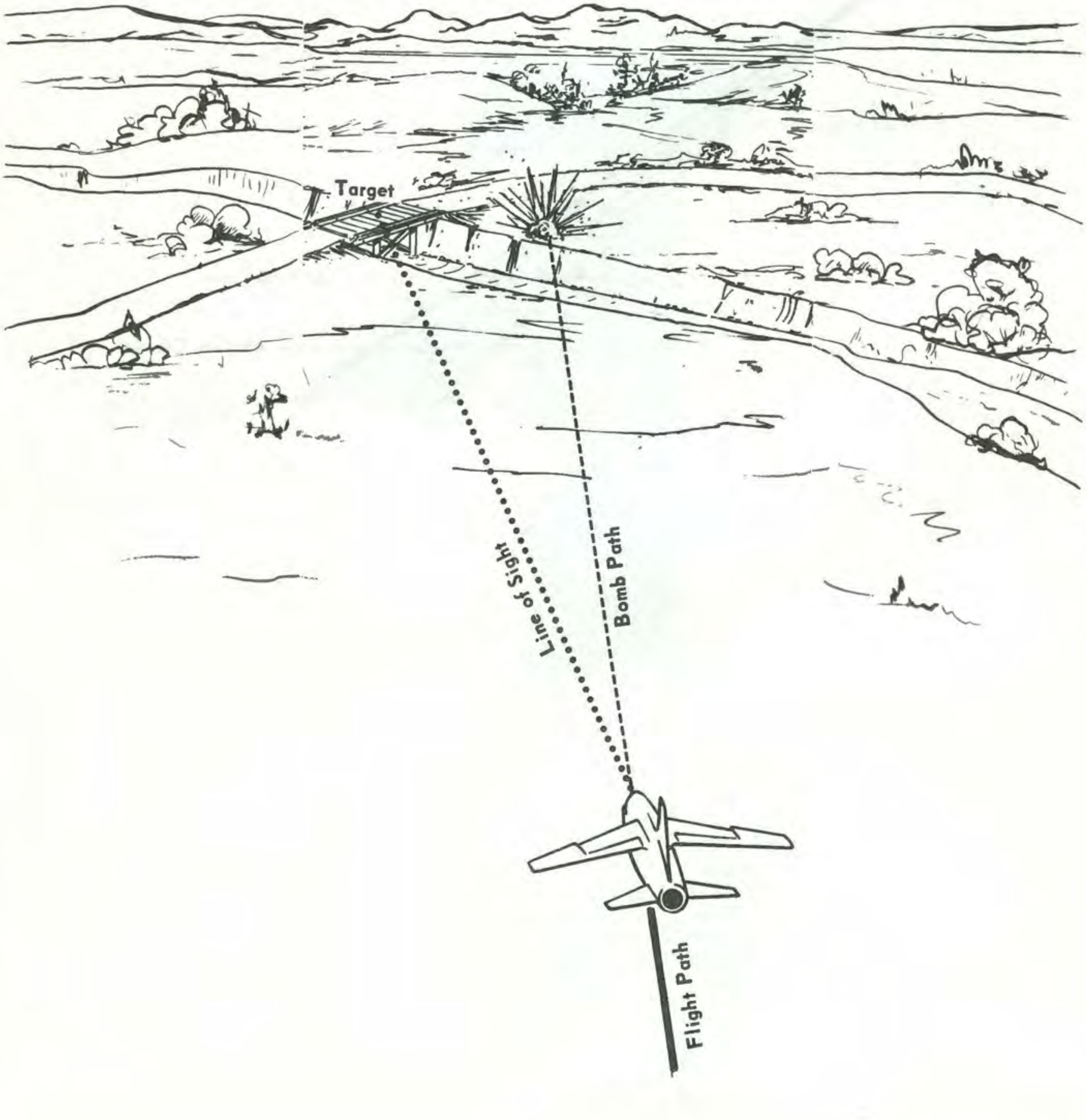


Figure 2-33

Effect of Skid on Bullet and Rocket Impact

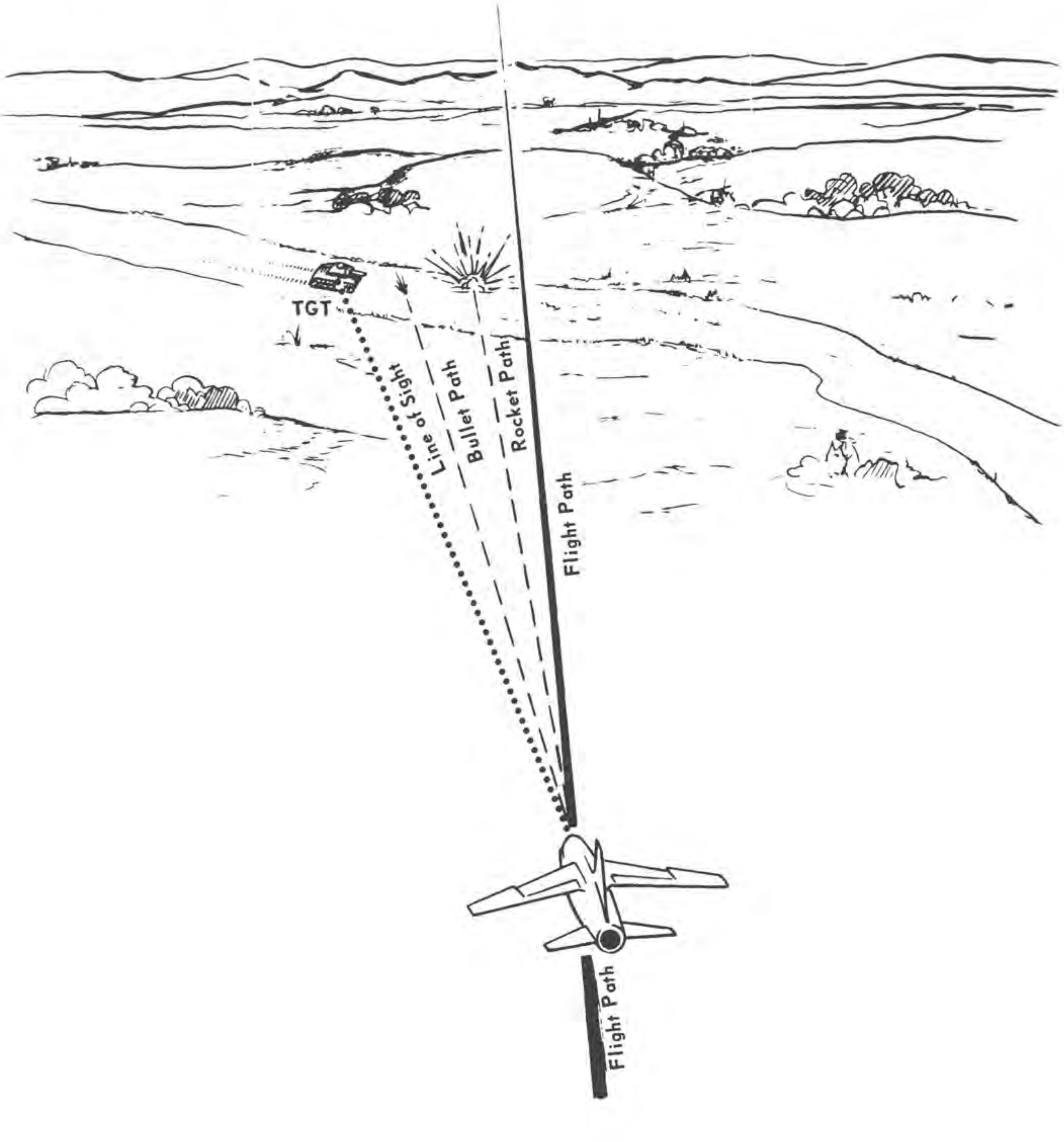


Figure 2-34

Effect of Releasing in a Bank

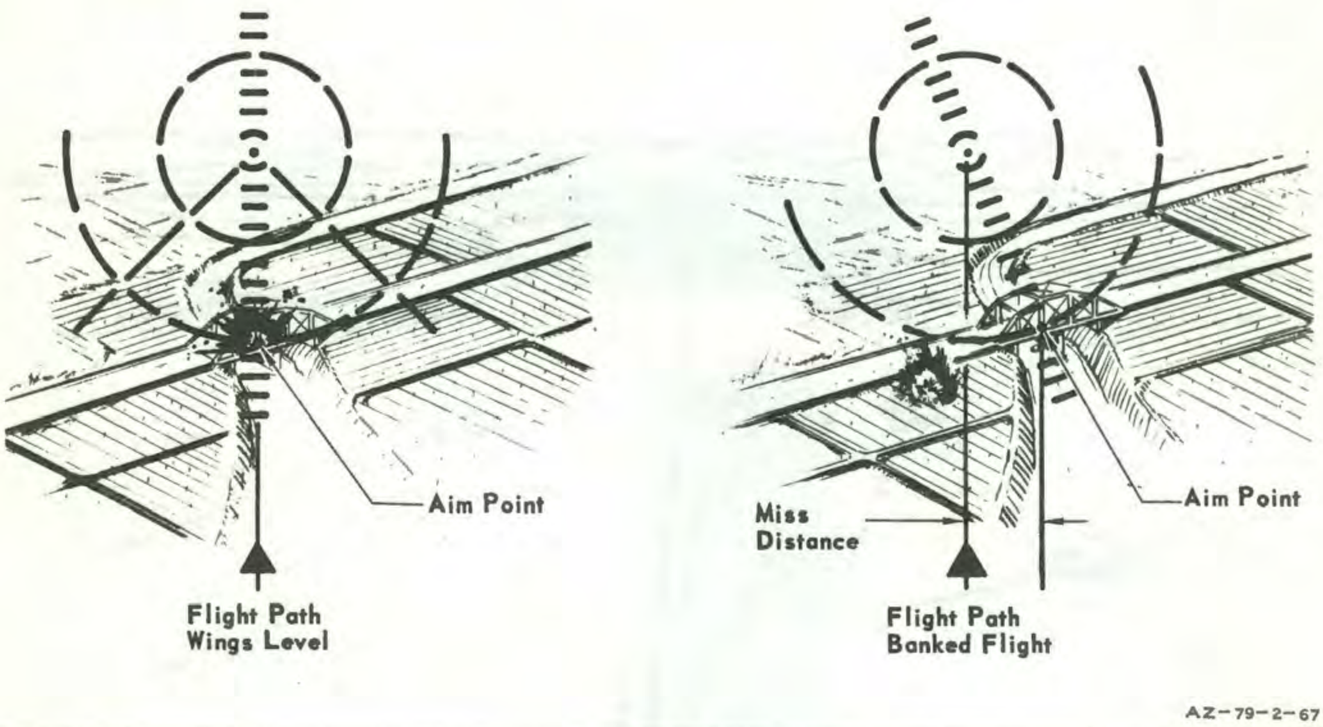


Figure 2-35

LEVEL DELIVERY

Level attacks encompass dive angles of less than 10 degrees. Entry can be attained by several methods: a climbing entry, level entry, or a diving approach followed by level off prior to reaching the target. Entry should be established early enough in the attack to allow the pilot sufficient time to perform minor altitude, airspeed and track corrections before stabilizing prior to weapons release (figure 2–36).

ENTRY

Locating the target and establishing an accurate run-in are the first requirements for effective low-level delivery. An IP, with a known location relative to the target, may be required for accurate approaches to targets with little or no vertical development. The attack should be started at the maximum range consistent with terrain and visibility conditions. Descent, if necessary, should be controlled so as to arrive on the desired run-in heading, wings-level, 100 to 200 feet above release altitude (level terrain). From this altitude, at a position approximately 5,000 feet from the target, final descent to release altitude can be made. During the descent, make corrections necessary to establish a stabilized track to the target.

TRACKING

Release airspeed should be established as early in the attack as possible. Then, as the run-in progresses, only small corrections will be necessary to stabilize track and release speed. The pilot can then devote most of his attention to tracking the target. The primary considerations during this initial portion of the attack are: airspeed, altitude, level flight, and crosswind.

The release point must be anticipated as the mil lead point approaches the target, and the weapon release button must be pressed at the instant the desired sight picture is attained. In turbulent air, the pilot should average out erratic movements of the mil lead point to determine the correct release point. The final portion of the run is particularly critical since difficulty in stabilizing pitch can result in an early or late release.

RECOVERY

The same maneuvers used in dive recovery will apply depending upon the tactical situation. Normally the recovery from a level delivery at low altitude will consist of a wings level, full power, 4g to 6g pull-up to a climbing attitude. Once the nose is above the horizon, evasive action is started.

LEVEL DELIVERY ERRORS

The level delivery maneuver is similar to the dive delivery except that the dive angle is zero. The basic factors that affect the accuracy of the dive delivery also affect level delivery accuracy. Generally, deflection errors will be smaller in level deliveries and range errors will be larger. See figures 2–37 and 2–38 for errors produced by deviations in release conditions.

Level Delivery

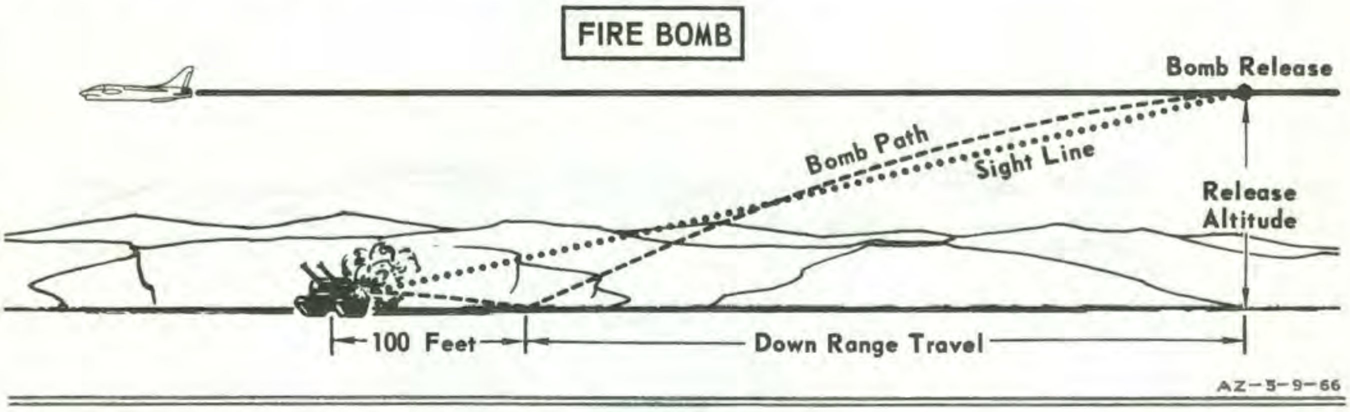


Figure 2–36

Release Airspeed Error for Level Bombing

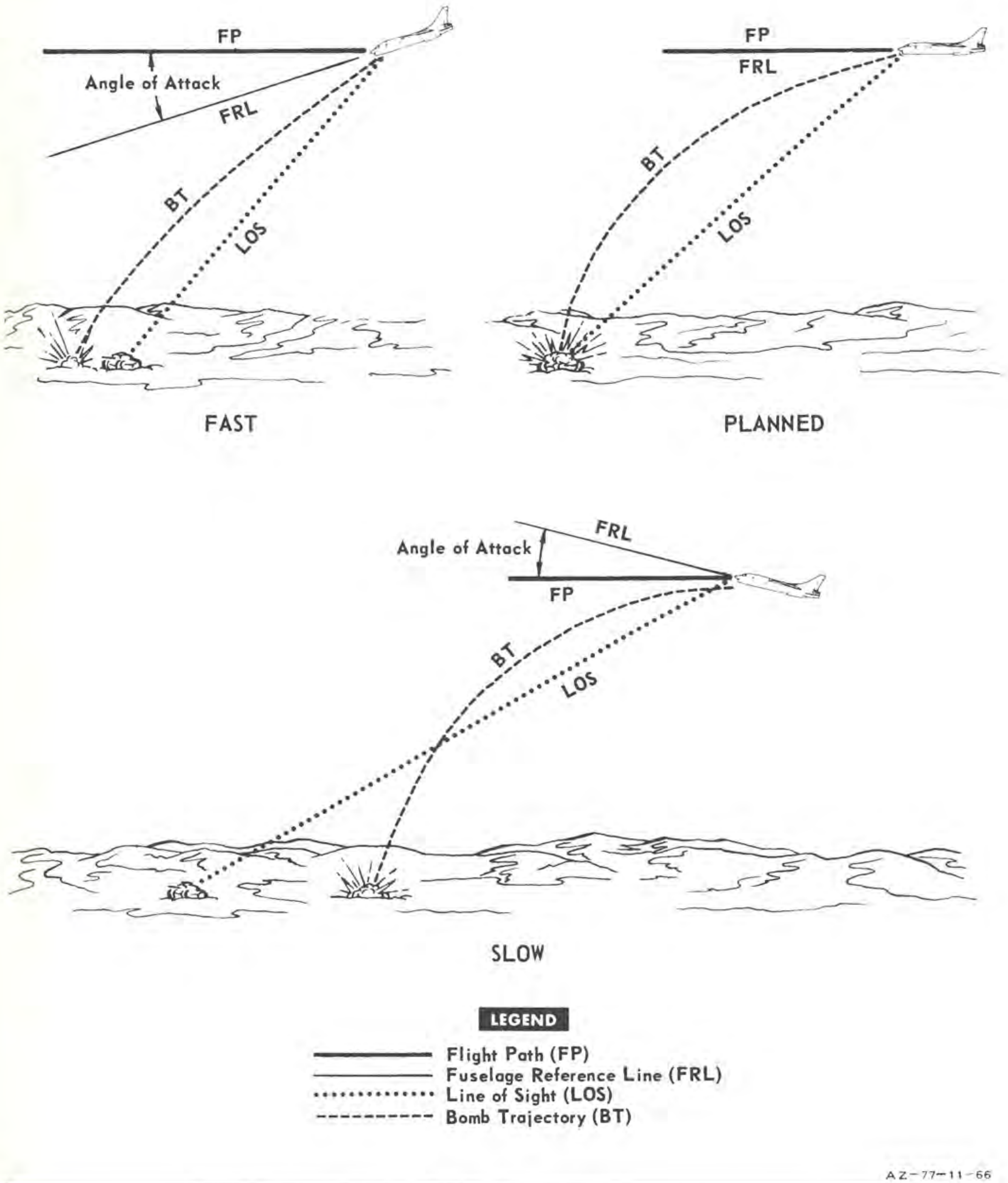


Figure 2–37

Release Attitude Error

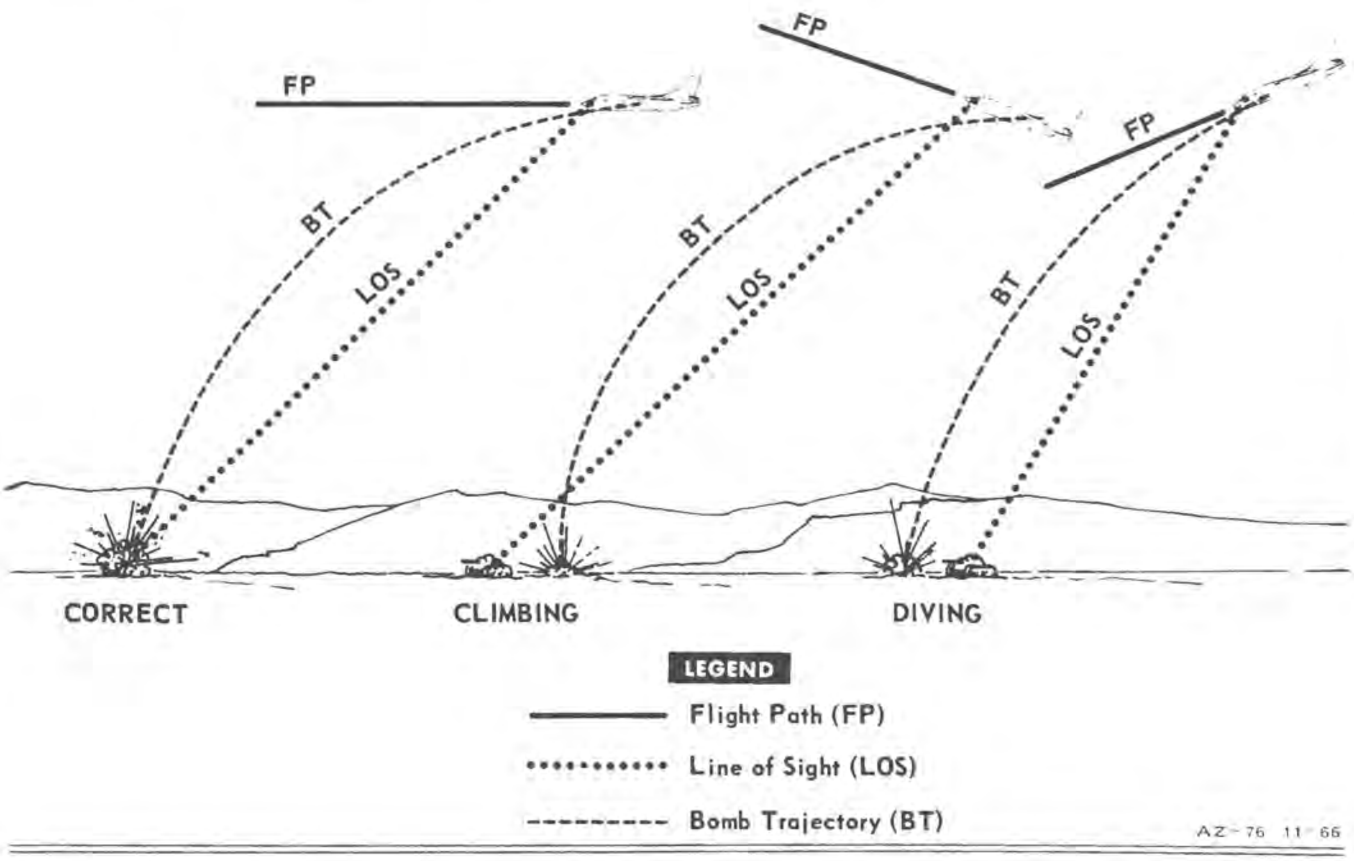


Figure 2–38

WIND AND TARGET MOTION

Wind drifts the aircraft in its dive prior to release and drifts the weapon in its trajectory after release. An offset aim point upwind of the target is selected to compensate for the wind effect. To counteract the effects of a headwind the roll-in point should be closer to the target. For a tailwind the opposite is true. See figure 2–39.

Offset aim point (feet) can be computed using the following formula:

$$\text{CORRECTION (FEET)} = V_{\text{wind}} \text{ X Time of Fall of the Weapon (Sec) X } 1.69$$

Offset aim point (mils) can be computed using the following formula:

$$\text{CORRECTION (MILS)} = \frac{\text{Correction (feet)}}{\text{Slant Range}} \text{ X SIN } \theta \text{ X } 1000$$

$$\text{Where: } \theta = \text{Arctan } \frac{\text{Release Height}}{\text{Horizontal Range}}$$

Target motion is corrected for in a similar manner to wind correction. An off-set aim point is selected ahead of the moving target. This off-set aim point should be selected based on the estimated location of the target at impact.

Tested delivery data tables in Part 4 of this section give wind correction values in feet per 10 knots of wind.

STRAFING

INTRODUCTION

The chief characteristics of aircraft guns are their versatility, accuracy, and sustained concentration of fire, which makes them highly effective against a wide variety of targets. The three basic types of strafing that may be required in combat are (1) suppression, (2) line targets, and (3) point targets. Suppression type strafing is generally used in conjuction with bomb or rocket runs to "keep their heads down" and tracking is relatively unimportant. When strafing a line

Drift Method of Crosswind Correction

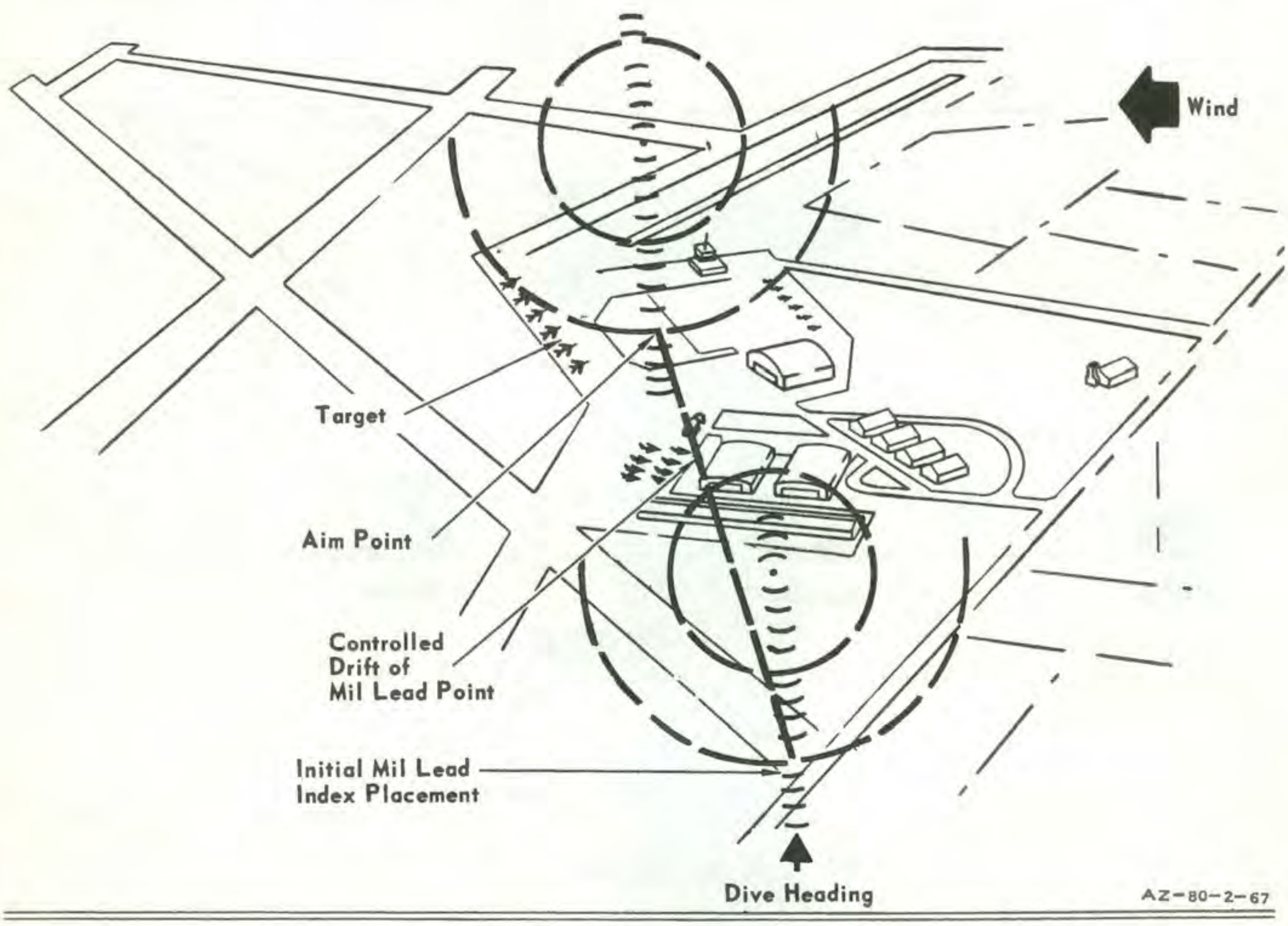


Figure 2–39

target such as a truck convoy, a column of troops, or a line of ships, firing is usually commenced at extremely long slant ranges; and series of bursts, either long or short, are repeated until recovery is initiated. In this type of strafing, the pilot can use actual impacts to adjust the aim point. When strafing a point target, the pilot attempts to meet specific firing parameters with a predetermined sight angle. The pipper is held on the target during the firing burst. One feature which enhances delivery effectiveness at long ranges is that the pilot can assess target damage immediately after cease fire. The pilot can also make corrections during burst by observing the flight of the APT projectiles. Effective low angle strafing range extends to approximately 4,000 feet; however, the effective strafing range will increase with corresponding increase in dive angle up to 12,000 feet in a 60-degree dive. The choice of delivery maneuver will depend on the target, the enemy defenses, and the weather conditions in the target area. For example, steep dive, coupled with high airspeed, should be used in attacking ships; whereas, a shallow dive which is more likely to produce waterline hits, is more effective against small boats (or junks). Camouflaged targets are more easily seen when a low angle attack is conducted at medium speed. Trenches or AAA positions should be strafed in steeper dives in order to pinpoint the target. Recovery should be initiated as high as possible, consistent with the desired accuracy, in order to minimize the effectiveness of the enemy small arms and automatic weapons fire. Against ammunition dumps, the steeper dive maneuvers are recommended with recovery being completed above 2,000 feet AGL in order to avoid explosion fragments.

ENTRY

The strafing attack is relatively easy to perform and may be initiated from almost any position with a minimum of preplanning. However, for maximum effectiveness the pilot should strive for consistent dive angles, slant ranges, and airspeeds. This is best accomplished by initiating the attack from an angle off the desired firing heading of at least 45 degrees. The roll-in technique should be varied to meet existing conditions. That is, if the roll-in position appears too far out, the turn-in should be almost level until the desired dive angle is intercepted, or if too close in, the nose should be lowered immediately and pulled through to the desired dive angle. Tracking time will be lost if the roll-in is made too gradually. Conversely it is difficult to make a precise rollout from a hard turn, and entry airspeed will be difficult to maintain. A 2 to 3g turn will normally allow an easily controlled roll-in entry and rollout on the desired attack heading.

TRACKING

Three to five seconds should be available for tracking after rolling out on the attack heading. The recommended power settings should be set during roll-in and adjusted early in the tracking phase. Normally one airspeed check should be made about midway between roll-in and firing. Depending on the rate of approach to the desired firing airspeed, a power correction should be made and then attention should be concentrated on tracking, firing altitude, and firing. As the roll-in is completed, the pipper is initially placed on or slightly above (5 to 10 mils) the target, and the aircraft is trimmed slightly nose heavy for the release airspeed. As the correct dive angle is established, the pipper is allowed to drop 10 to 20 mils (pilot preference) below the target, and primary attention is then given to deflection alignment. As the aircraft approaches the firing altitude the pipper is allowed to move up to the desired aiming point. The pipper should reach the aiming point just before the aircraft reaches the firing altitude and must be held steady during firing.

FIRING

Firing at the proper slant range is very important; therefore, the firing conditions of dive angle and release altitude are critical. If firing is commenced at a greater range than desired, the initial impacts will be short of the target unless an aiming correction has been made. Additionally, pattern density will be decreased due to increase dispersion, which will result in a larger impact area and reduced effectiveness. Firing at ranges below safe minimum slant range will increase chances of ricochet damage. At present, the best method of arriving at the proper firing slant range is to be on dive angle and fire at the proper altitude AGL. The most important factor in accurate point target strafing is to have the pipper on the target when firing is commenced and to keep it there for the duration of the firing burst. A slight amount of forward trim is desirable when firing longer bursts. This will help concentrate bullet impacts and will tend to prevent "walking-the-burst."

COMMENCE FIRE ALTITUDE

To determine the commence fire altitude, the altitude lost during firing must be calculated. Altitude lost during firing is a function of airspeed, dive angle, and firing burst length. Figure 2–40 provides altitude lost information for firing true airspeeds of 400, 450, and 500 KTAS and dive angles of 10 to 45 degrees. Downrange travel of the aircraft during firing is also a function of airspeed, dive angle, and firing burst time. This information can also be obtained from the illustration.

CEASE FIRE ALTITUDE

Figure 2–150 shows minimum cease fire altitudes which preclude aircraft entry into the fragment envelope or allow the delivery aircraft to recover above ground level, whichever is greater. Ricochet should not be expected from soil impact when projectiles are fired at dive angles of 30 degrees or greater. Information on ricochet hazards for dive angles less than 30 degrees is not presently available.

RECOVERY

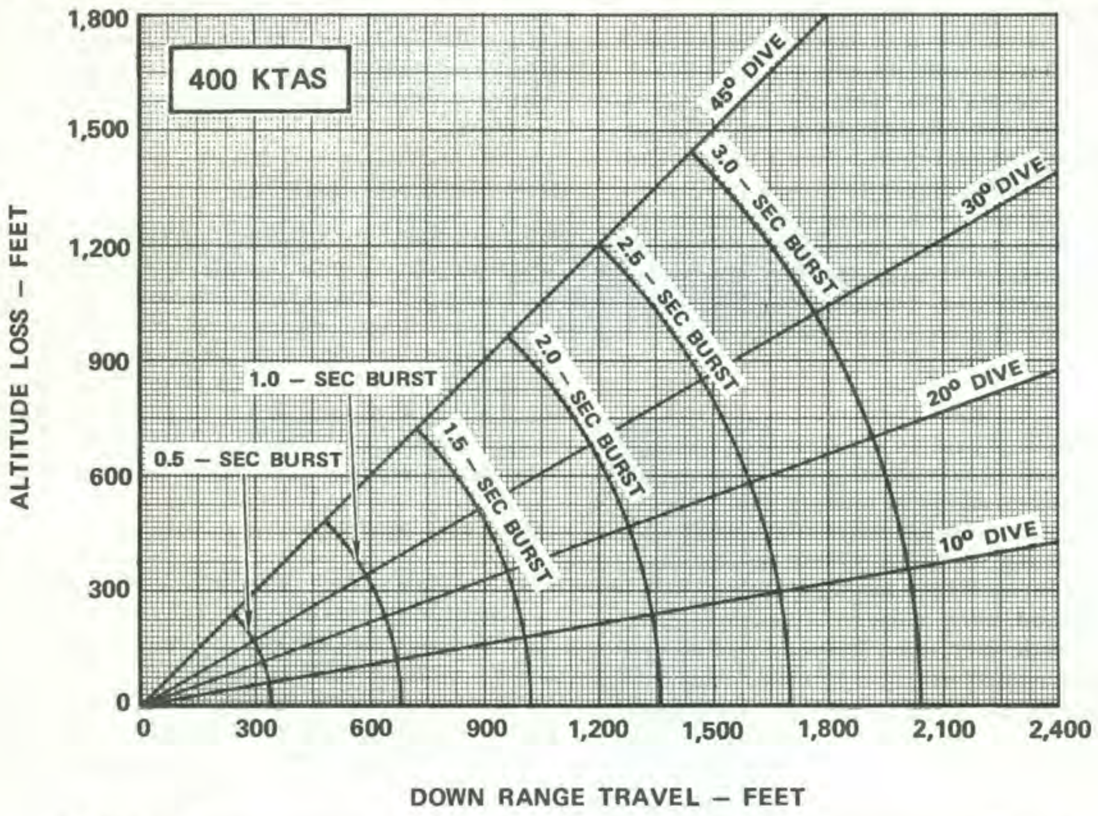
Recovery should be initiated with a pullup as soon as the trigger is released. If a long burst has been fired, bullet impact may be seen before the aircraft nose banks out the target. The recovery should be made by breaking away from, instead of over the target, since this reduces the probability of damage from ricochets, fragments, or an exploding target. It also complicates the prediction problem for defensive ground fire. Where effective missile defenses exist, execute a hard turn to low altitude after recovering to level flight. For undefended target, reposition and reattack as desired.

MULTIPLE RELEASE CONSIDERATIONS

MANUAL RELEASE

It will be desirable in some types of delivery to lay bombs across a target with spacing between bomb impacts. Since there is no cockpit intervalometer in

Strafing Down Range Travel and Altitude Loss



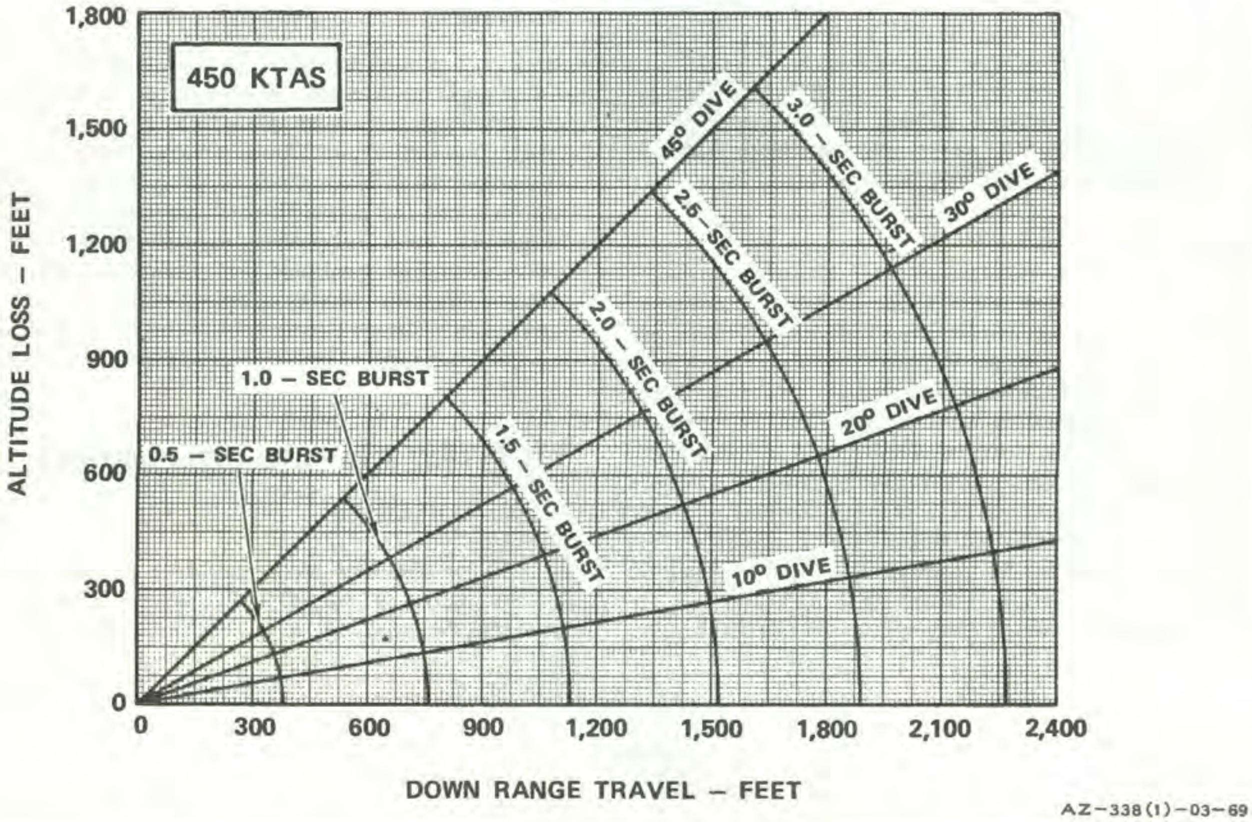


Figure 2–40 (Sheet 1)

Strafing Down Range Travel and Altitude Loss

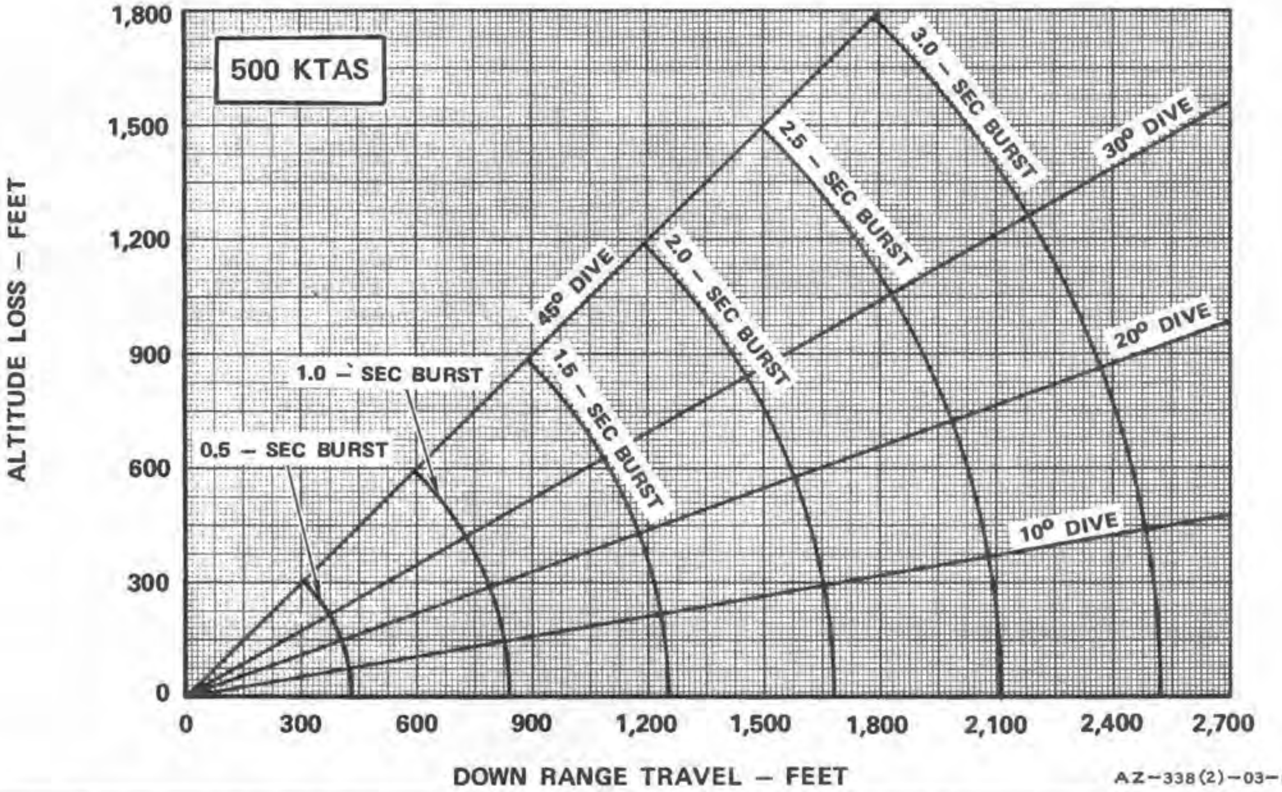


Figure 2–40 (Sheet 2)

the F-8, bomb spacing is accomplished by picking the bombs manually at periodic intervals. To perform a manual multiple release, the single/simultaneous release maneuver and switch positioning should be used with the following modifications:

a. For dive delivery, adjust the altitude of the first bomb release point upward to permit the last bomb to be released from a height that will ensure a safe recovery and escape.

b. Adjust the aim point to place the center of the bomb pattern on the target (see figure 2–41). The bomb pickle must be depressed for each single/simultaneous release in the delivery.

c. Maintain steady tracking and stable flight during the multiple release.

MER/TER AND MBR INTERVALOMETER RELEASE

WARNING

Consult the external store limitations and fuze sections in this manual to ensure the bomb/fuze combination being used is compatible with the multiple release conditions. Use minimum release intervals or greater to prevent bomb-to-bomb collisions and possible early fuze detonation.

Intervalometers incorporated in the MER/TER and MBR will allow multiple release. Figure 2–42 shows these multiple release options and intervals. These

Multiple Release

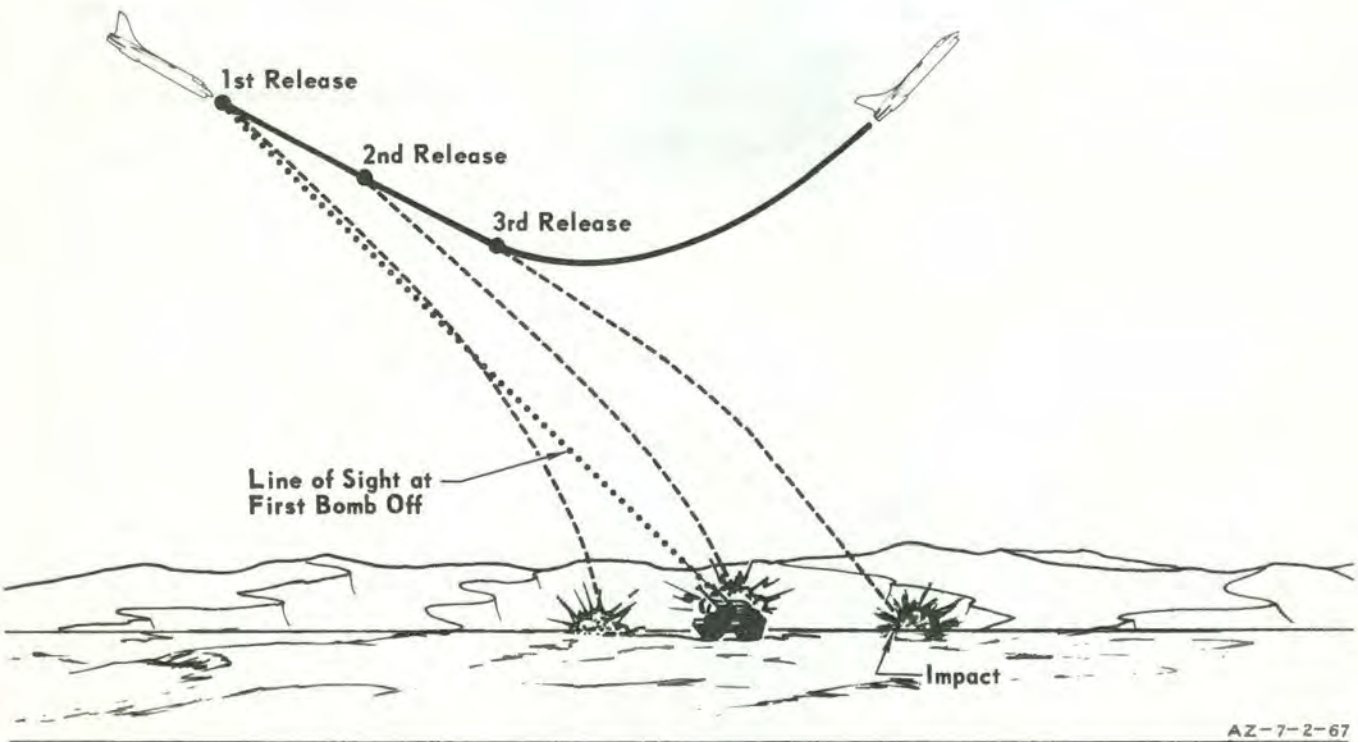


Figure 2–41

options must be preset on the ground prior to takeoff. Since these release intervals are of such short periods, close bomb impact spacing can be achieved.

Bomb Rack	*Rack Setting*	*Release Interval*
MER/TER (–505 or –521 models)	SALVO	15 to 25 milliseconds
	DUAL (MER only)	Simultaneous
MER/TER (–527 model)	AUTO RIPPLE	15 to 25 milliseconds
MBR	DUAL	Simultaneous
	.015 SEC	15 milliseconds
	.030 SEC	30 milliseconds
	.060 SEC	60 milliseconds
SIMULTANEOUS RELEASE OF SINGLE STORES FROM AERO 7A, 7A-1 EJECTOR BOMB RACK (AFTER AFC 488)		150 milliseconds

Figure 2–42. Multiple Release Options.

COORDINATED ATTACKS

When more than one aircraft are involved in an attack, careful consideration must be given to the fragmentation patterns of the other aircraft. Refer to Maximum Fragment Envelope Charts in this section for specific information.

NIGHT ATTACK

A night mission requires that consideration be given to the following:

a. Defensive maneuvers for enemy ground and air defense.

b. Coordination between all aircraft in the area regarding altitude, airspeed, and attack headings.

c. Heading and altitude from the target area in the event of disorientation or aircraft difficulties.

d. Adjusting the attack to the burn time of the flares.

e. Release and recovery altitudes. (Recovery should be above the burning flares. Occasionally a dropped flare will not ignite although its parachute is deployed. It will descend at a slightly higher rate than a burning flare.)

f. Flare effectiveness.

1. With a low ragged overcast, fog or drizzle, flare light will be seriously reduced. Disorientation and vertigo may occur.
2. With a high overcast or in clear weather flare light is excellent. Partial instruments will be required during dive recoveries.

See figure 2–43 for a typical night attack pattern.

Two Aircraft Night Initial Attack Pattern

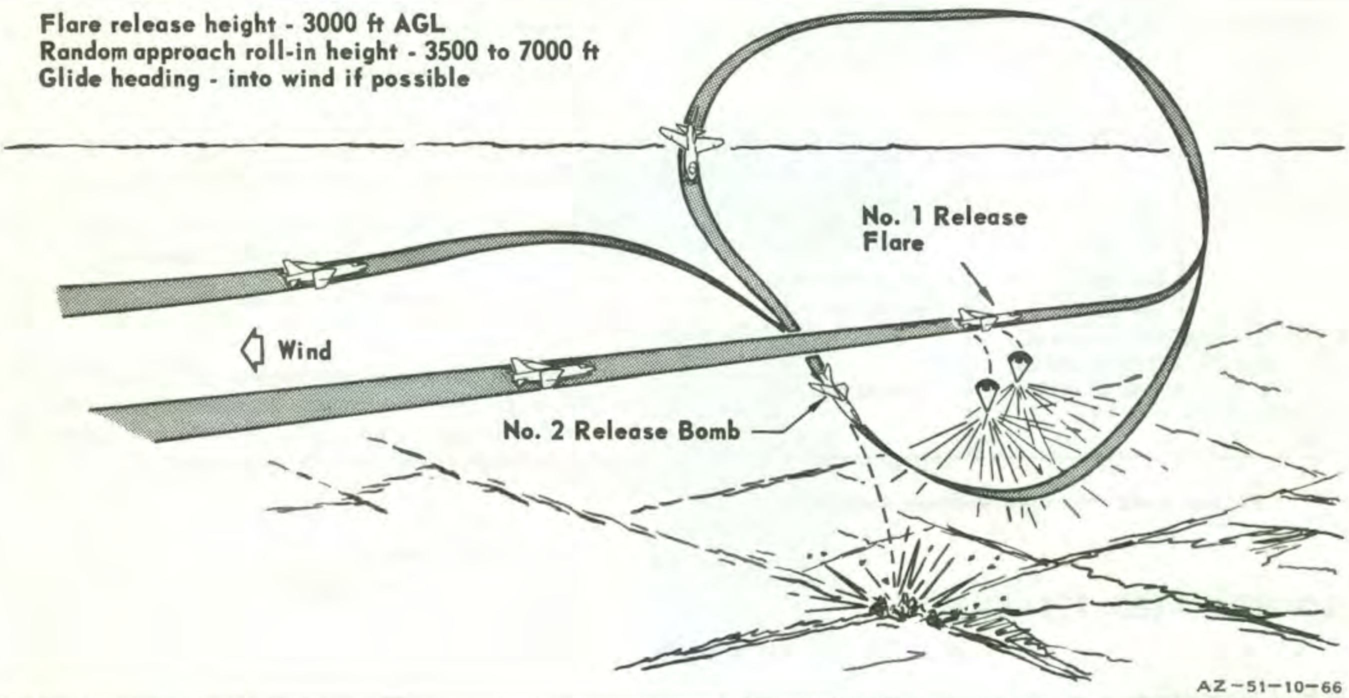


Figure 2-43

PART 4 — WEAPONS

INTRODUCTION

This part contains weapons system harmonization procedures and a detailed description and illustration of individual weapons used by the F-8 in both its air-to-air and air-to-ground missions.

WEAPON SYSTEM HARMONIZATION

Harmonization is the process of obtaining the optimum adjustment and alignment of all the aircraft's 20mm armament and fire control system components. This process includes:

a. Boresighting Guns

b. Firing in Guns

c. Gunsight Alignment

d. Alignment of Radar

e. Gunsight Camera Boresighting

HARMONIZATION SCHEDULE

a. As part of every major inspection (will not be able to fire in if a range is not available).

b. When the sight unit, guns, or gun mounts are changed or moved.

c. When the aircraft demonstrates poor harmonization.

d. Approximately every 15 firing missions.

TYPES OF BORESIGHTING

Three types of boresight used are:

a. Parallel, in which all guns are parallel to the ADL. It is acceptable for guns having a very small dispersion but results in an unacceptably large pattern for the Mk 12 Mod 0 as installed in the F-8.

b. Infinity, which is nearly the same as parallel but permits boresighting on a point of land in the distance.

c. Converging, which is the type most commonly used in the F-8. The guns are boresighted to converge at a given range. This compensates for the large dispersion pattern of the F-8 gun. Ground targets are sometimes so small that converging boresight is necessary to provide concentration of fire on the target. Normally, F-8 guns are boresighted to converge at 1,500 feet.

GUN BORESIGHT AND FIRE-IN PROCEDURES

The relationship of lines and factors involved in harmonization and the boresight template are depicted in figure 2–44. The template is aligned with the aircraft ADL and all adjustments are made relative to this point. The fixed pipper is never moved from the OSL. This allows the air-to-ground sight lead computations to be correct and makes possible the infinity boresight check. Notice that the guns are cross boresighted with the upper and lower guns on each side converging on the same cross. Barrel whip and bullet bounce will move the MPI laterally back across the centerline seven inches. This aim point was obtained through trial and error only but will cause bullet convergence laterally at 1,500 feet. If the center of the MPI exceeds 21.3 inches for the upper guns and 20.6 inches for the lower guns from the center line, the projectiles are not converging and the GBL must be readjusted. The vertical distance between the OSL and GBL's is also decreased to correct for parallax. This has been done by raising the GBL's two thirds of the distance (27 inches) for the 1,000-foot template. This will converge the OSL and the GBL's vertically at 1,500 feet.

Gun Boresight and Fire-in Procedures are as Follows:

a. Place aircraft on pad at boresight range, aligned toward target.

b. Jack aircraft at three points sufficient to take weight off of landing gear (strut starts extending). Level aircraft laterally with leveling tool across canopy rails.

c. Install ADL boresight telescope on left side of the fuselage for a one degree depression below the FRL.

d. Position the boresight target (figure 2–44) 1,000 feet down the range in such a manner that the ADL cross on the target is aligned with the cross hairs in the ADL boresight telescope (boresight kit CV15-206126-87). The nose wheel may be adjusted for azimuth corrections. The nose of the aircraft may be elevated slightly with the nose jack to facilitate the alignment. Ensure that the target banner is vertical by using a plumb bob.

e. Tie the aircraft down securely in at least three points. The combination of jacks and tie downs will prevent the aircraft from shifting position during fire-in.

f. Install a boresight tool (Mk 3 Mod 0) in each gun and align the gun so that the cross hairs of the tool

Reference Lines and Boresight Target

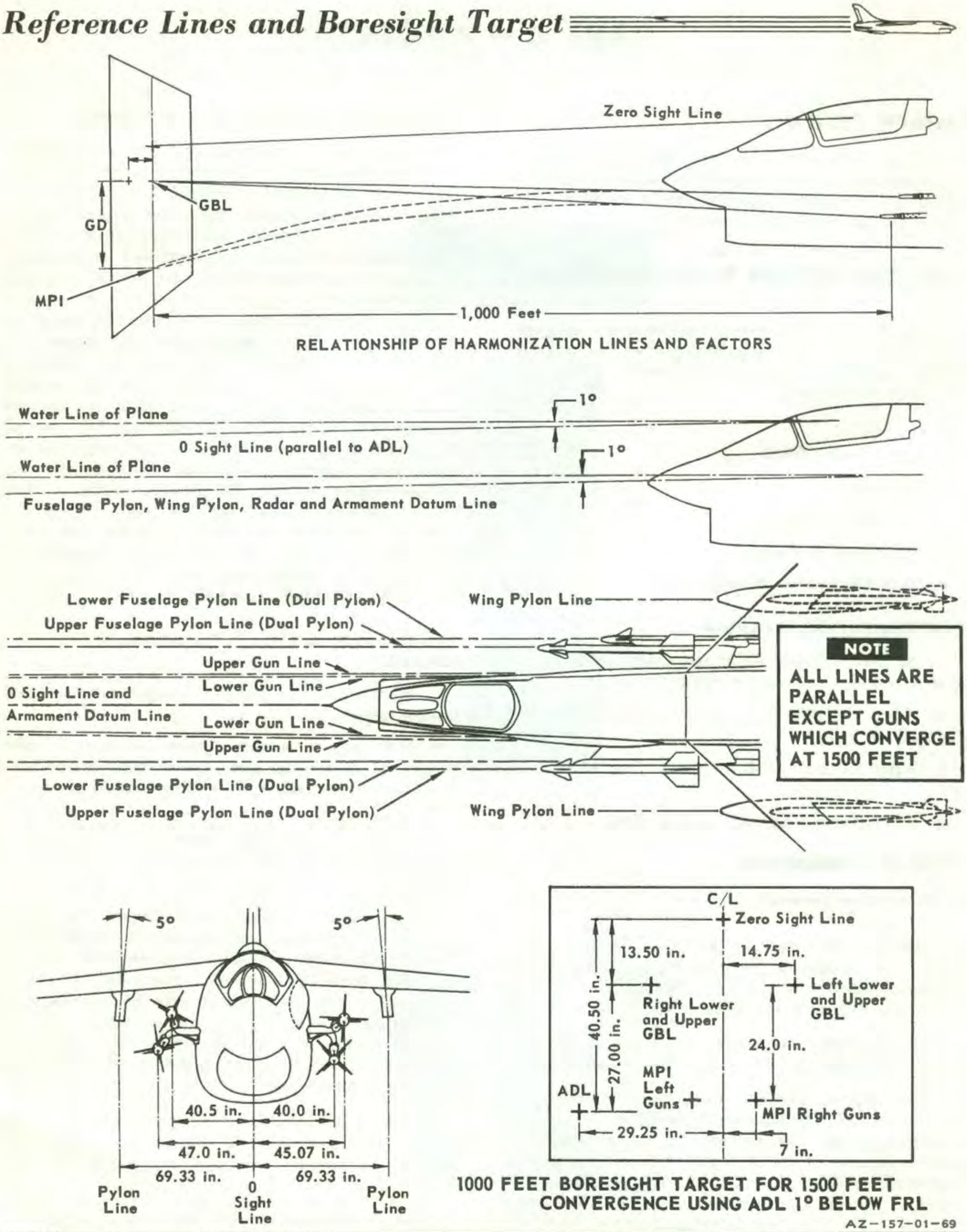


Figure 2-44

coincide with the GBL cross on the opposite side of the target centerline (i.e., cross the guns). Align the guns by adjusting the double eccentrics located in the forward gun mount.

g. Load each gun with 15 rounds of TP ammunition. The ammunition should be painted a different color for each gun to mark that particular gun's pattern. Guns may be fired in pairs or quads but never fire one gun without firing the corresponding gun on the opposite side to approximate stresses and vibrations encountered in aerial gunnery.

h. Observing all range safety precautions, fire-in the guns. Each gun must produce 15 rounds of uninterrupted fire. If a gun stops before fire-out, it must be examined, repaired, and reloaded with 15 rounds until it will produce 15 rounds of uninterrupted fire. This requirement will solve most gun problems prior to the first firing mission and will greatly improve gun performance and increase fire-out rates.

i. For each gun, 13 out of 15 rounds must impact an area 5 feet 10 inches square and having as its center a point seven inches from the centerline and approximately 24 inches below the GBL crosses. If an individual gun does not meet this requirement, it must be re-boresighted, moving its GBL off the cross to correct for its error in MPI, and re-fired until it does meet the requirements.

j. A detailed record of the fire-in data should be made to allow the aircraft to be boresighted when a fire-in range is not available.

GUNSIGHT ALIGNMENT PROCEDURE

a. Connect electrical power and place the power and fixed switches on the Mk 44 Mod 0 control box in ON.

b. Align the vertical ladder image with the vertical reference line (center line) on the boresight target.

c. Align the center (pipper) of the fixed reticle image with the zero sight line cross on the boresight target. Use the elevation adjustment for vertical corrections and the azimuth adjustment for lateral corrections. Lock the adjustments in place.

Note

This is a most critical procedure if sight alignment is to be maintained.

d. Place the power and fixed switches on the Mk 44 Mod 0 control box in OFF and disconnect electrical power.

RADAR ALIGNMENT PROCEDURE

Refer to NAVAIR 0-45HHD-2-6.1 for this alignment procedure.

GUNSIGHT CAMERA BORESIGHT PROCEDURE

Refer to NAVAIR 01-45HHD-2-6 for this boresight procedure.

GENERAL CHARTS AND TABLES

A series of charts and tables applicable to all weapons and/or delivery modes is provided to complete mission planning. These charts and tables are described in the following paragraphs.

AIRSPEED CONVERSION

The airspeed conversion chart (figure 2–45) is used to relate calibrated airspeed, true airspeed and true Mach number.

FUSELAGE ANGLE OF ATTACK

The fuselage angle of attack chart (figure 2–46) is required for computing mil lead. The fuselage angle of attack minus 17 mils (the armament datum line or zero sight line is one degree below the fuselage reference line) is added to the trajectory drop of a bomb to determine the mil lead. Parameters required for using the chart must include indicated airspeed, aircraft gross weight, dive angle and release altitude.

DIVE RECOVERY

These charts (figure 2–47) can be used to determine altitude loss during dive recovery when 4g or 6g pullouts are made. The pullout is based on a 4g in 2 seconds rate.

AIRCRAFT DOWNRANGE TRAVEL AND ALTITUDE LOSS

These charts (figure 2–48) are used to determine the loss of altitude and the distance covered on the ground between bomb releases of a multiple release. The charts are based on the MER/TER release interval for multiple releases.

ICAO STANDARD DAY DATA

This chart (figure 2–49) provides the ICAO standard temperature for each 1,000-foot level up to 15,000 feet. Each bomb mil lead chart contains mil lead correction data for variance from standard temperatures at release altitudes. By comparing temperature given for release altitude at prestrike briefing with the standard temperature, a mil lead correction can be determined.

Airspeed Conversion

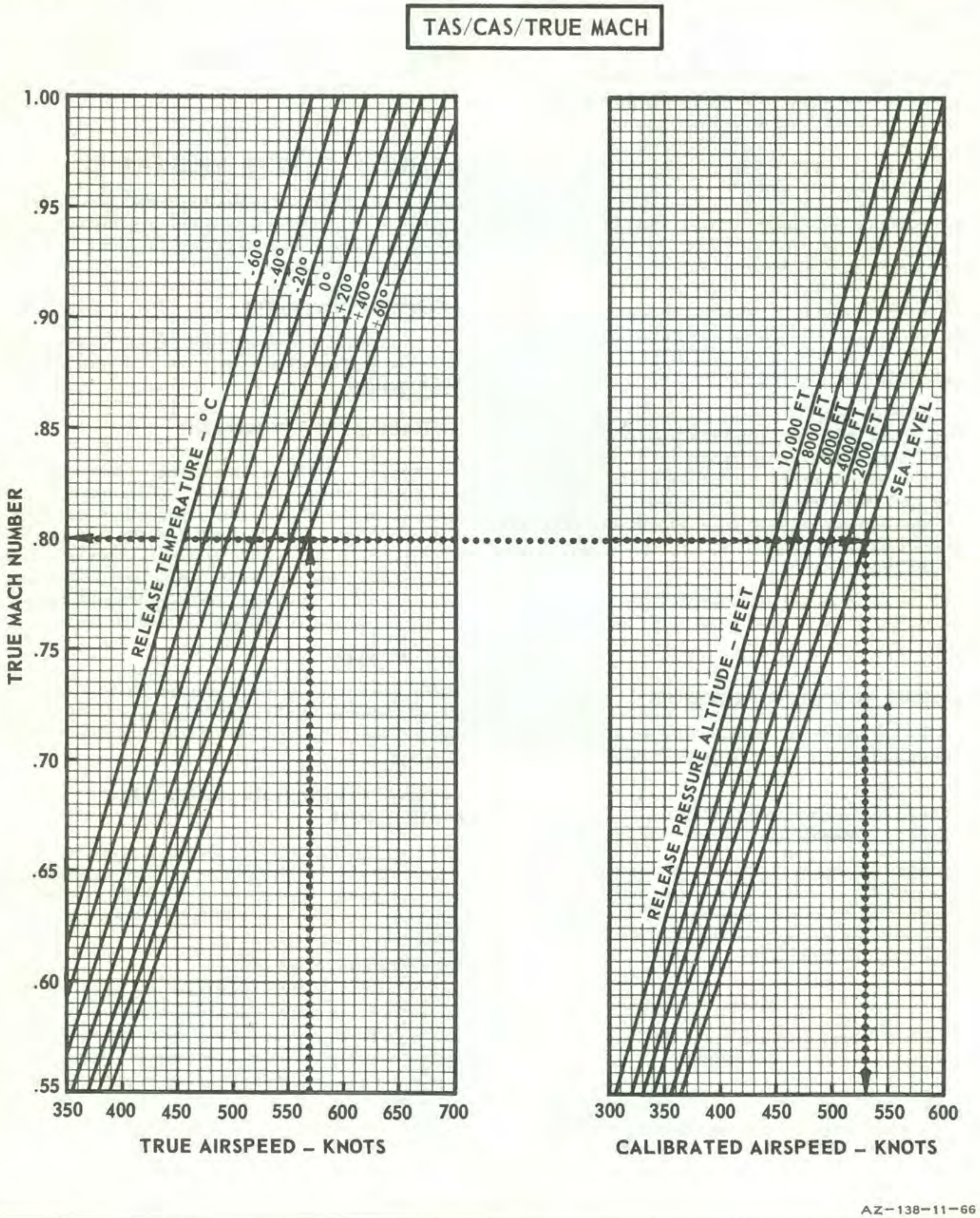


Figure 2–45

Fuselage Angle of Attack

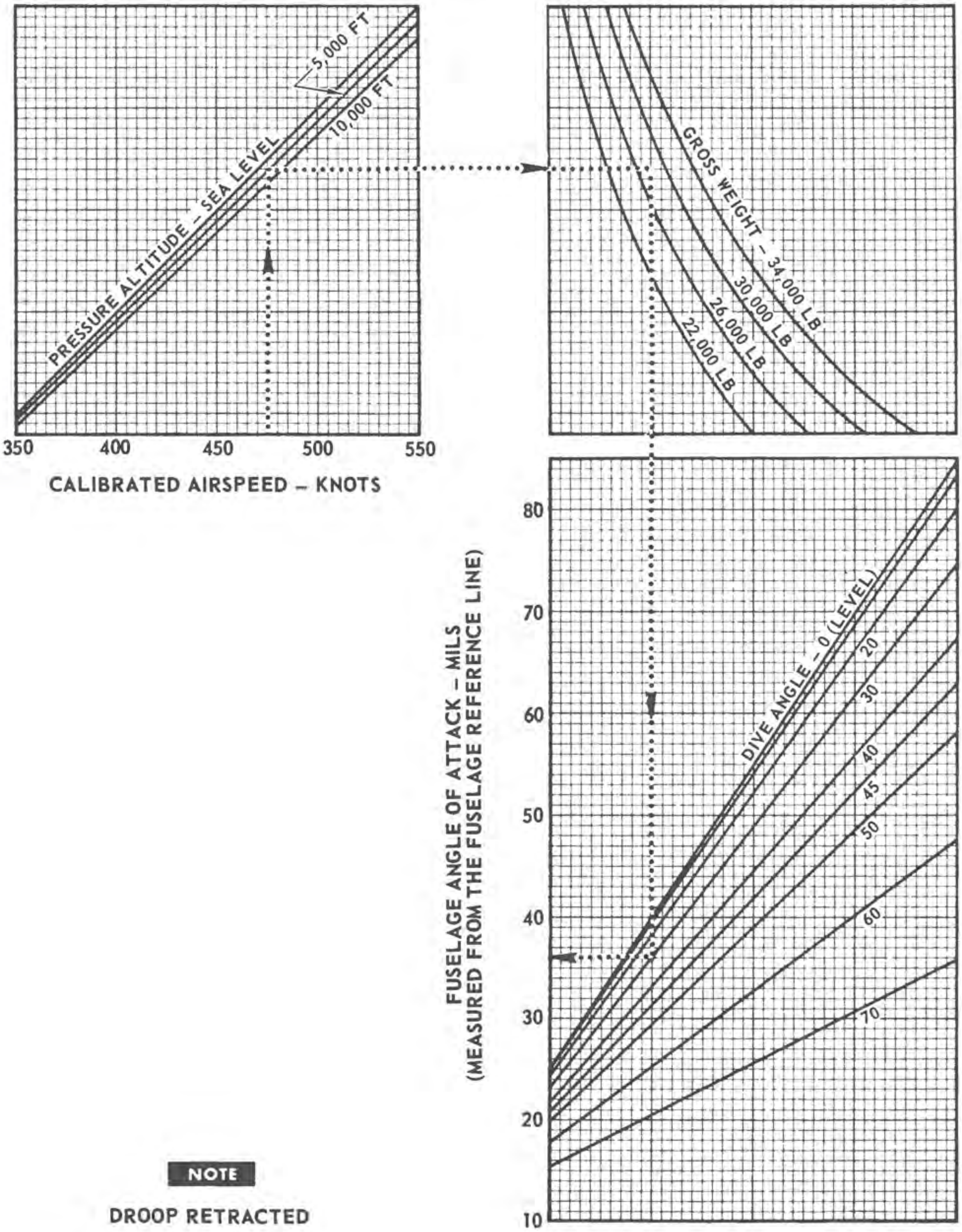


Figure 2–46

Dive Recovery Chart

4g PULLOUT

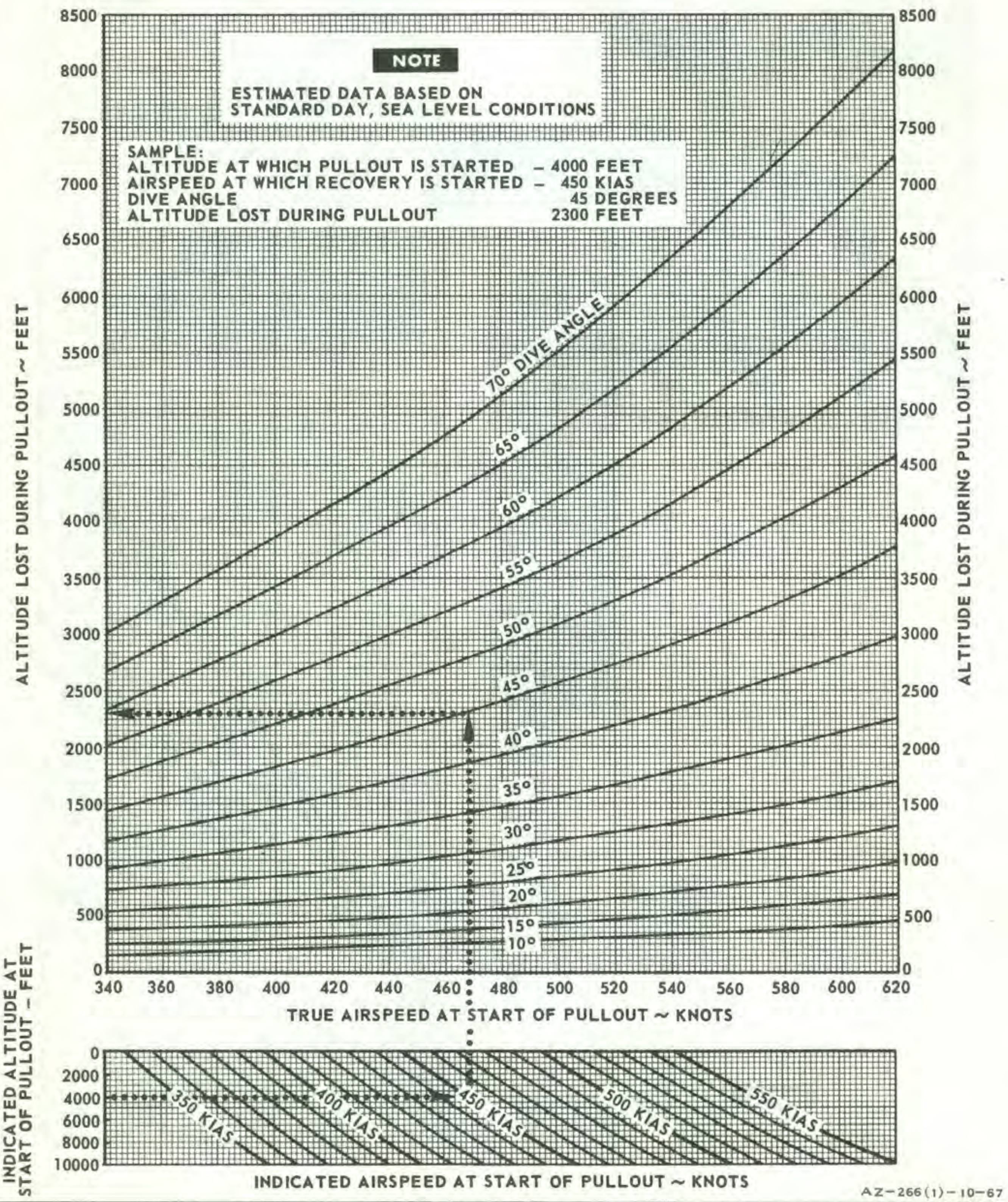


Figure 2–47 (Sheet 1)

Dive Recovery Chart

6g PULLOUT

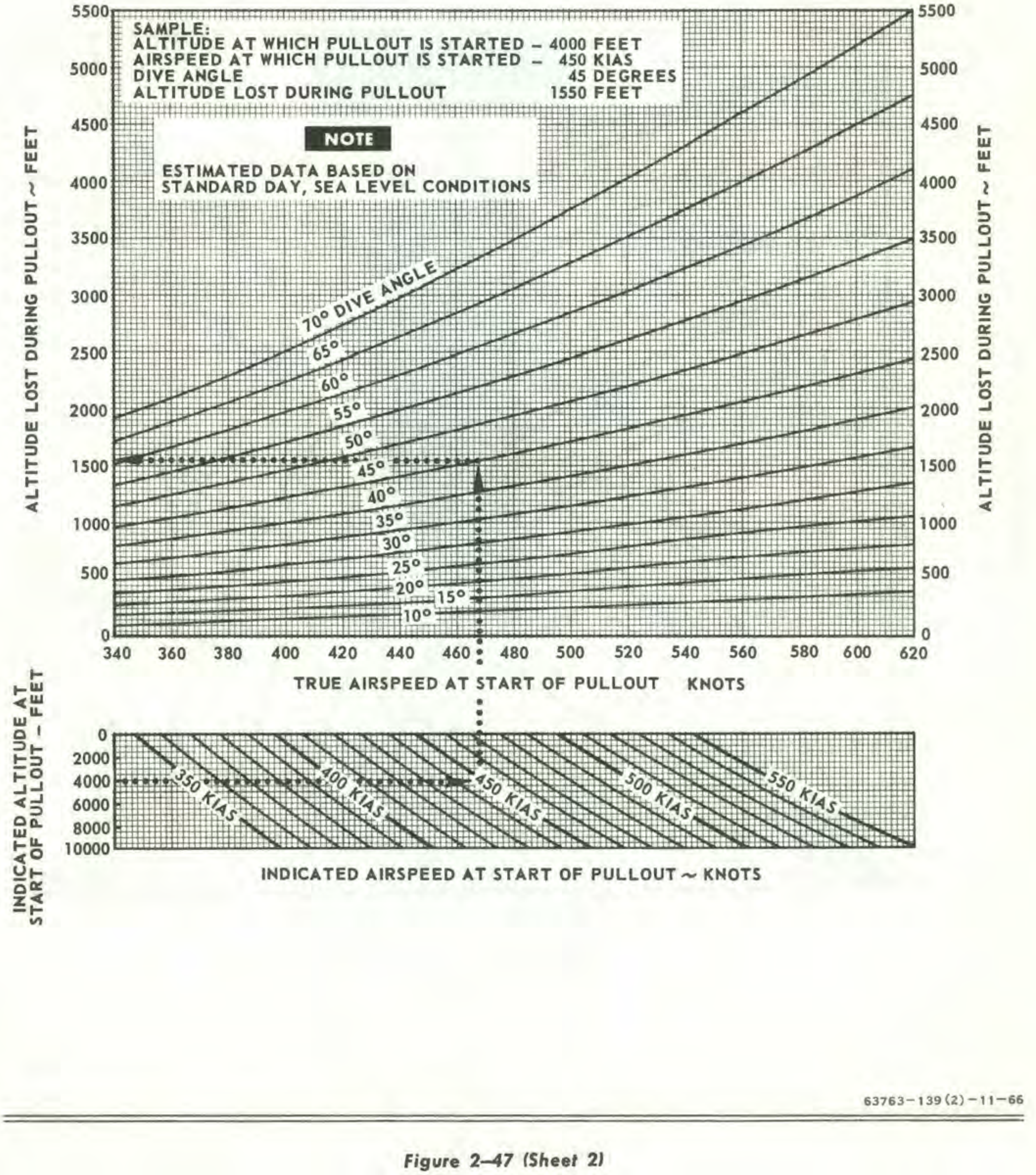


Figure 2–47 (Sheet 2)

Aircraft Down Range Travel and Altitude Loss

A RELEASE INTERVAL OF 0.06 SEC

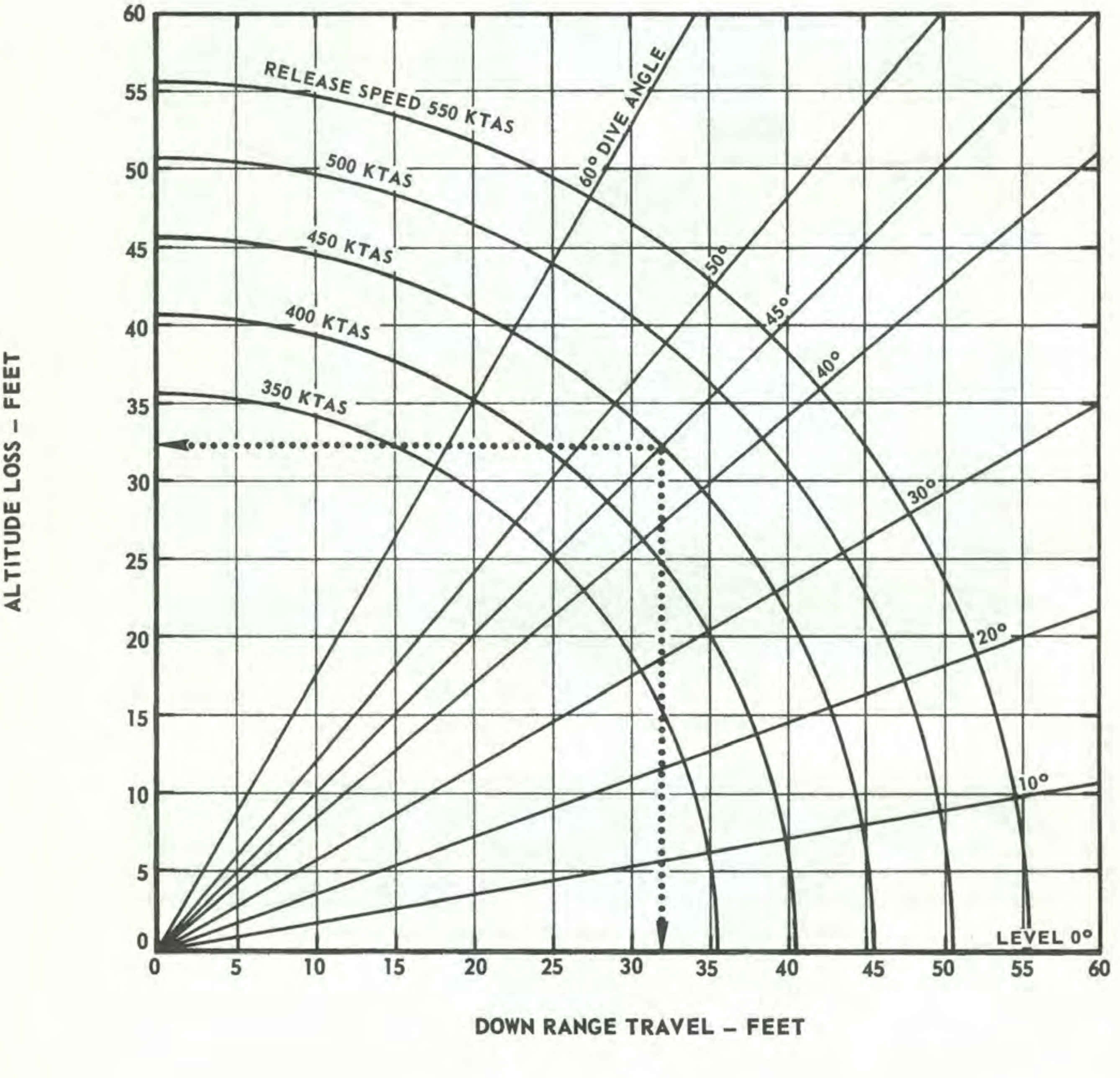


Figure 2–48 (Sheet 1)

Aircraft Down Range Travel and Altitude Loss

A RELEASE INTERVAL OF 0.10 SEC

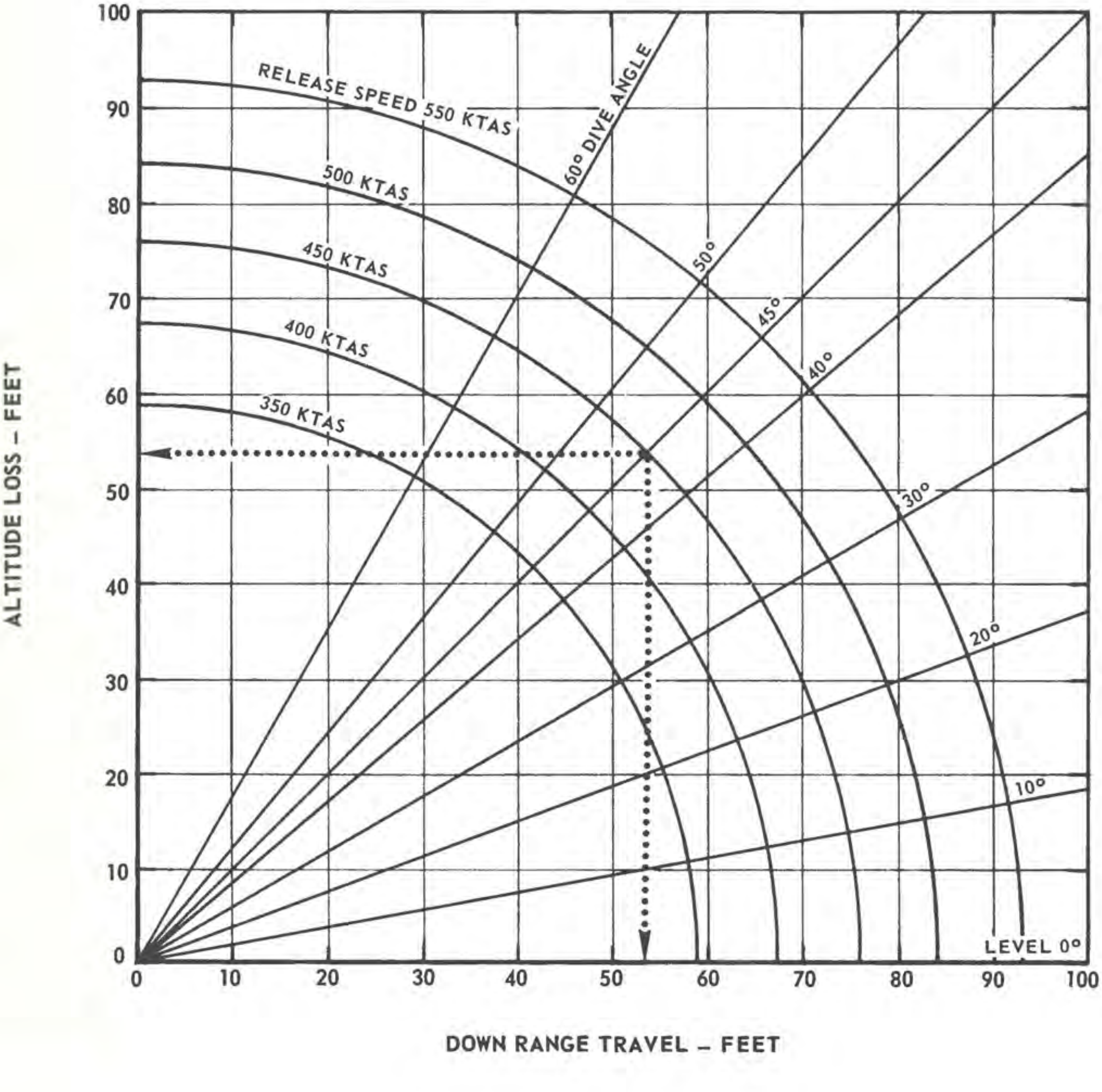


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Figure 2–48 (Sheet 2)

Aircraft Down Range Travel and Altitude Loss

A RELEASE INTERVAL OF 0.14 SEC

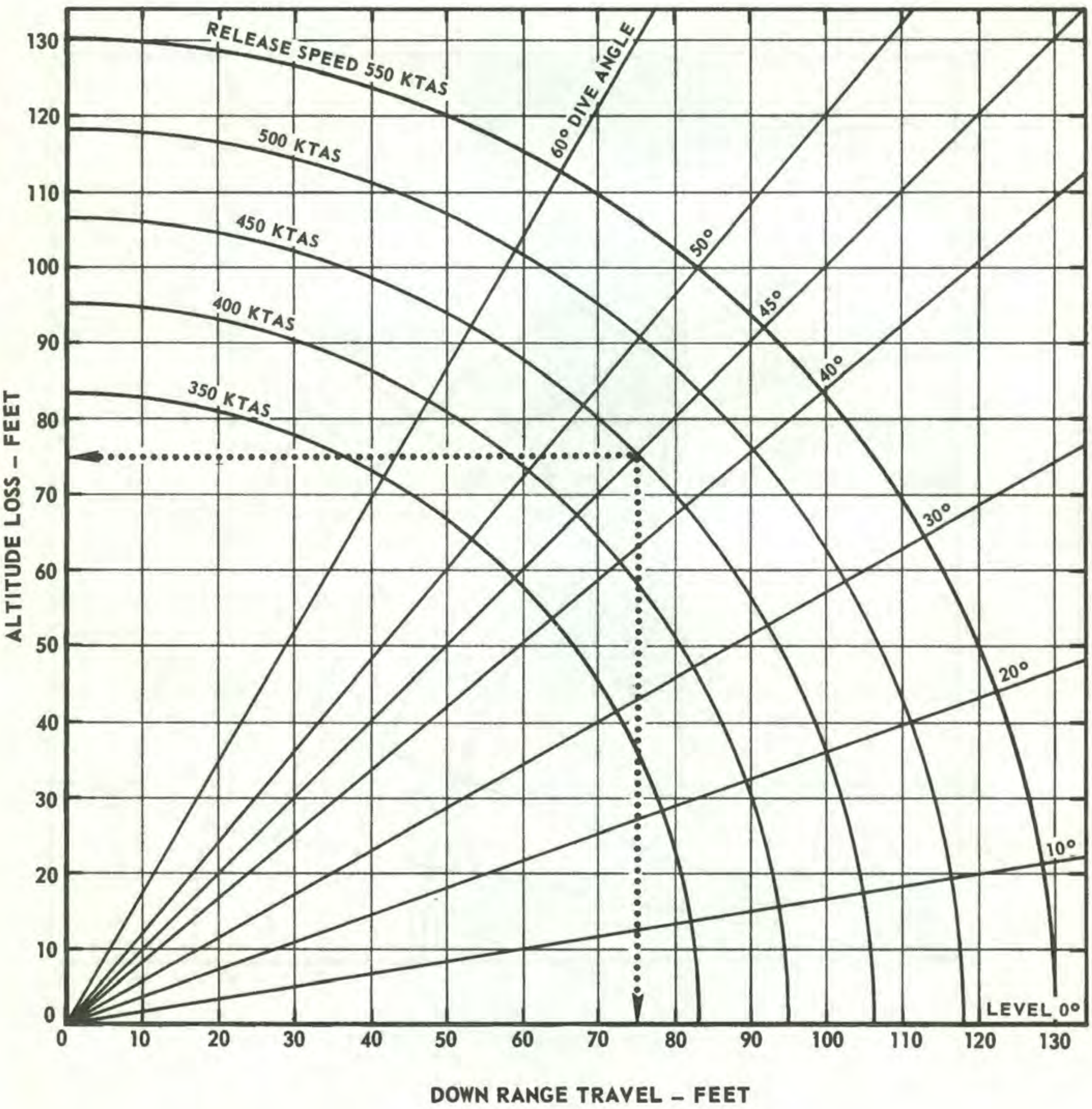

Figure 2–48 (Sheet 3)

ICAO Standard Day Data

STANDARD SL CONDITIONS:

TEMPERATURE – 15°C (59°F)
PRESSURE – 29.921 IN. Hg; 2116.216 LB/SQ FT
SPEED OF SOUND – 1116.89 FT/SEC; 661.7 KNOTS

ALTITUDE FEET	STANDARD TEMPERATURE °C	STANDARD TEMPERATURE °F	SPEED OF SOUND KNOTS	PRESSURE IN. Hg
0	15.000	59.000	661.7	29.921
1,000	13.019	55.434	659.5	28.856
2,000	11.038	51.868	657.2	27.821
3,000	9.056	48.302	654.9	26.817
4,000	7.076	44.735	652.6	25.842
5,000	5.094	41.169	650.3	24.896
6,000	3.113	37.603	648.7	23.978
7,000	1.132	34.037	645.6	23.088
8,000	– 0.850	30.471	643.3	22.225
9,000	– 2.831	26.905	640.9	21.388
10,000	– 4.812	23.338	638.6	20.577
11,000	– 6.793	19.772	636.2	19.791
12,000	– 8.774	16.206	633.9	19.029
13,000	– 10.756	12.640	631.5	18.292
14,000	– 12.737	9.074	629.0	17.577
15,000	– 14.718	5.508	626.6	16.886

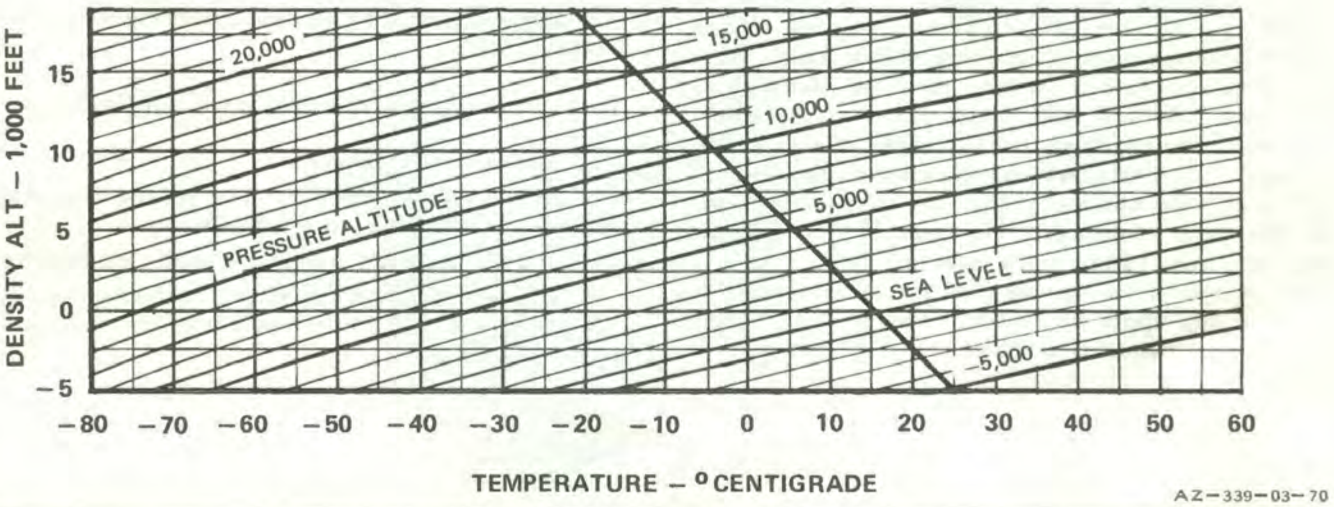

Figure 2–49 (U)

WEAPON DESCRIPTION AND DELIVERY DATA

CAUTION

Weapons illustrations do not constitute authority for loading or carriage. This information is presented in figure 2–2, External Stores Limitations.

Each weapon carried by the F-8 is illustrated along with some typical loading configurations for each wing and fuselage station. Weapon firing or bomb dropping procedures are provided along with a check list for jettisoning stores.

Delivery data for each type of weapon is provided in a series of charts and tables following the weapons illustration.

MIL LEAD CHARTS

WARNING

Variations from the following assumptions and the release restrictions specified in the mil lead charts may significantly change the release altitudes required to avoid weapon fragments. The weapons may not be cleared for release at all delivery conditions specified in the mil lead charts. See figure 2–2 for weapon release limitations.

Mil lead charts are given for single bomb releases from a specified rack. These charts provide the mil lead for various dive angles, release altitudes (AGL), release airspeeds and an aircraft gross weight of 27,000 pounds. Time of fall (TOF) curves are plotted on the graphs for use in selecting release heights that will provide adequate arming time for the type of fuze used. The mil lead values given in the charts include trajectory drop, aircraft angle of attack and the effect of ejection velocity imparted to the weapon by the rack for which the charts are applicable. Parallax has been neglected. Since most of the weapons may be released from more than one type of rack, a table of corrections to mil lead for various racks is given in the upper left corner of each chart. These are average corrections which can be expected to introduce inaccuracies as large as ±5 mils in extreme cases. Since ICAO standard day temperatures are used in computing the mil lead charts, an additional set of corrections is given on each chart. The corrections are for 10°C and 30°C variations from the ICAO standard day temperature *at the release altitude* of the particular weapon. For an increase from standard, add the correction, for a decrease from standard, subtract the correction. See figure 2–49 to determine standard temperatures.

The mil lead charts are terminated at the required release altitudes to provide a specified terrain clearance and avoidance of all predictable fragments projected from the weapon at detonation. The chart area encompassing unsafe release conditions is shaded and designated as "release unsafe". Generally, the release restrictions are due to fragment hazards for dive angles less than 45 degrees and terrain clearance requirements for dive angles greater than 45 degrees. These restrictions are predicated on the following:

a. An assumed straight and level, constant velocity recovery for level delivery, and a 4g pullup to 15 degrees for dive delivery.

b. A 2-second g buildup time for dive recovery.

c. Terrain clearance requirements as follows:

Dive Angle (deg)	*Terrain Clearance (ft)**
0	100
10	200
20	300
30	500
40,45	700
50,60	1000

*Difference between burst altitude and minimum aircraft altitude in pull-out.

d. Instantaneous weapon detonation at ground level (zero altitude).

The release altitude restrictions are also applicable to:

a. Salvo weapon delivery.

b. Ripple weapon delivery. The release restriction should be based on the last bomb released.

c. Delayed bomb detonations, assuming no ricochet.

d. VT fuzed air burst delivery. In this case, the zero altitude on the mil lead chart should be considered as the burst altitude.

MAXIMUM FRAGMENT ENVELOPE CHARTS

Maximum fragment envelope charts, showing fragment position relative to the weapon burst point as a function of time, are given for use in determining safe release intervals between aircraft for multiple aircraft attacks. These fragmentation charts are based on the assumption that the most hazardous fragment (ie, the heaviest fragment with the maximum velocity) can be projected from the burst point at any angle irrespective of weapon delivery conditions. Similar charts for rockets are given as a function of impact angle where the impact angle is approximately equal to the launch angle. The rocket envelopes may be rotated for consideration of launch angles other than those given.

A conservative estimate of a safe release interval may be obtained from the charts by using the following procedure.

Note

> This procedure is valid only if both the leading and trailing aircraft deliver their weapons at the same airspeed, dive angle, and direction relative to the target.

Compute the trailing aircraft's recovery altitude. If this recovery altitude is greater than the maximum ordinate of the leading aircraft's weapon fragments (as given in the maximum fragment envelope chart), any interval between aircraft may be used without endangering the trailing aircraft.

If the trailing aircraft's recovery altitude is less than the maximum ordinate of the leading aircraft's weapon fragments, the safe release interval is the sum of the weapon's time of flight and the fragment's time of flight from burst through maximum ordinate to the recovery altitude of the trailing aircraft.

SAFE RELEASE INTERVAL — SAMPLE CALCULATION

Weapon: MARK 81 Conical Fin

Release Conditions:	20 degrees
	550 KIAS
	2500 feet

Trailing Aircraft: Recovery altitude is the aircraft release altitude minus altitude loss (6g pullout)

Recovery altitude =	2,500-700 feet
=	1,800 feet

Recovery altitude is less than the maximum ordinate of the MARK 81 GPLD fragment envelope from the leading aircraft; therefore, safe release interval is the weapon's time of flight plus fragment's time of flight from burst through maximum ordinate to the recovery altitude of the trailing aircraft.

Weapon time of flight = 6 seconds
Fragment time = approximately 18 seconds (value obtained from MARK 81 GPLD maximum fragment envelope)
Safe release interval = 6 seconds + 18 seconds
= 24 seconds

TABULATED DELIVERY DATA

Tabulated delivery data providing trajectory drop in mils, weapon fall in seconds, horizontal range of the weapon in feet, and slant range in feet are available and can be obtained from NAVAIR 11-5T-55, Tactical Manual Ballistic Tables. These tables are based on zero ejection velocity. To determine the correct mil lead, refer to the multiplier chart to determine correction factor for the bomb rack to be used.

TESTED DELIVERY DATA TABLES

The tested delivery data tables are the results of actual tests. The tested information may vary slightly from the data on the mil lead charts. These minor differences are a result of the assumptions made above in computing the mil lead charts.

Note

> The tested delivery data is based on a 0.001 probability of fragmentation damage whereas the mil lead charts are based on zero probability of fragmentation damage. Consequently, release altitudes for the tested data may be in the release unsafe area of the corresponding mil lead chart. (Each mil lead chart depicts in tabular form the probability of fragmentation damage for 0.000, 0.001 and 0.010.)

MIL LEAD COMPUTATION FOR A SINGLE BOMB RELEASE

The mil lead is obtained by adding algebraically the trajectory drop of the weapon in mils to the fuselage angle of attack minus 17 mils (to correct for the difference between the armament datum line and the fuselage reference line) and the correction for parallax in mils. The parallax correction for the F-8 aircraft is small and may be neglected. Hence, the equation for computing mil lead for bombs is

$$ML = D + AA$$

where

ML	is mil lead
D	is trajectory drop in mils
AA	is angle of attack of Armament Datum Line in mils

The angle of attack for the desired delivery conditions and standard aircraft delivery weight (27,000 pounds) may be obtained from figure 2–46.

SAMPLE PROBLEM

Release Conditions: MARK 81/Unretarded/Snakeye I, 30-degree Dive, 500 KIAS, 4,000-foot AGL, 25,000-pound, Aero 7A Rack

Angle of attack (figure 2–46) minus 17 mils	– 13 mils
Trajectory drop (NWL Ballistic Table)	119 mils
Ejection velocity correction (0.2 obtained from the multiplier table (figure 2–49) multiplied by correction from NWL Ballistic Table)	2 mils
Mil lead	134 mils

MIL LEAD COMPUTATION FOR ROCKET FIRING

The mil lead computation for unguided rockets differs from the mil lead computation for bombs since the attitude of the rocket at release (or firing) must be considered due to the fact that rockets tend to align with the airstream. The general equation for computing mil lead for rockets is

$$ML = D + f(AA + L) - L + B + P$$

where

ML	is mil lead
D	is trajectory drop in mils
f	is launch factor, dimensionless
AA	is angle of attack of Armament Datum Line (ADL) in mils (angle of attack of fuselage reference line minus 17 mils)
L	is launcher angle in mils (negative when the launcher line is below the ADL)
B	is the angle between the ADL and the zero sight line in mils (negative when the zero sight line is below the ADL)
P	is parallax correction in mils

The above equation can be simplified considerably for use with F-8 aircraft with no significant loss in accuracy. The launcher angle (L) and the angle between the ADL and the zero sight line (B) are zero for F-8 aircraft. The parallax correction for F-8 aircraft is small and may be neglected. Therefore the mil lead equation reduces to the following:

$$ML = D + (f)(AA)$$

The trajectory drop data (D) and launch factors (f) for the 2.75-inch FFAR and 5.0-inch Zuni rockets may be obtained from Ballistic Ordnance Pamphlets 2532 and 2682 respectively, or from ballistic tables published by the Naval Weapons Laboratory, Dahlgren, Virginia. The angle of attack of the ADL may be obtained by subtracting 17 mils from the fuselage reference line angle of attack (figure 2–46).

In order to correct the mil lead for 2.75-inch FFAR and 5.0-inch Zuni rockets for an increase in aircraft angle of attack, 0.8 mil should be added for each 1.0 mil increase in aircraft angle of attack. This is an approximation and is equivalent to using an average launch factor for all airspeeds. This may introduce error as large as ±4 mils for large increases in angle of attack.

SAMPLE PROBLEM

Release Conditions:

Dive angle	20 degrees
Indicated airspeed at release	450 knots
Release altitude (AGL)	3,000 feet
Aircraft gross weight	30,000 pounds
Rocket	2.75 inch FFAR
Launcher	LAU-3/A

1. Obtain trajectory drop (D) from OP 2532	31 mils
2. Obtain the angle of attack of ADL (AA) from figure 2–46	
3. Obtain the launch factor for the 2.75-inch FFAR from OP 2532	0.834
4. Multiply item 2 by item 3	22 mils
5. Add items 1 and 4 for mil lead	53 mils

JETTISONING

F-8 MODELS: H, J, K, L* AND C AFTER AFC 497

There are two jettison circuits, salvo and selective. The salvo circuit permits immediate jettisoning of all stores

*The F-8L has provisions for installing ventral fins and a wing stores system. The flight characteristics and flight limitations necessary to operate with these features have not been published. Wing stores shall not be carried nor ventral fins installed without specific authority from Naval Air Systems Command.

(except fuselage-mounted Zuni rockets) through the movement of a single switch. The selective circuit allows for the selection and jettisoning of individual stations (except fuselage Zuni stations) when time and circumstances are more permitting. (Note that it is impossible to jettison Zuni's from fuselage pylons using either of these circuits. If it becomes necessary to get rid of Zuni rockets, they can only be fired armed using the normal firing procedure. The empty Zuni packs must then be retained, for they are nonjettisonable.) Stores jettisoned by these circuits separate in an unarmed and unguided condition. Electrical power for salvo or selective jettisoning is supplied by the emergency dc bus. This permits jettisoning on main generator power or on emergency electrical power supplied by the ram air turbine with the emergency generator switch in ON or LAND. The master armament switch need not be placed in ON for salvo or selective jettisoning. See figure 2–49A for jettisoning controls and their functions.

F-8 MODELS: A, B, AND C WITHOUT AFC 497

These aircraft are provided with only one jettisoning circuit as only fuselage external stores are authorized for carriage. It is impossible to jettison Zuni rockets from fuselage pylons using this circuit. Zuni's can only be fired armed using normal firing procedures. The empty Zuni packs are nonjettisonable. The missile jettisoning switch fires the Sidewinder missile in an unguided and unarmed state by applying firing voltage directly to the rocket motor squib. Electrical power for jettisoning is provided by the primary dc bus. See figure 2–49A for jettisoning controls and their functions.

See figures 2–50 through 2–115 for weapons illustrations, fragmentation, mil lead, and tested delivery charts and tables.

Jettisoning Controls and Functions

AIRCRAFT MODEL/ SWITCH	SWITCH LOCATION	FUNCTION
F-8 Models: A/B Missile jettisoning switch	F-8A – Top of instrument panel F-8B – Armament panel	LH MISSILE JETTISON – launches left missile in unarmed and unguided condition (landing gear handle in WHEELS UP). RH MISSILE JETTISON – launches right missile in unarmed and unguided condition (landing gear handle in WHEELS UP). NORMAL – disconnects jettisoning circuit.
F-8 Models: H, J, K and C after AFC 497 Selective jettison switch	All models – armament panel	ON – jettisons stores selected by armament selector switch with landing gear handle in the WHLS UP* position. With a wing pylon selected, jettisons all stores attached to the AERO 7A-1 ejector rack, including any multiple racks or launchers. MER/TER STORES – placing the switch in this position with the landing gear handle in WHLS UP* and the pylon MER/TER mode switch in RKT position, permits one rocket pack to be jettisoned from the MER or TER of the selected wing pylon with each depression of the stores release button. With both triple-multiple rack fire-mode switches in DUAL, simultaneous jettisoning from the left and right MER/TER occurs. OFF – deenergizes select jettison circuit.
Salvo jettison switch	All models – Left longeron panel	LW/F-U – jettisons stores being carried on left wing pylon and upper fuselage pylons with landing gear handle in the WHLS UP* position. RW/F-L – jettisons stores being carried on right wing pylon and lower fuselage pylons with landing gear handle in the WHLS UP* position. *Placarded WHEELS UP for F-8C and F-8K
F-8 Model: C before AFC 497 Missile jettisoning switch	Armament panel	UP – jettisons left and right upper missile simultaneously in an unarmed and unguided condition with landing gear handle in WHEELS UP position. LWR – jettisons left and right lower missiles simultaneously in an unarmed and unguided condition with landing gear handle in WHEELS UP position. Switch must be in LWR to jettison missile from single pylons.
F-8 Model: L Selective jettison switch	Armament panel	ON – jettisons stores selected by armament selector switch with landing gear handle in the WHEELS UP position. OFF – deenergizes select jettison circuit.
Salvo jettison switch	Left longeron panel	LEFT WING/FUS – jettisons stores being carried on left fuselage pylons with landing gear handle in the WHEELS UP position. RIGHT WING/FUS – jettisons stores being carried on right fuselage pylons with landing gear handle in the WHEELS UP position.

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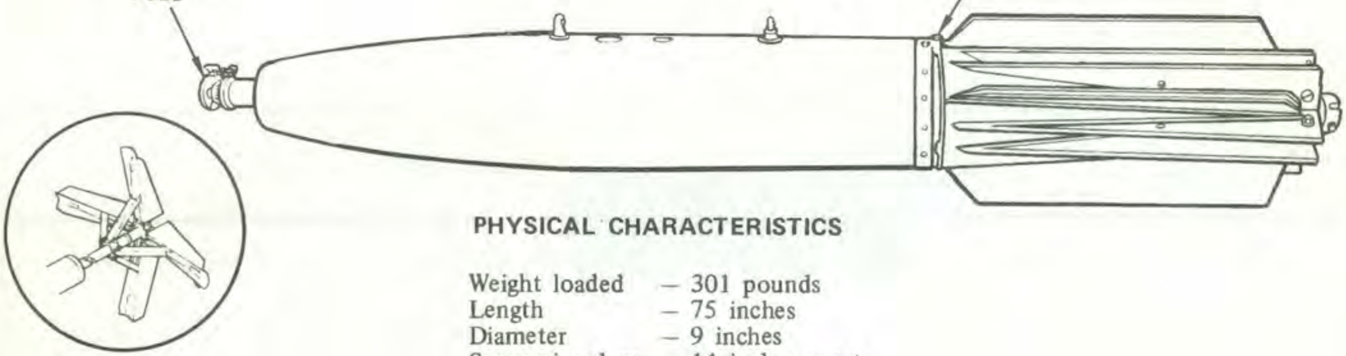
Figure 2–49A

MK 81 GP Bomb Snakeye I



PHYSICAL CHARACTERISTICS

Weight loaded	– 301 pounds
Length	– 75 inches
Diameter	– 9 inches
Suspension lugs	– 14 inches apart

DESCRIPTION

The Mk 81 Snakeye Weapon is a general purpose drogue-type bomb which can be adapted to be delivered either unretarded or retarded. Unretarded, the weapons ballistics are very similar to those of the Mk 81 LDGP. When retarded (high drag mode); the trajectory drop of the weapon is about 25% greater than in the low drag mode and the impact angle is increased for improved effectiveness. The retarded feature of Snakeye Weapon provides for a lower release altitude and hence greater accuracy and release flexibility.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT
AERO 7A-1 SUSPENSION One Bomb Each Wing 	2 MK 81 602 2 Aero 7A-1 104 2 Pylons 350 Total Wt 1056 One Wing Only 528
TER SUSPENSION Three Bombs Each Wing 	6 MK 81 1806 2 TER 210 2 Aero 7A-1 104 2 Pylons 350 Total Wt 2470 One Wing Only 1235
MBR SUSPENSION Four Bombs Each Wing 	8 MK 81 2408 2 MBR 318 2 Aero 7A-1 104 2 Pylons 350 Total Wt. 3180 One Wing Only 1590
MER SUSPENSION Four Bombs Each Wing 	8 MK 81 2408 2 MER 446 2 Aero 7A-1 104 2 Pylons 350 Total Wt 3308 One Wing Only 1654

DROPPING PROCEDURE
(Mechanical Fuzing)

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Mechanical Fuzing Sw – TAIL or NOSE
4. Stores Rel Sw - DEPRESS

DROPPING PROCEDURE
(Electrical Fuzing)

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Option Sel Sw – AS DESIRED
4. Safe-Stby- Ready Sw – STBY (30 sec) then RDY
5. HVDC light – ON
6. Stores Rel Sw - DEPRESS

NOTE

For simultaneous releases from the Aero 7A-1 racks the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

To step the MER or TER stepping switch past an empty station it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -505 or -521 TER or MER, the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past the empty stations.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HHH-75
4. Bomb Loading Procedures – NAVAIR 01-45HHH-75

AZ–1–03–70

Figure 2–50 (U)

Mil Lead for SingleDelivery

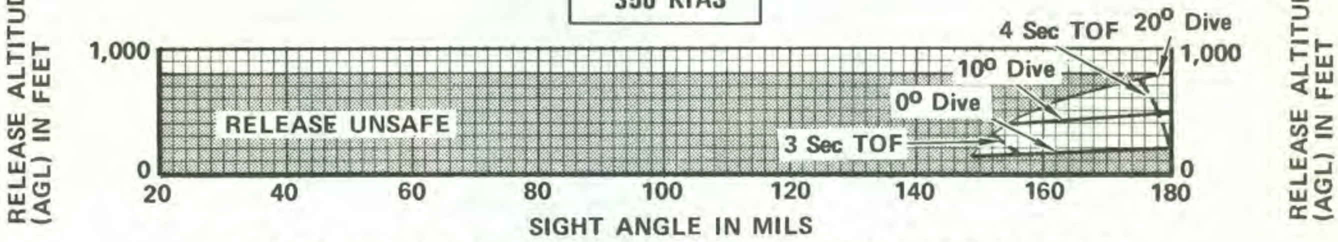
MARK 81 SNAKEYE I – RETARDED

*Mil lead corrections (±mils) for:

	350 KIAS	400 KIAS	450 KIAS	500 KIAS
Aero 7A Rack	+3	+3	+2	+2
Multiple Bomb Rack	−10	−9	−8	−8 mils
Cruise Droops Extended	+4	+4	+4	+4

RELEASE ALTITUDE TEMP VARIATION	DIVE ANGLE	0°	10°	20°	
± 10° C		± 2	± 3	± 5	mils
± 30° C		± 6	± 11	± 16	

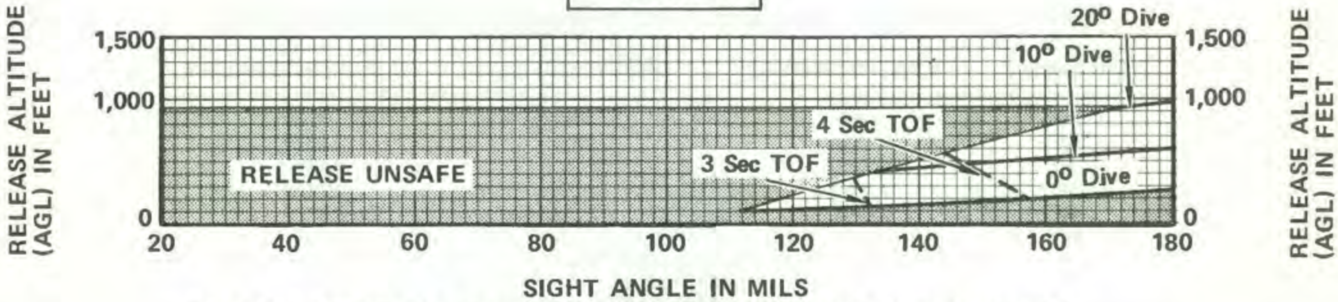
350 KIAS



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	100	100*	100*
10°	420	420*	420*
20°	850	850*	850*
30°	1,510	1,510*	1,510*
40°	2,290	2,290*	2,290*
45°	2,630	2,630*	2,630*

400 KIAS



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	100	100*	100*
10°	460	460*	460*
20°	970	970*	970*
30°	1,750	1,750*	1,750*
40°	2,690	2,690*	2,690*
45°	3,130	3,130*	3,130*

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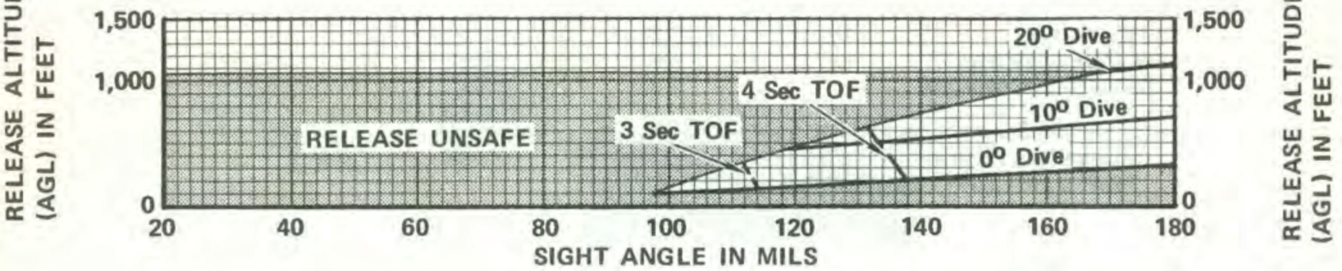
Figure 2–51 (Sheet 1)

Mil Lead for Single Delivery

MARK 81 SNAKEYE I – RETARDED

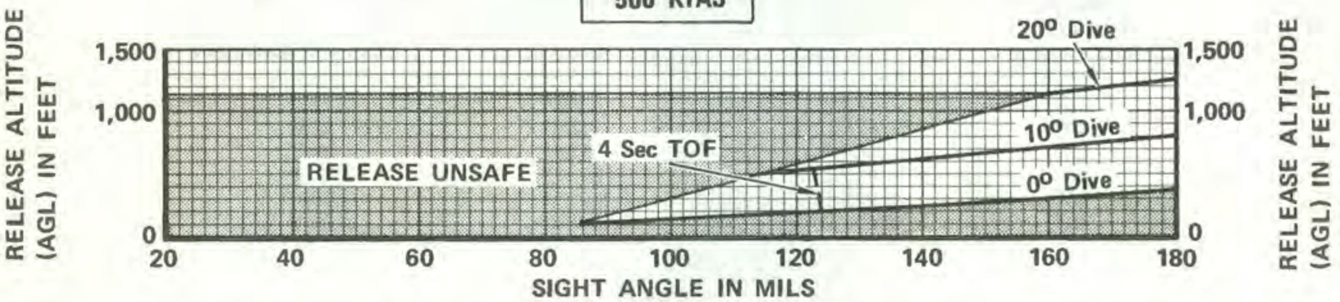
450 KIAS



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	100	100*	100*
10°	500	500*	500*
20°	1,100	1,100*	1,100*
30°	2,010	2,010*	2,010*
40°	3,130	3,130*	3,130*
45°	3,680	3,680*	3,680*

500 KIAS



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	100	100*	100*
10°	550	550*	550*
20°	1,240	1,240*	1,240*
30°	2,280	2,280*	2,280*
40°	3,610	3,610*	3,610*
45°	4,270	4,270*	4,270*

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

For increase (decrease) in temperature, increase (decrease) the mil lead; linear interpolation shall be used for nonstandard temperatures other than those given.

*Terrain avoidance is determining factor for this release altitude limitation.

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Figure 2-51 (Sheet 2)

Tested Delivery Data

MARK 81 SNAKEYE I – RETARDED

DIVE ANGLE	MIL LEAD EJECTED MILS	MIL LEAD NON-EJECTED (MBR) – MILS	ENTRY KIAS	ENTRY ALTITUDE FT AGL	ENTRY APPROX RPM %	RELEASE KTAS	RELEASE ALTITUDE FT AGL	RELEASE ALTIMETER LAG – FT	CORRECTION PER 10 KT OF DIRECT WIND – MILS Range	CORRECTION PER 10 KT OF DIRECT WIND – MILS Cross	RELEASE ERROR SENSITIVITIES FT/KT KIAS	RELEASE ERROR SENSITIVITIES FT/100 FT ALTITUDE	RELEASE ERROR SENSITIVITIES FT/DEG DIVE ANGLE
LEVEL	144	137	435	150	93	450	150	0	3	35	2.5	750	Climb -300 Dive +170
10°	138	135	400	3,000	91	450	500	125	3	35	2	160	50

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

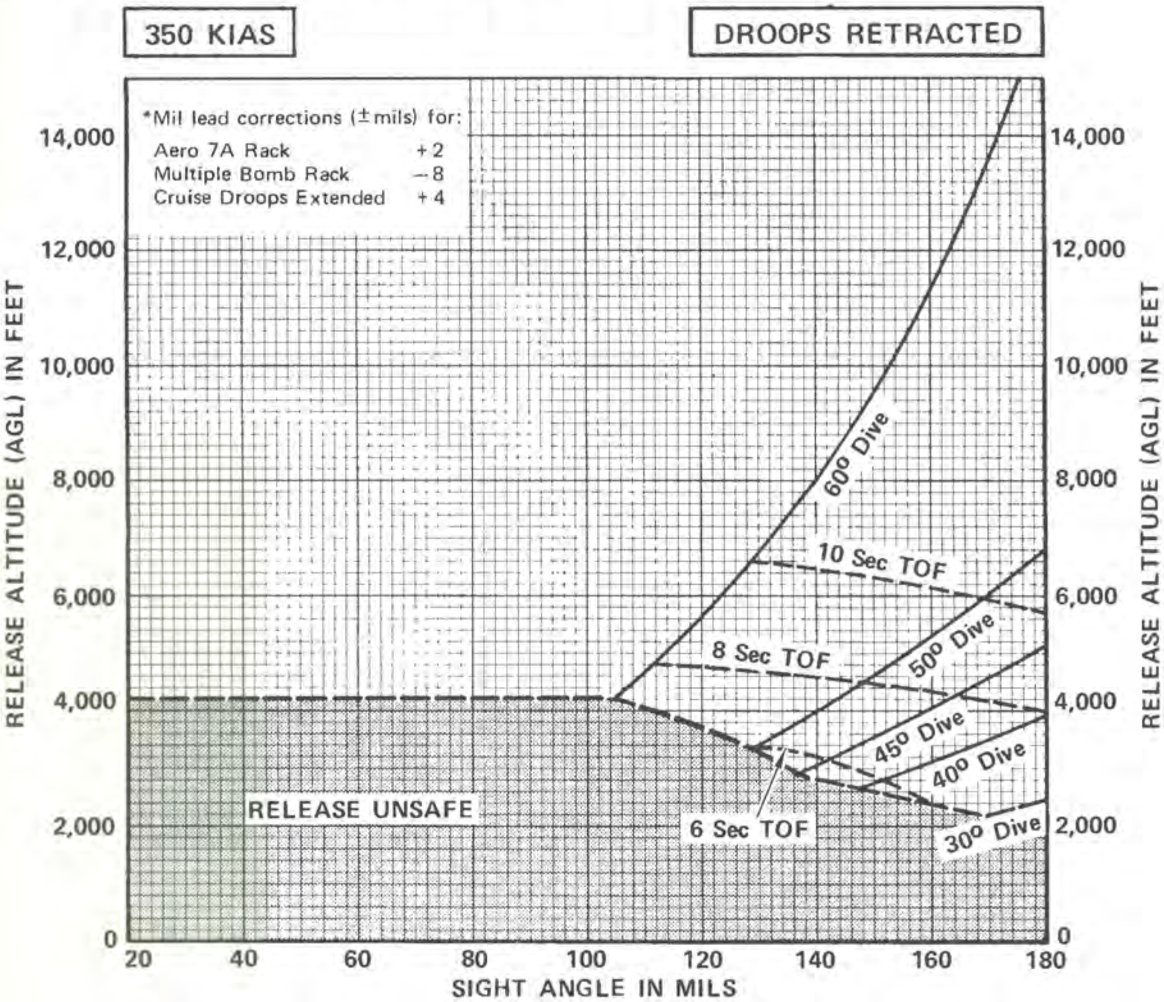
2. F-8 used in test was flown with cruise droop extended.

AZ–238–2–67

Figure 2–52

Mil Lead for Single Delivery

MARK 81 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,360	1,070	760
10°	1,190	1,040	800
20°	1,620	1,490	1,210
30°	2,040	1,940	1,620
40°	2,550	2,390	2,290
45°	2,750	2,630	2,630†
50°	3,310	3,310†	3,310†
60°	4,150	4,150†	4,150†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

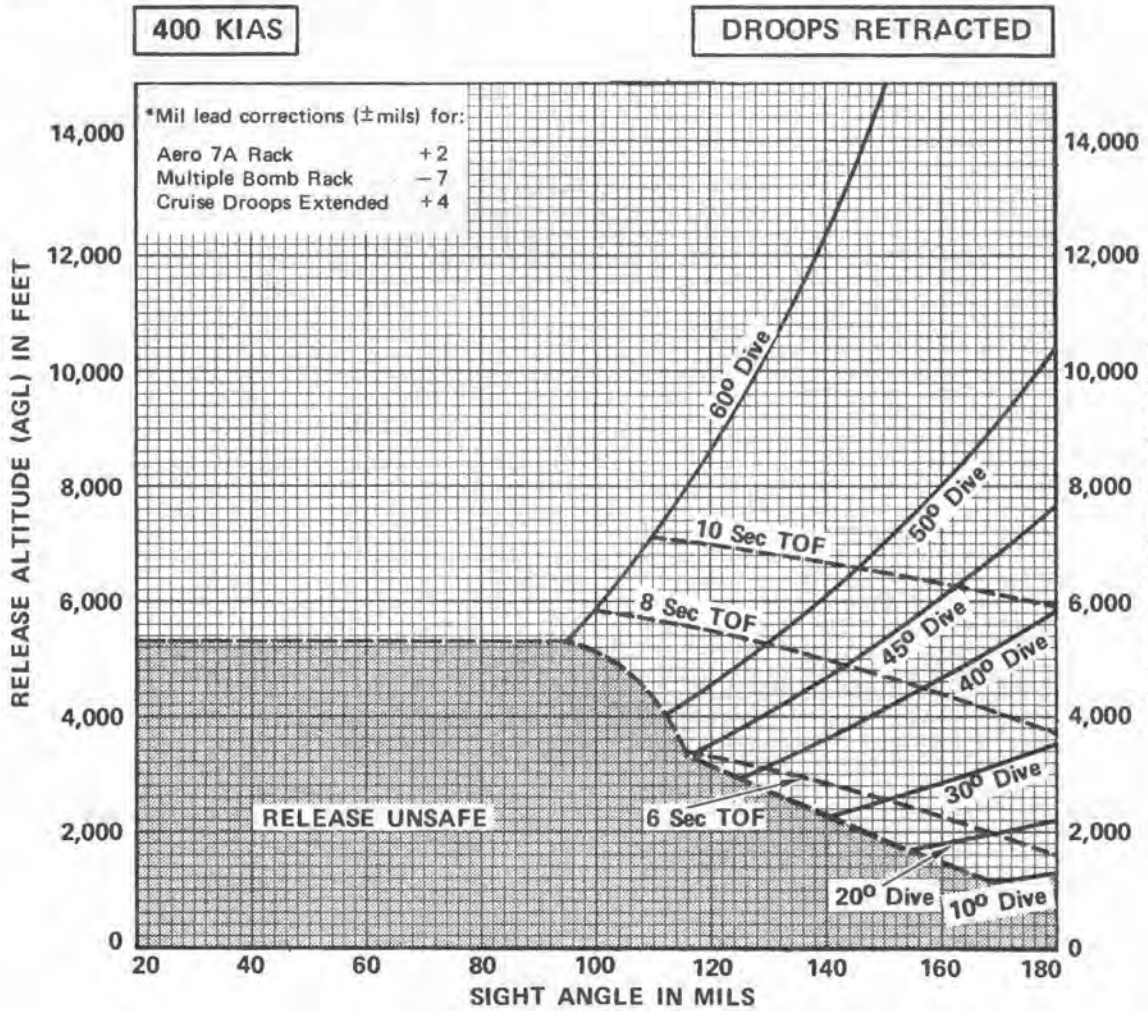
*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-214(1)-02-69

Figure 2–53 (Sheet 1)

Mil Lead for SingleDelivery

MARK 81 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,080	910	670
10°	1,110	1,020	810
20°	1,720	1,540	1,300
30°	2,220	2,070	1,750
40°	2,760	2,690	2,690†
45°	3,130	3,130†	3,130†
50°	3,930	3,930†	3,930†
60°	5,040	5,040†	5,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

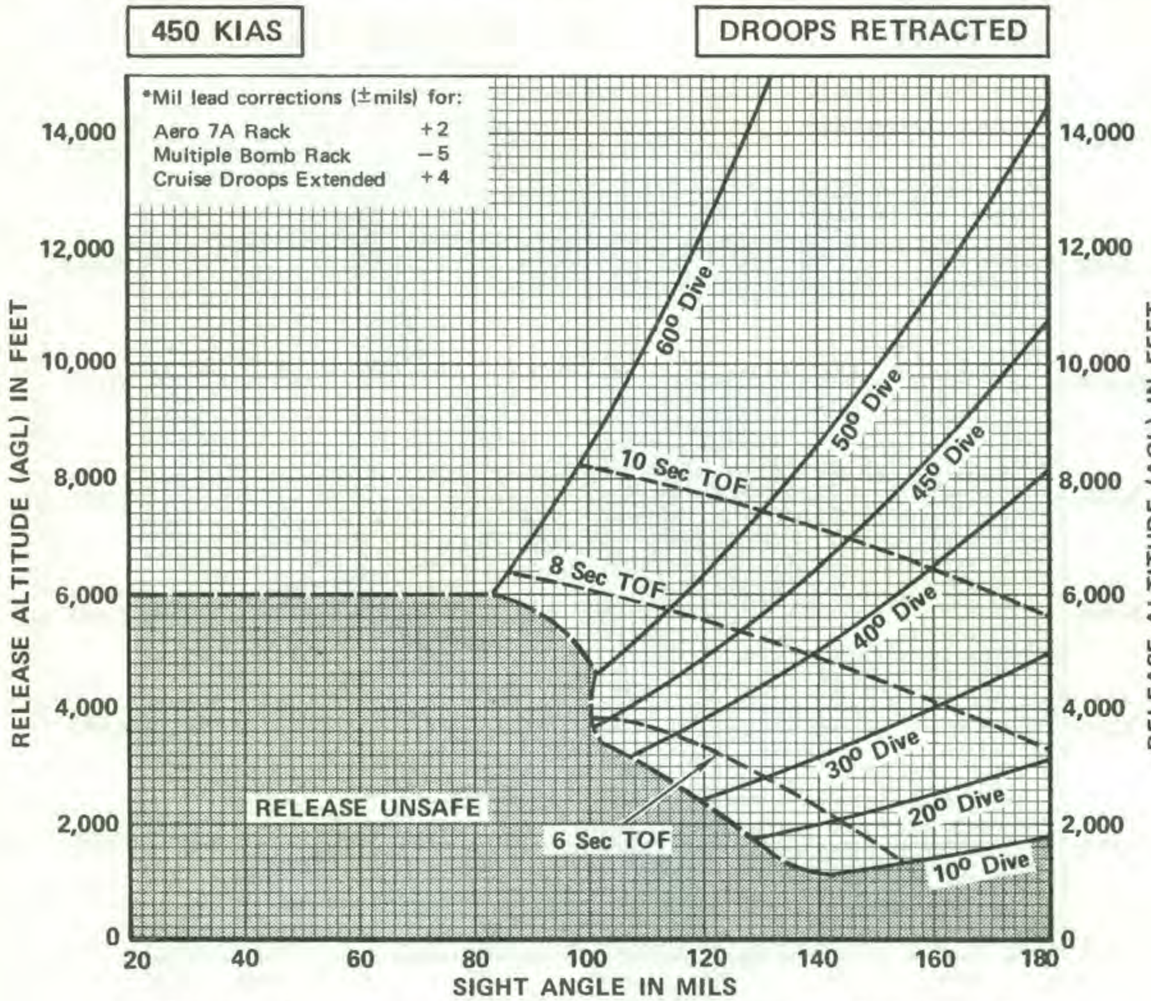
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-214(2)-02-69

Figure 2–53 (Sheet 2)

Mil Lead for Single Delivery

MARK 81 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	890	810	610
10°	1,190	1,010	840
20°	1,800	1,580	1,390
30°	2,330	2,110	2,010
40°	3,130	3,130†	3,130†
45°	3,680	3,680†	3,680†
50°	4,610	4,610†	4,610†
60°	6,030	6,030†	6,030†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.

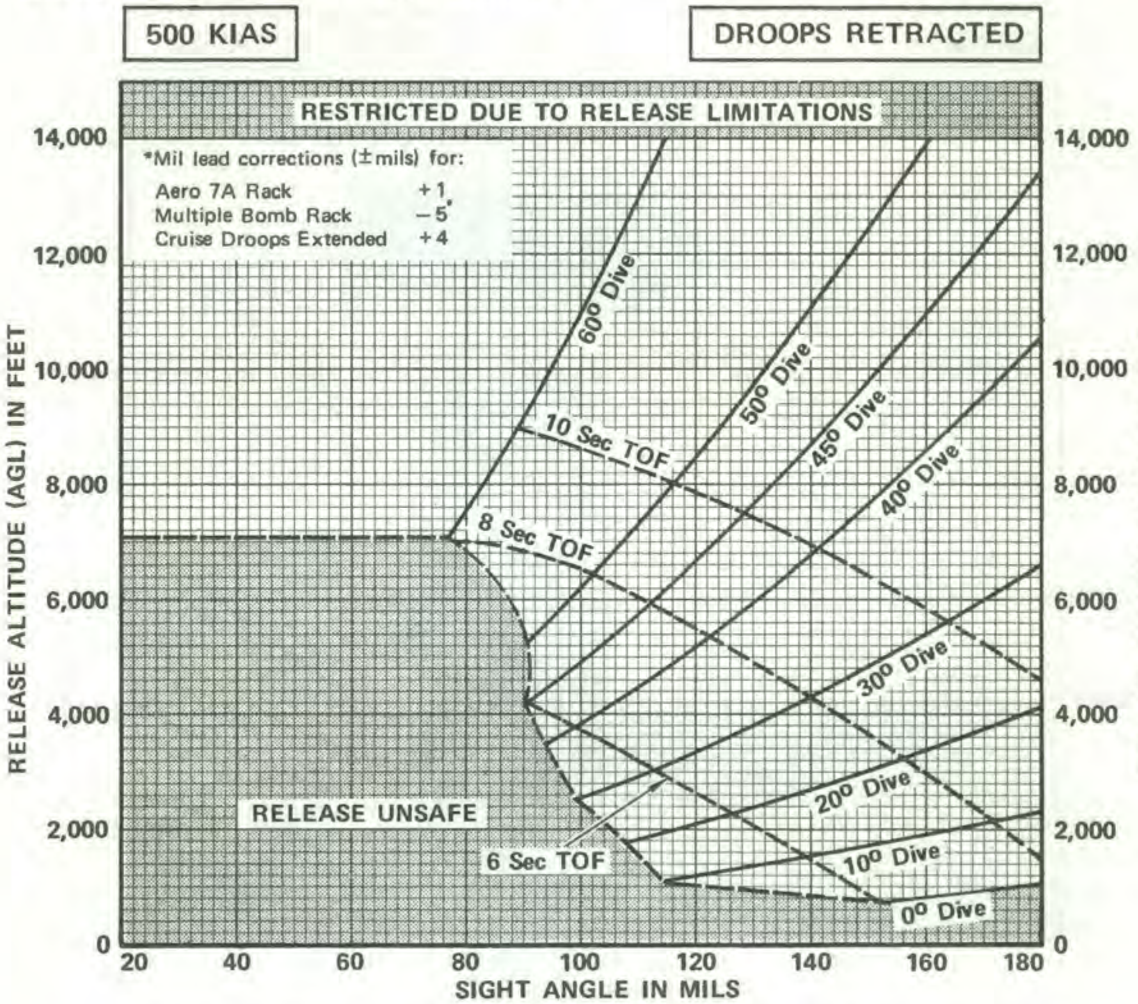
†Terrain avoidance is determining factor for this release altitude limitation.

AZ–214(3)–02–69

Figure 2–53 (Sheet 3)

Mil Lead for Single Delivery

MARK 81 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	780	670	560
10°	1,100	1,000	880
20°	1,800	1,610	1,460
30°	2,430	2,280†	2,280†
40°	3,610	3,610†	3,610†
45°	4,270	4,270†	4,270†
50°	5,340	5,340†	5,340†
60°	7,040	7,040†	7,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

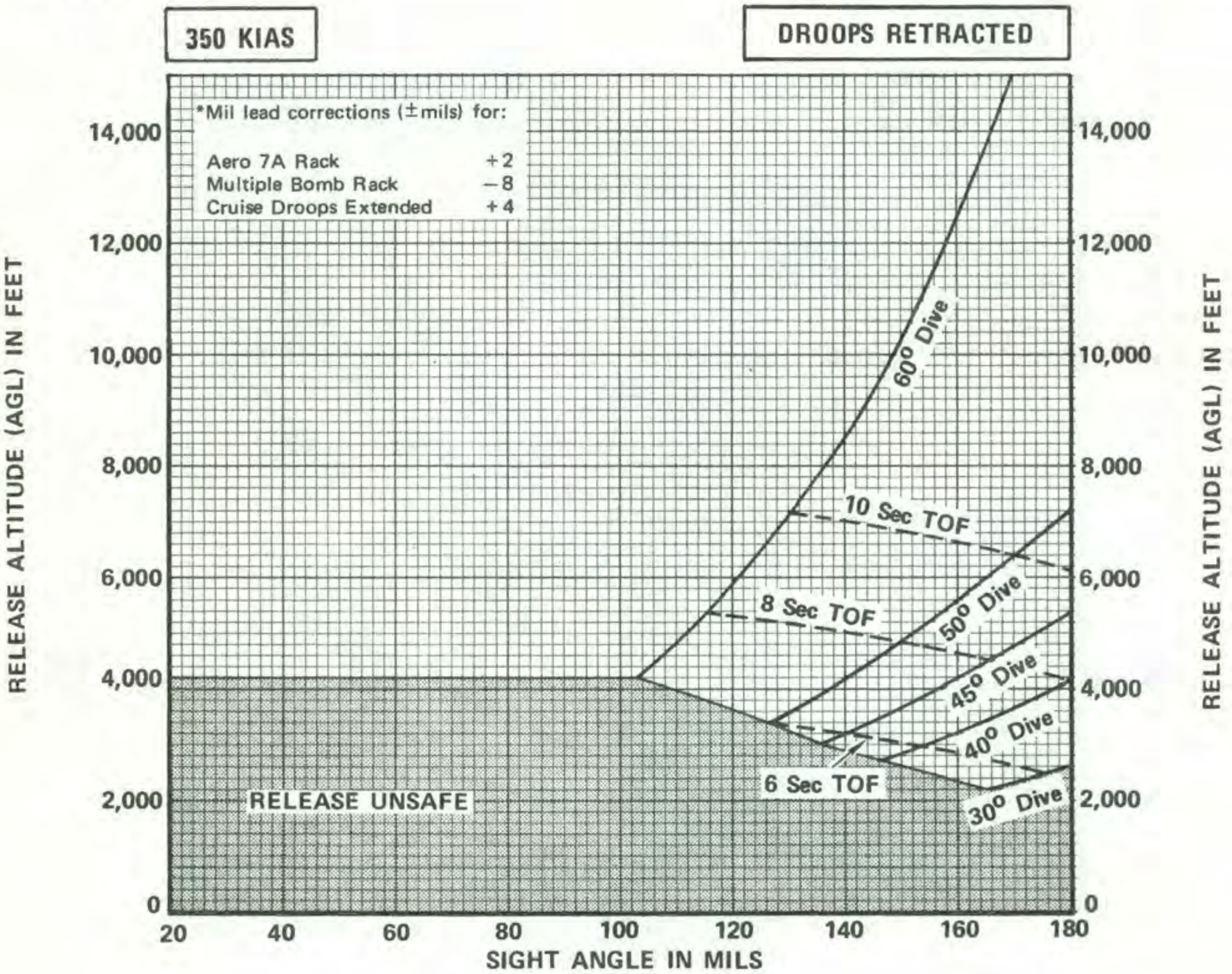
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-214(4)-02-69

Figure 2–53 (Sheet 4)

Mil Lead for Single Delivery

MARK 81 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,470	1,200	810
10°	1,200	1,070	860
20°	1,700	1,530	1,270
30°	2,120	1,990	1,700
40°	2,550	2,440	2,290
45°	2,780	2,650	2,630
50°	3,310	3,310†	3,310†
60°	4,150	4,150†	4,150†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

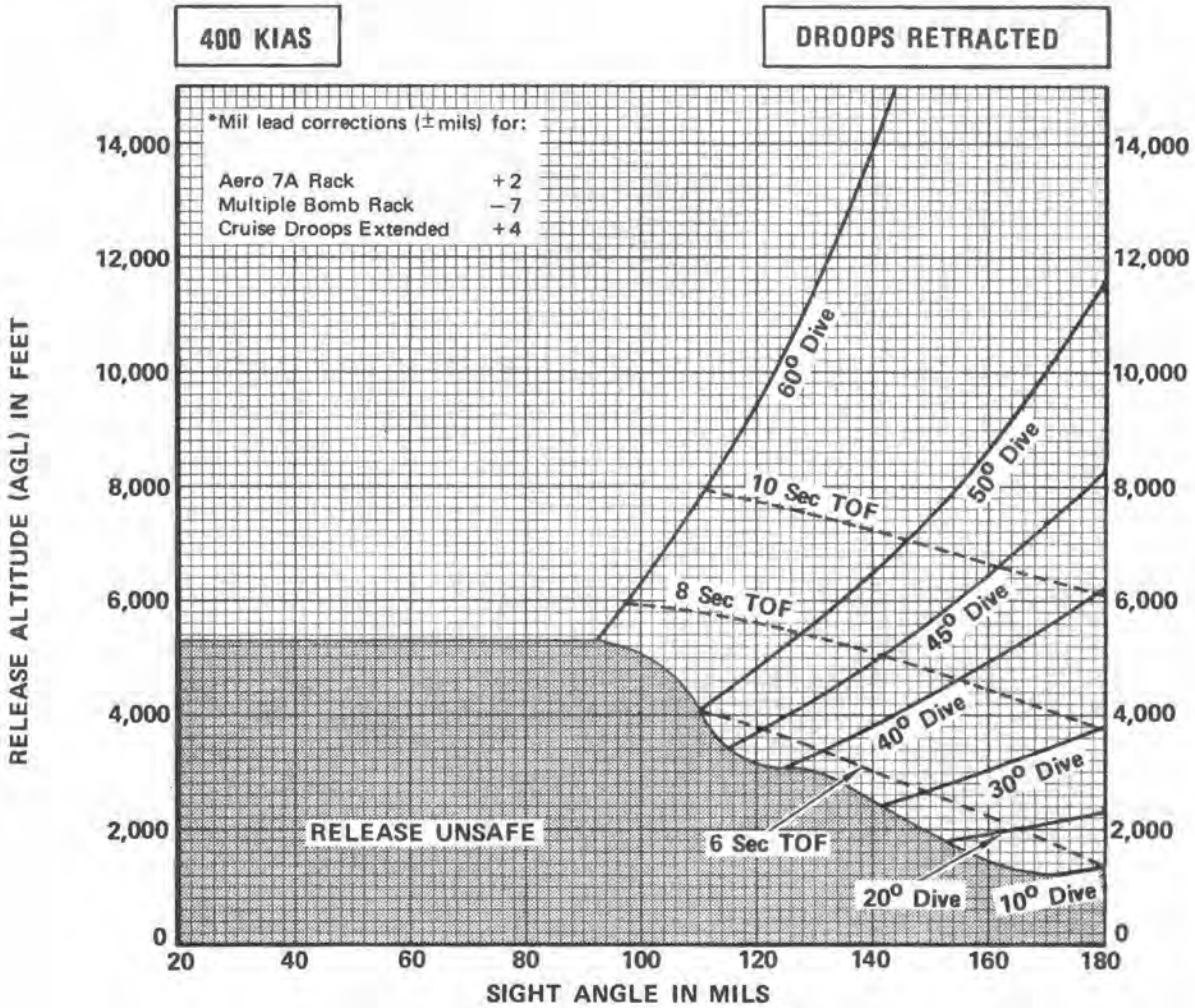
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-215(1)-02-69

Figure 2–54 (Sheet 1)

Mil Lead for Single Delivery

MARK 81 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,290	1,080	760
10°	1,200	1,060	870
20°	1,720	1,600	1,310
30°	2,250	2,150	1,820
40°	2,790	2,690	2,690†
45°	3,130	3,130†	3,130†
50°	3,930	3,930†	3,930†
60°	5,040	5,040†	5,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

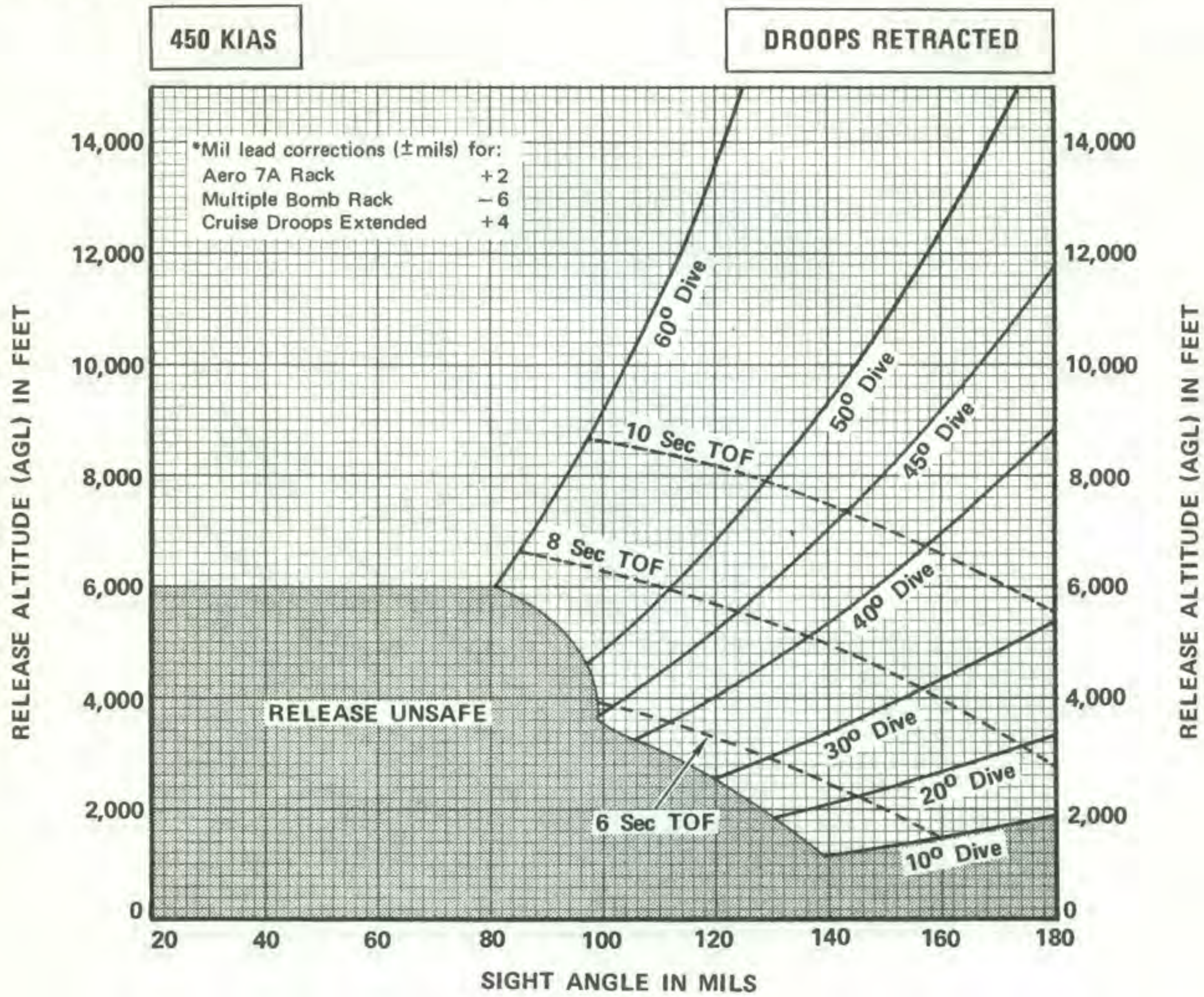
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-215(2)-02-69

Figure 2-54 (Sheet 2)

Mil Lead for Single Delivery

MARK 81 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,170	960	680
10°	1,200	1,050	890
20°	1,820	1,690	1,420
30°	2,430	2,310	2,010
40°	3,130	3,130†	3,130†
45°	3,680	3,680†	3,680†
50°	4,610	4,610†	4,610†
60°	6,030	6,030†	6,030†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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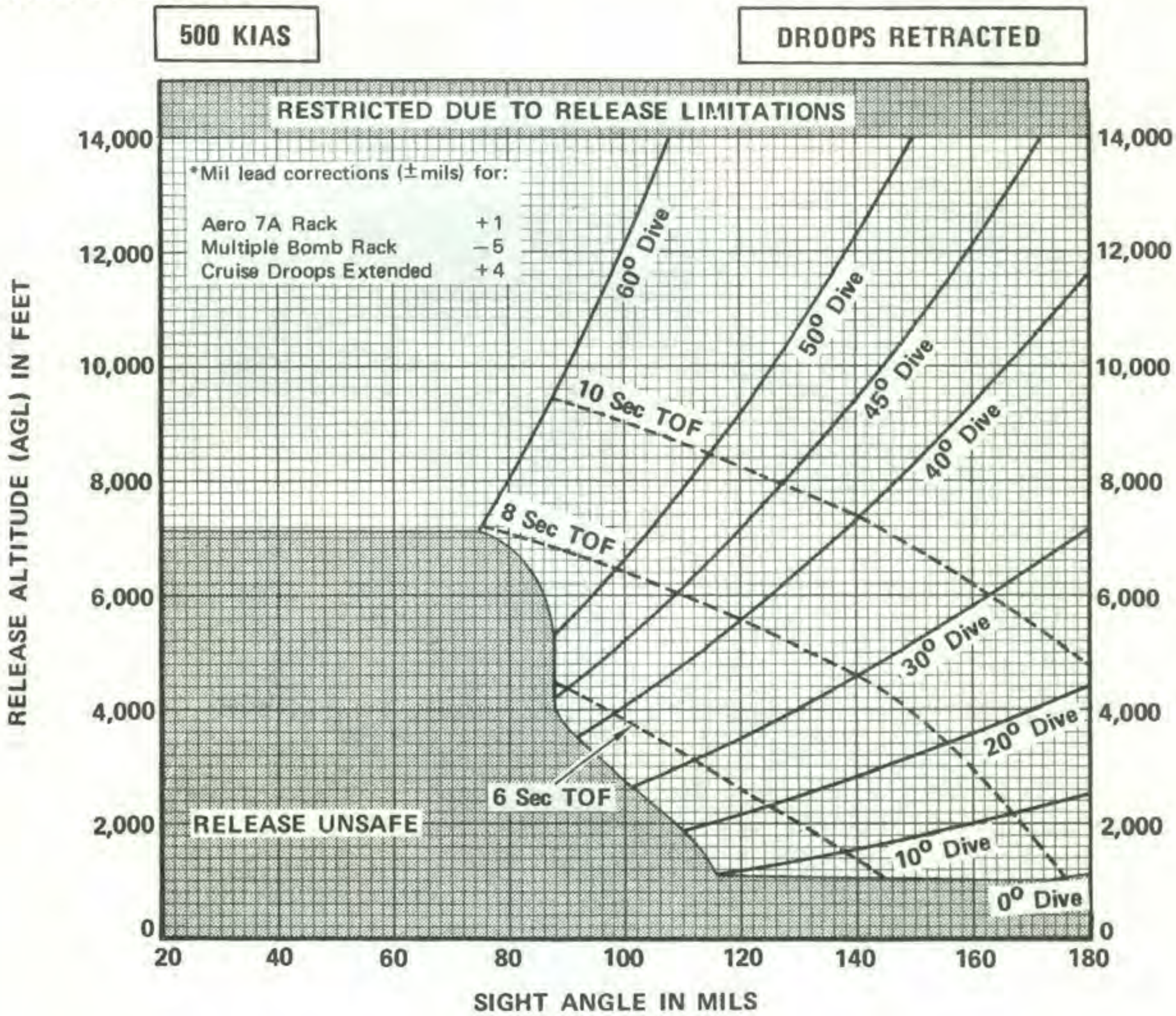
Figure 2-54 (Sheet 3)

Mil Lead for Single Delivery

MARK 81 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	990	830	680
10°	1,200	1,070	910
20°	1,900	1,770	1,520
30°	2,530	2,440	2,280
40°	3,610	3,610†	3,610†
45°	4,270	4,270†	4,270†
50°	5,340	5,340†	5,340†
60°	7,040	7,040†	7,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

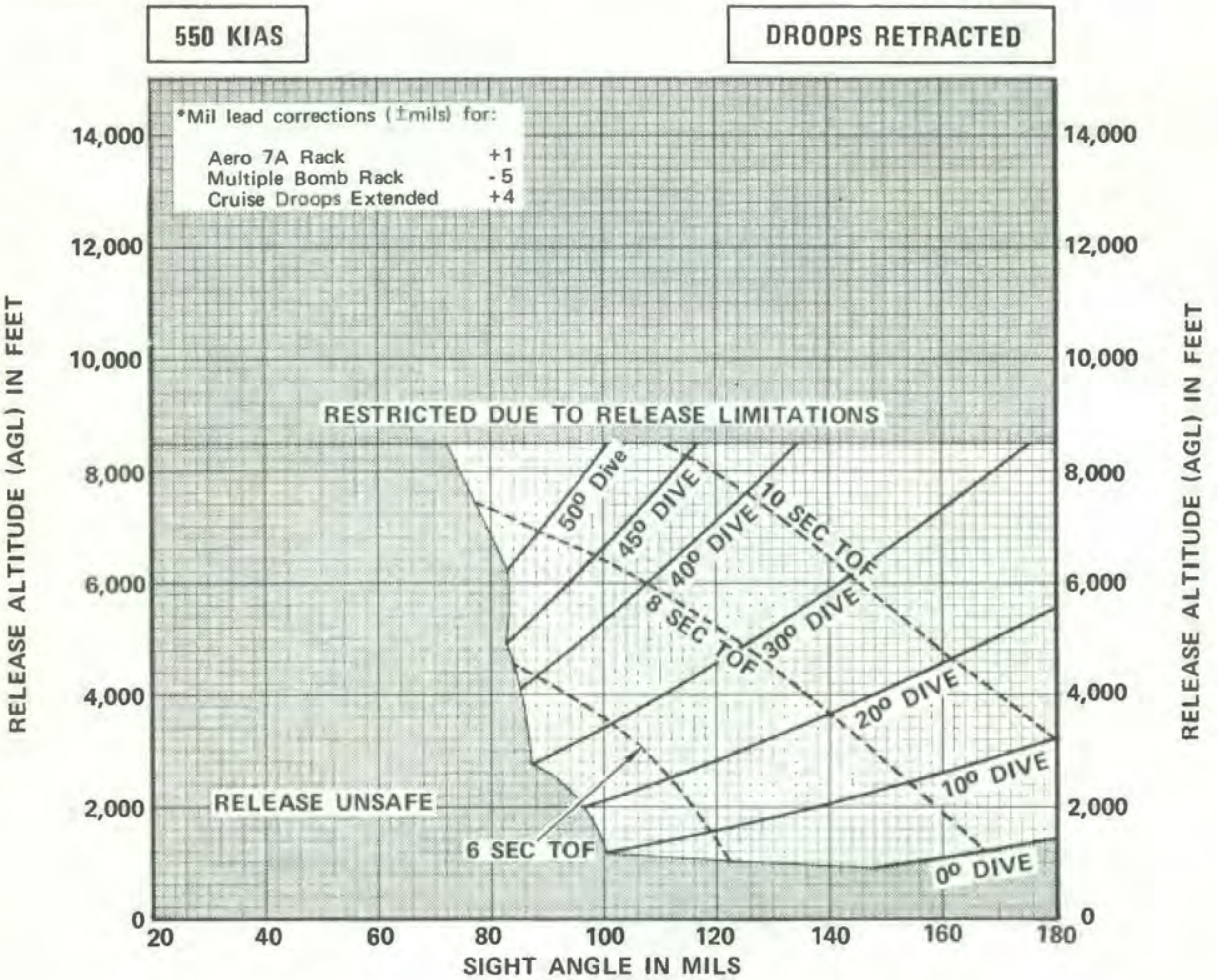
†Terrain avoidance is determining factor for this release altitude limitation.

AZ−215(4)−02−69

Figure 2–54 (Sheet 4)

Mil Lead for Single Delivery

MARK 81 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	880	780	600
10°	1,200	1,100	950
20°	1,910	1,830	1,600
30°	2,640	2,570	2,570†
40°	4,080	4,080†	4,080†
45°	4,840	4,840†	4,840†
50°	6,000	6,000†	6,000†
60°	7,920	7,920†	7,920†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10°C increase (decrease) in release altitude temperature increase (decrease) the mil lead by 3 mils.**
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-215(5)-02-69

Figure 2-54 (Sheet 5)

Maximum Fragment Envelope

MK 81 GENERAL PURPOSE AND SNAKEYE I (RETARDED OR UNRETARDED)

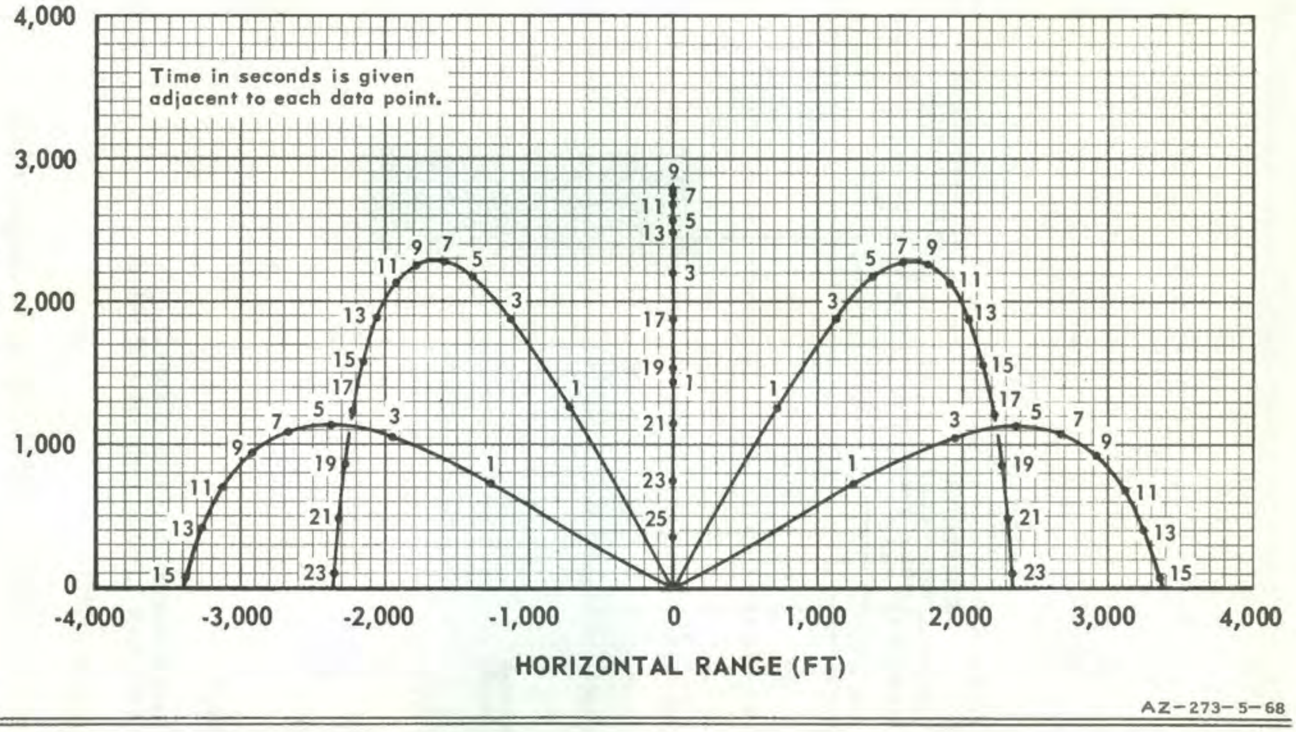


Figure 2–55

MARK 81 CONICAL FIN

DIVE ANGLE	MIL LEAD		ENTRY			RELEASE			CORRECTION PER 10 KT OF DIRECT WIND – MILS		RELEASE ERROR SENSITIVITIES				
	EJECTED MILS	NON-EJECTED (MBR) – MILS	KIAS	ALTITUDE FT AGL	APPROX RPM %	KTAS	ALTITUDE FT AGL	ALTIMETER LAG – FT	Range	Cross	FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE	FT/MIL RANGE	FT/MIL DEFLECTION
30°	114	108	350	7,000	94	500	2,500	250	11	19	2	20	22	8	5
45°	115	108	250	10,000	86	450	3,500	0	16	20	2	10	15	6	5
45°	125	118	250	10,500	86	450	4,000	0	16	20	2	10	15	6	5

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

2. Mil lead computed for 28,000 lb aircraft with cruise droop extended.
   Correction – Add/subtract 1 mil for each 1,000 lb over/under 28,000 lb.

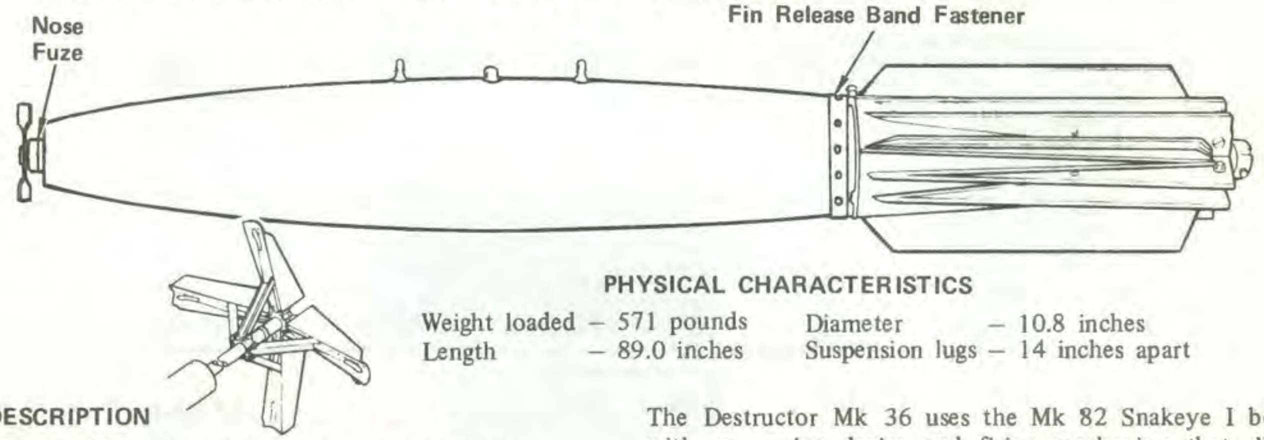
3. 45° dive profiles flown with speed brakes OUT.

AZ-242-2-67

Figure 2–56

MK 82 GP Bomb Snakeye I

DESTRUCTOR MK 36 AND MK 124 PRACTICE BOMB



PHYSICAL CHARACTERISTICS

Weight loaded – 571 pounds Diameter – 10.8 inches
Length – 89.0 inches Suspension lugs – 14 inches apart

DESCRIPTION

The Mk 82 Snakeye Weapon is a general purpose drogue-type bomb which can be adapted for delivery either retarded or unretarded. Unretarded the weapon follows a free-fall trajectory. Retarded, the trajectory drop of the weapon is about 25% greater than in the low-drag mode and the impact angle increases for improved effectiveness. The retarded mode allows lower release altitude and gives greater accuracy and release flexibility.

The Destructor Mk 36 uses the Mk 82 Snakeye I bomb with an arming device and firing mechanism that allows the weapon to function as an influence weapon against shallow water and land targets. The Mk 124 is a full scale, retarded or free-fall practice bomb for fleet training in Snakeye I and conical versions of the Mk 82 series. The Mk 82 mil lead charts are applicable to the Mk 36 and the Mk 124.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A SUSPENSION One Bomb Each Wing 	2 MK 82 2 Aero 7A-1 2 Pylons Total One Wing Only	1142 104 350 1596 798
TER SUSPENSION Three Bombs Each Wing 	6 MK 82 2 TER 2 Aero 7A-1 2 Pylons Total One Wing Only	3426 210 104 350 4090 2045
MER SUSPENSION Three Bombs Each Wing 	6 MK 82 2 MER 2 Aero 7A-1 2 Pylons Total One Wing Only	3426 446 104 350 4326 2163
MBR SUSPENSION Three Bombs Each Wing 	6 MK 82 2 MBR 2 Aero 7A-1 2 Pylons Total One Wing Only	3426 318 104 350 4198 2099

DROPPING PROCEDURE (Mechanical Fuzing)	DROPPING PROCEDURE (Electrical Fuzing)
1. Master Arm Sw – ON 2. Armament Sel Sw – Wing L or R 3. Mechanical Fuzing Sw – NOSE or TAIL 4. Stores Release Sw – DEPRESS	1. Master Arm Sw – ON 2. Armament Sel Sw – Wing L or R 3. Option Sel Sw – As Desired 4. Safe-Stby-Ready Sw – STDY (30 sec) then RDY 5. HV DC Light – ON 6. Stores Release Sw – DEPRESS

NOTE

For simultaneous releases from the Aero 7A-1 racks, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position and the Arm Sel Sw in the WING, L position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -505 or -521 TER or MER, the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past empty stations.

JETTISONING PROCEDURES

See JETTISONING, this section.

REFERENCES

1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216) and DST 36 OP 3529 (Mk 36)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ-93-03-70

Figure 2–57 (U)

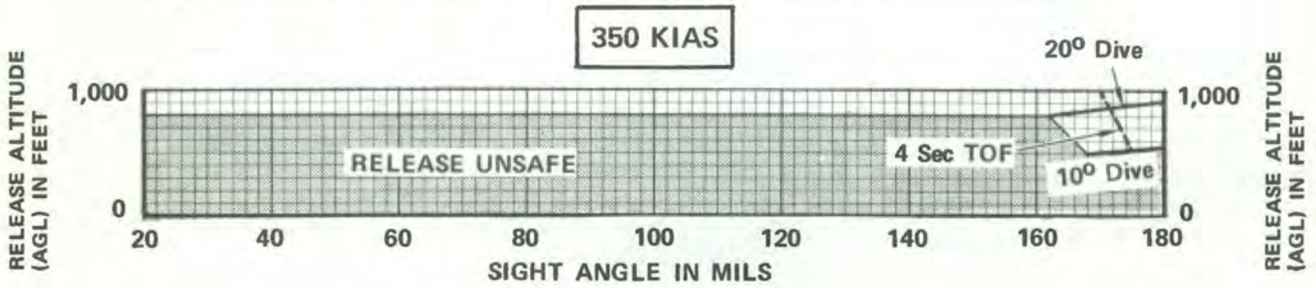
Mil Lead for Single Delivery

MARK 82 SNAKEYE 1 – RETARDED

*Mil lead corrections (±mils) for:

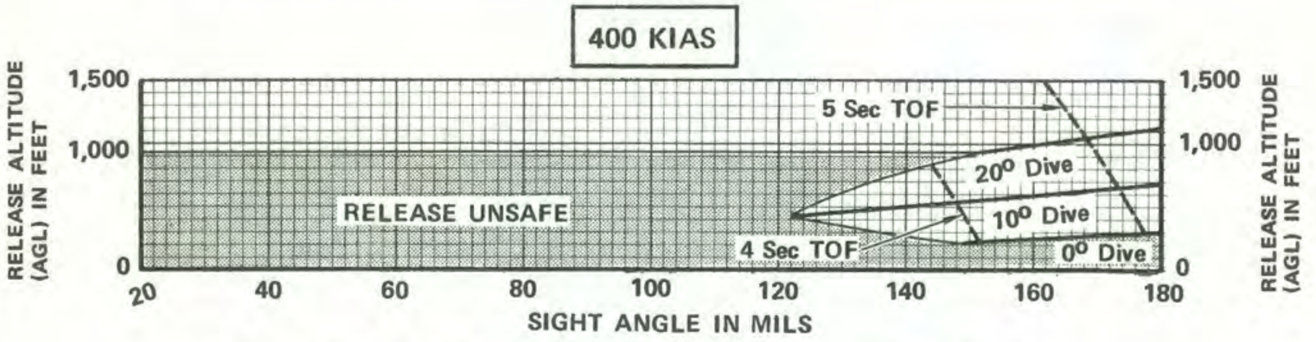
	350 KIAS	400 KIAS	450 KIAS	500 KIAS
Aero 7A Rack	+1	+1	+1	+1
Multiple Bomb Rack	−7	−7	−6	−6 mils
Cruise Droops Extended	+4	+4	+4	+4

RELEASE ALTITUDE TEMP VARIATION	DIVE ANGLE	0°	10°	20°
± 10° C		± 2	± 3	± 5
± 30° C		± 8	± 11	± 14 mils



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	200	200*	100
10°	500	420*	420*
20°	850	850*	850*
30°	1,510	1,510*	1,510*
40°	2,290	2,290*	2,290*
45°	2,630	2,630*	2,630*



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	200	100*	100*
10°	460	460*	460*
20°	970	970*	970*
30°	1,750	1,750*	1,750*
40°	2,690	2,690*	2,690*
45°	3,130	3,130*	3,130*

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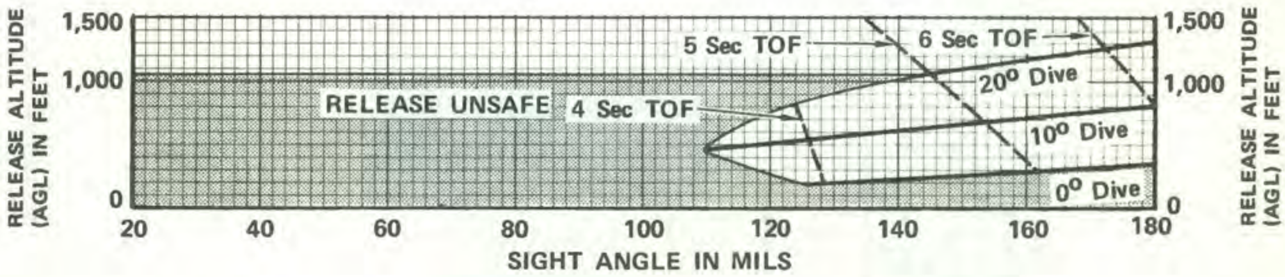
Figure 2–58 (Sheet 1)

Mil Lead for Single Delivery

MARK 82 SNAKEYE I – RETARDED

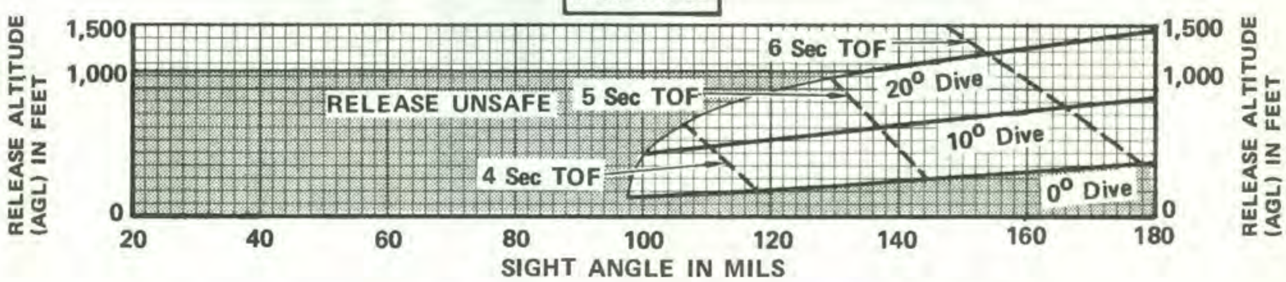
450 KIAS



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	100	100*	100*
10°	500	500*	500*
20°	1,100	1,100*	1,100*
30°	2,010	2,101*	2,010*
40°	3,130	3,130*	3,130*
45°	3,680	3,680*	3,680*

500 KIAS



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	100	100*	100*
10°	550	550*	550*
20°	1,240	1,240*	1,240*
30°	2,280	2,280*	2,280*
40°	3,610	3,610*	3,610*
45°	4,270	4,270*	4,270*

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.6 ft/sec average ejection velocity. Released from MER or TER.

For increase (decrease) in temperature, increase (decrease) the mil lead; linear interpolation shall be used for nonstandard temperatures other than those given.

*** Terrain avoidance is determining factor for this release altitude limitation.**

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Figure 2–58 (Sheet 2)

MARK 82 SNAKEYE I – RETARDED

DIVE ANGLE	MIL LEAD		ENTRY			RELEASE			CORRECTION PER 10 KT OF DIRECT WIND – MILS		RELEASE ERROR SENSITIVITIES		
	EJECTED MILS	NON-EJECTED (MBR) – MILS	KIAS	ALTITUDE FT AGL	APPROX RPM %	KTAS	ALTITUDE FT AGL	ALTIMETER LAG – FT	Range	Cross	FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE
LEVEL	135	128	435	150	94	450	150	0	3	35	2.5	750	Climb -300 Dive +170
10°	130	128	400	3,000	90	450	500	125	3	35	2	160	50

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

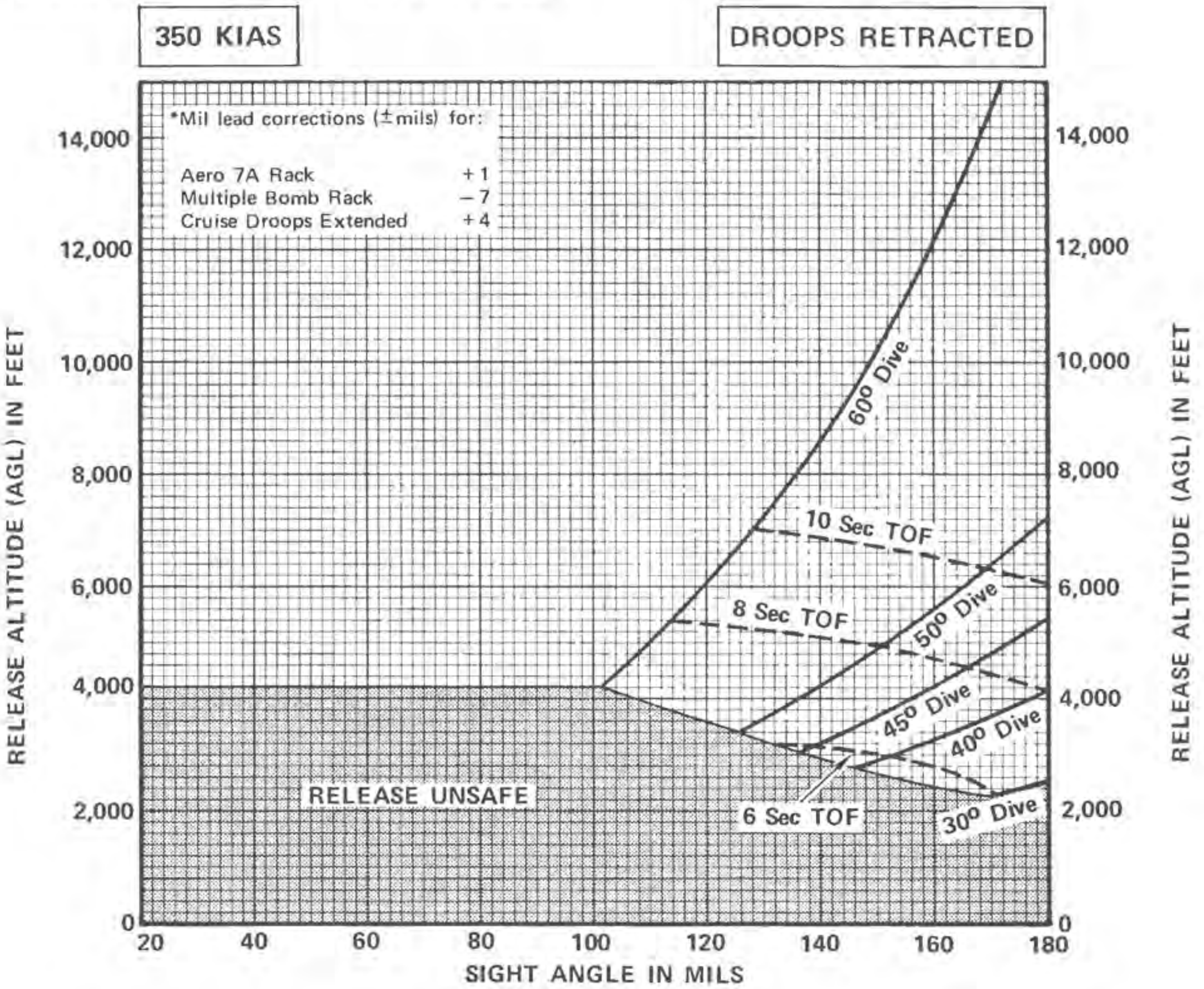
2. F-8 used in test was flown with cruise droop extended.

AZ–239–2–67

Figure 2–59

Mil Lead for Single Delivery

MARK 82 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,370	1,100	970
10°	1,200	950	900
20°	1,700	1,400	1,340
30°	2,120	1,830	1,760
40°	2,550	2,290	2,290†
45°	2,780	2,630	2,630†
50°	3,310	3,310†	3,310†
60°	4,150	4,150†	4,150†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.6 ft/sec average ejection velocity. Released from MER or TER.

*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.

†Terrain avoidance is determining factor for this release altitude limitation.

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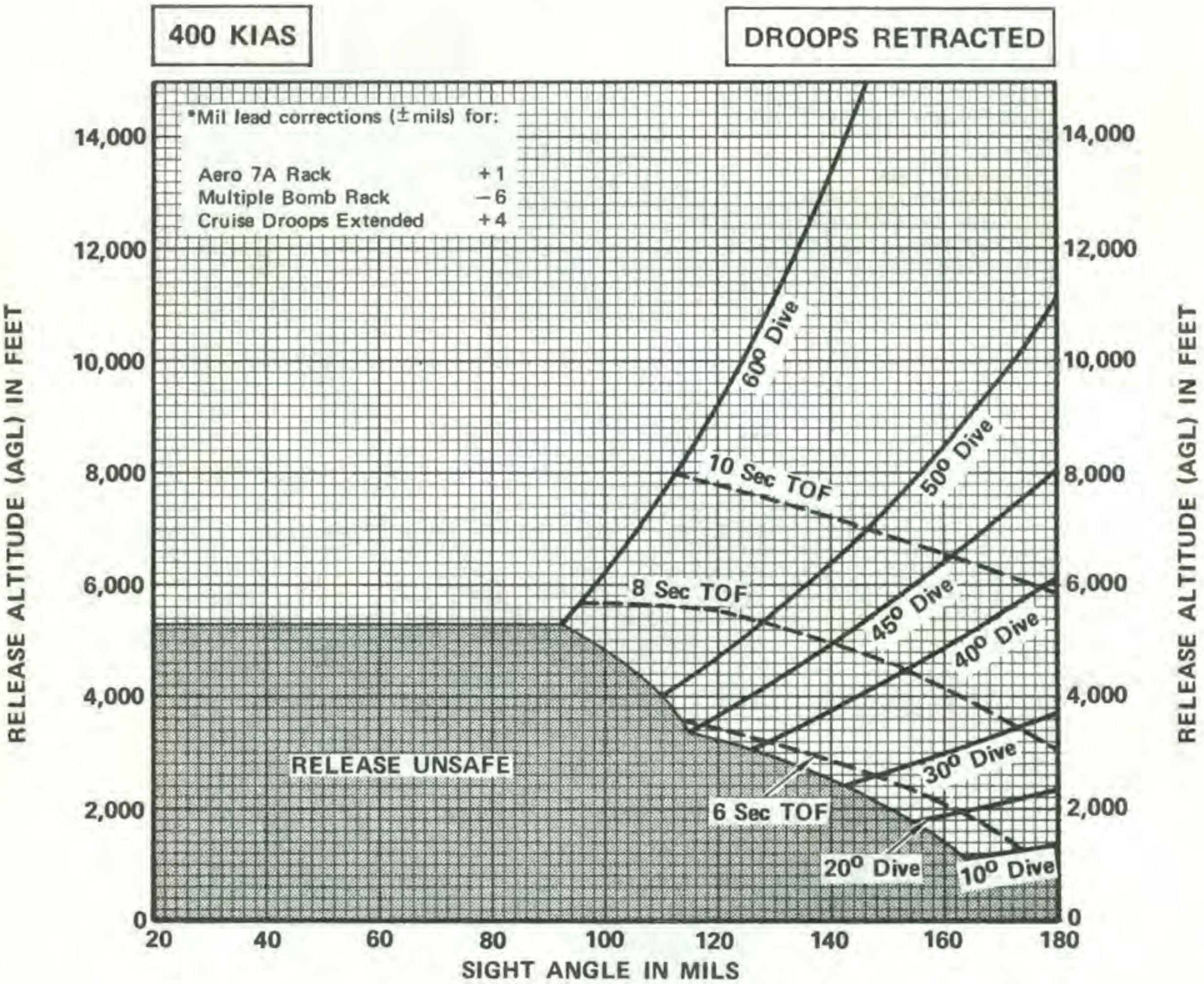
Figure 2–60 (Sheet 1)

Mil Lead for Single Delivery

MARK 82 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,180	960	840
10°	1,200	980	900
20°	1,720	1,460	1,390
30°	2,250	1,980	1,890
40°	2,790	2,690	2,690†
45°	3,130	3,130†	3,130†
50°	3,930	3,930†	3,930†
60°	5,040	5,040†	5,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.6 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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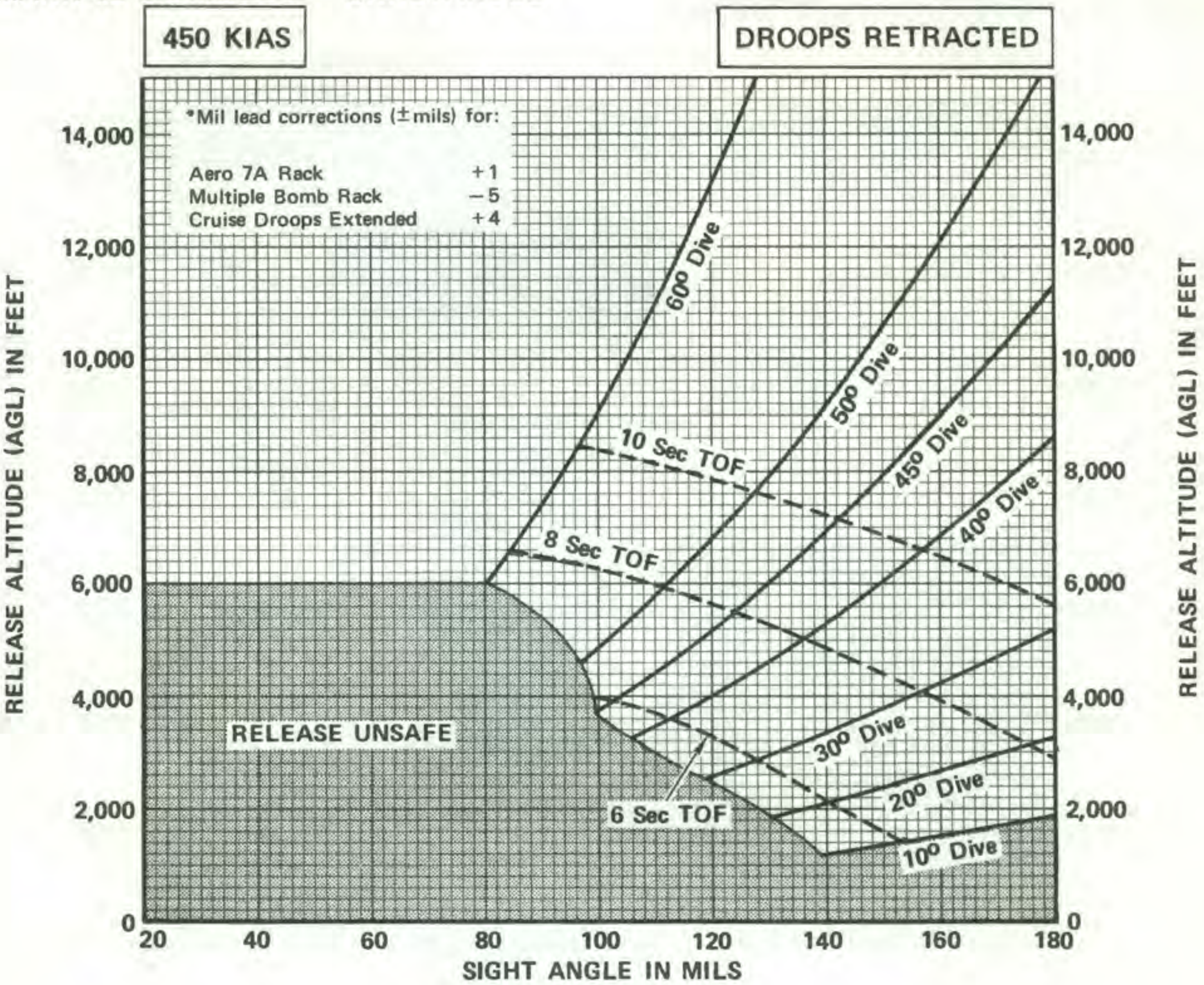
Figure 2-60 (Sheet 2)

Mil Lead for Single Delivery

MARK 82 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	980	820	750
10°	1,200	990	940
20°	1,820	1,550	1,480
30°	2,430	2,120	2,030
40°	3,130	3,130†	3,130†
45°	3,680	3,680†	3,680†
50°	4,610	4,610†	4,610†
60°	6,030	6,030†	6,030†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.6 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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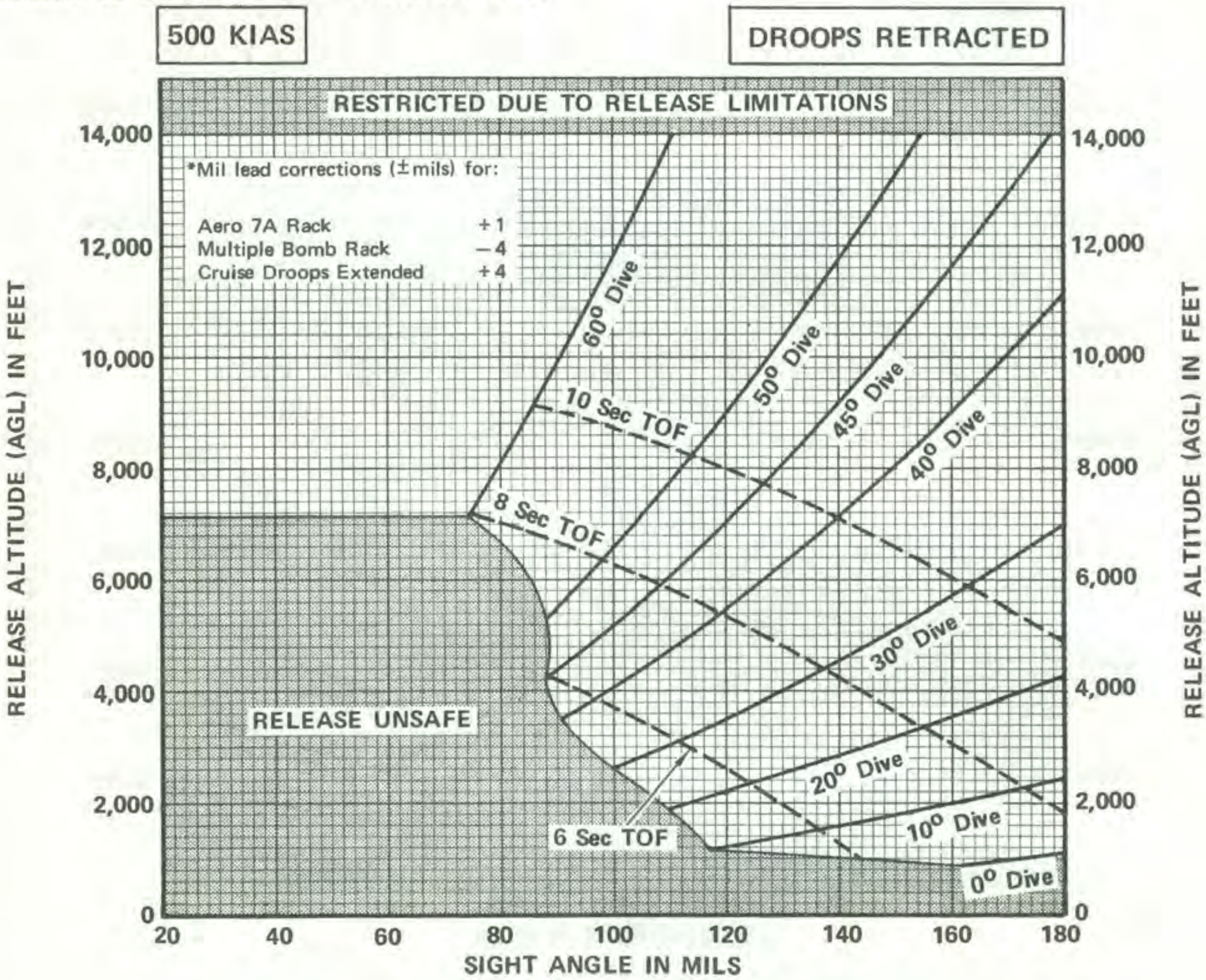
Figure 2-60 (Sheet 3)

Mil Lead for Single Delivery

MARK 82 SNAKEYE I – UNRETARDED



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	790	760	670
10°	1,200	1,000	930
20°	1,900	1,630	1,550
30°	2,530	2,280	2,280†
40°	3,610	3,610†	3,610†
45°	4,270	4,270†	4,270†
50°	5,340	5,340†	5,340†
60°	7,040	7,040†	7,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.6 ft/sec average ejection velocity. Released from MER or TER.

*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.

†Terrain avoidance is determining factor for this release altitude limitation.

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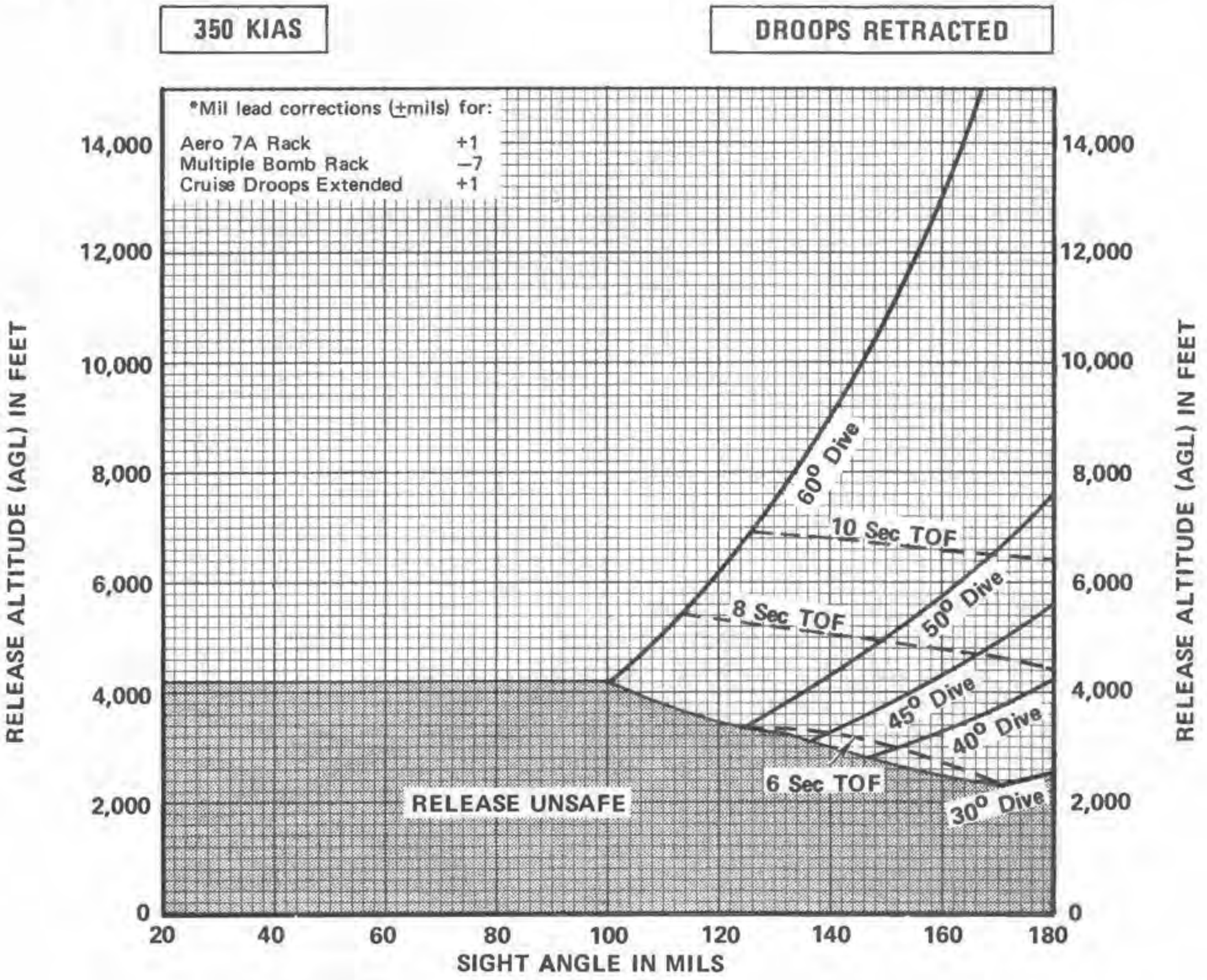
Figure 2-60 (Sheet 4)

Mil Lead for SingleDelivery

MK 82 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,570	1,230	1,010
10°	1,300	1,000	940
20°	1,720	1,410	1,360
30°	2,220	1,860	1,800
40°	2,650	2,300	2,290
45°	2,860	2,630	2,630†
50°	3,310	3,310†	3,310†
60°	4,150	4,150†	4,150†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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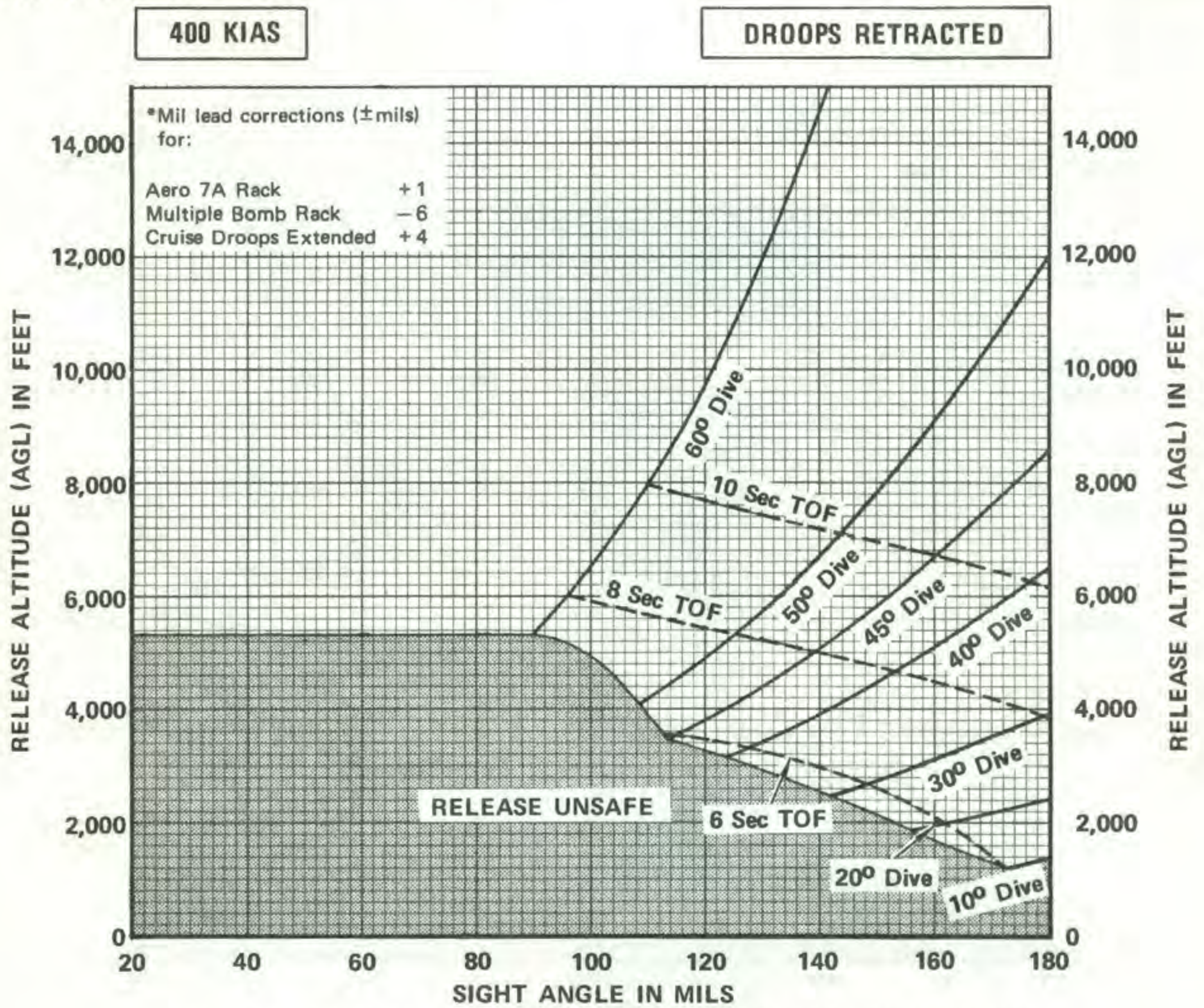
Figure 2-61 (Sheet 1)

Mil Lead for Single Delivery

MK 82 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,390	1,090	950
10°	1,290	1,000	930
20°	1,820	1,510	1,430
30°	2,350	2,040	1,950
40°	2,890	2,690	2,690†
45°	3,130	3,130†	3,130†
50°	3,930	3,930†	3,930†
60°	5,040	5,040†	5,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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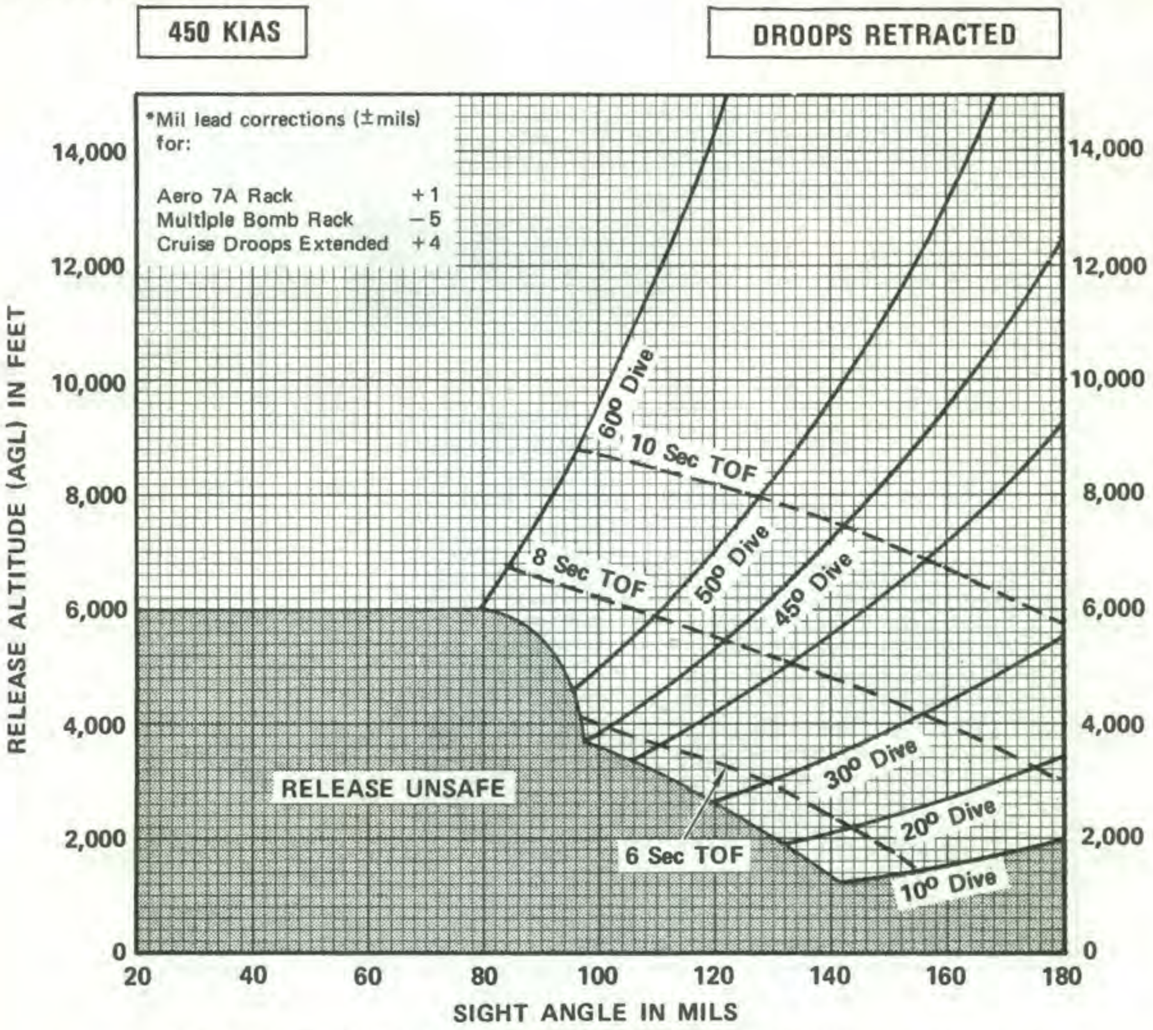
Figure 2-61 (Sheet 2)

Mil Lead for Single Delivery

MK 82 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,270	970	870
10°	1,210	1,020	960
20°	1,920	1,610	1,530
30°	2,530	2,200	2,090
40°	3,170	3,130	3,130†
45°	3,680	3,680†	3,680†
50°	4,610	4,610†	4,610†
60°	6,030	6,030†	6,030†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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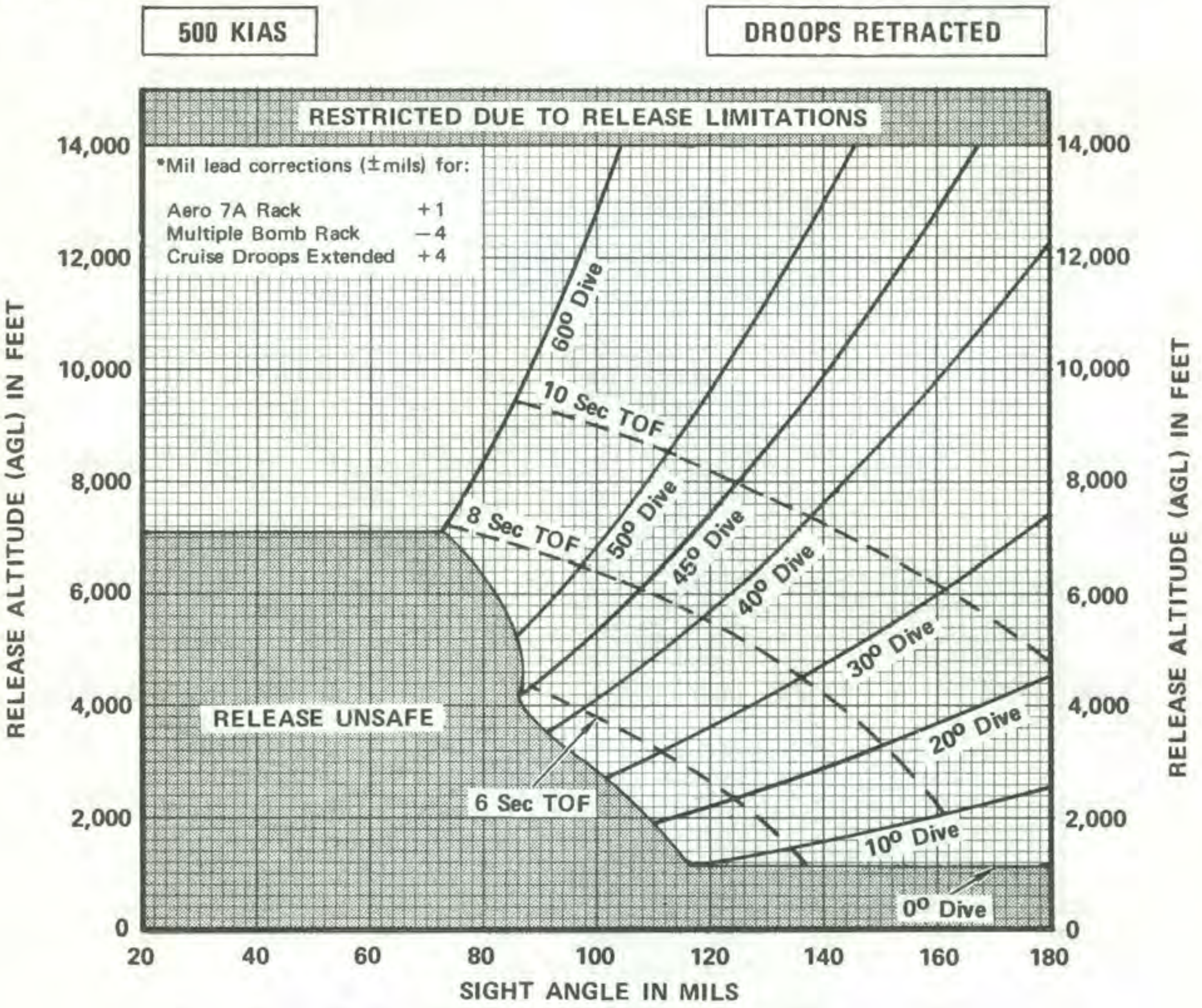
Figure 2-61 (Sheet 3)

Mil Lead for Single Delivery

MK 82 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,090	890	800
10°	1,300	1,050	990
20°	2,000	1,700	1,630
30°	2,670	2,330	2,280
40°	3,610	3,610†	3,610†
45°	4,270	4,270†	4,270†
50°	5,340	5,340†	5,340†
60°	7,040	7,040†	7,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity.

Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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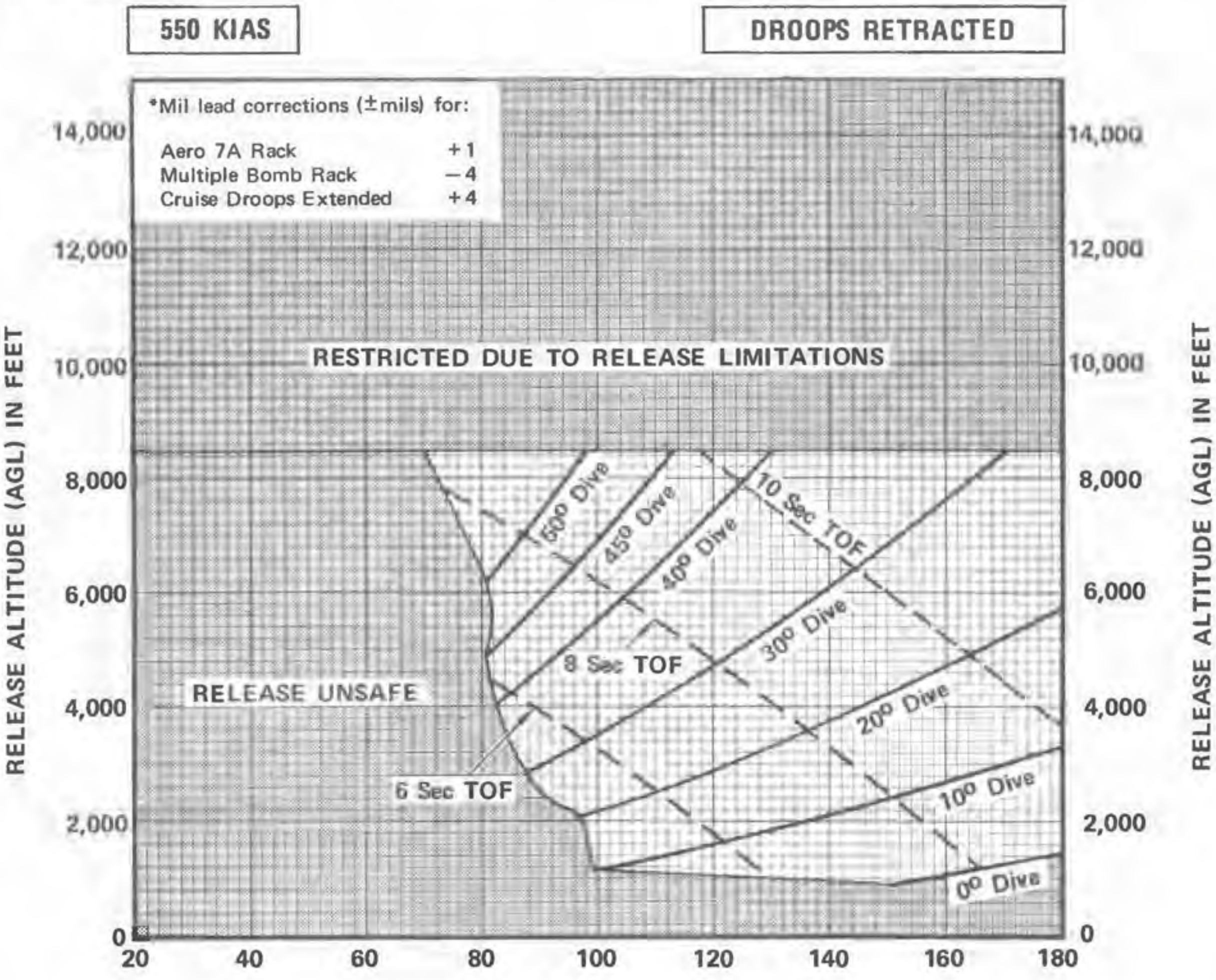
Figure 2–61 (Sheet 4)

Mil Lead for Single Delivery

MK 82 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	970	810	740
10°	1,300	1,090	1,030
20°	2,030	1,780	1,710
30°	2,840	2,570	2,570†
40°	4,080	4,080†	4,080†
45°	4,840	4,840†	4,840†
50°	6,000	6,000†	6,000†
60°	7,920	7,920†	7,920†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

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Figure 2–61 (Sheet 5)

Maximum Fragment Envelope

MK 82 GENERAL PURPOSE AND SNAKEYE I (RETARDED OR UNRETARDED)

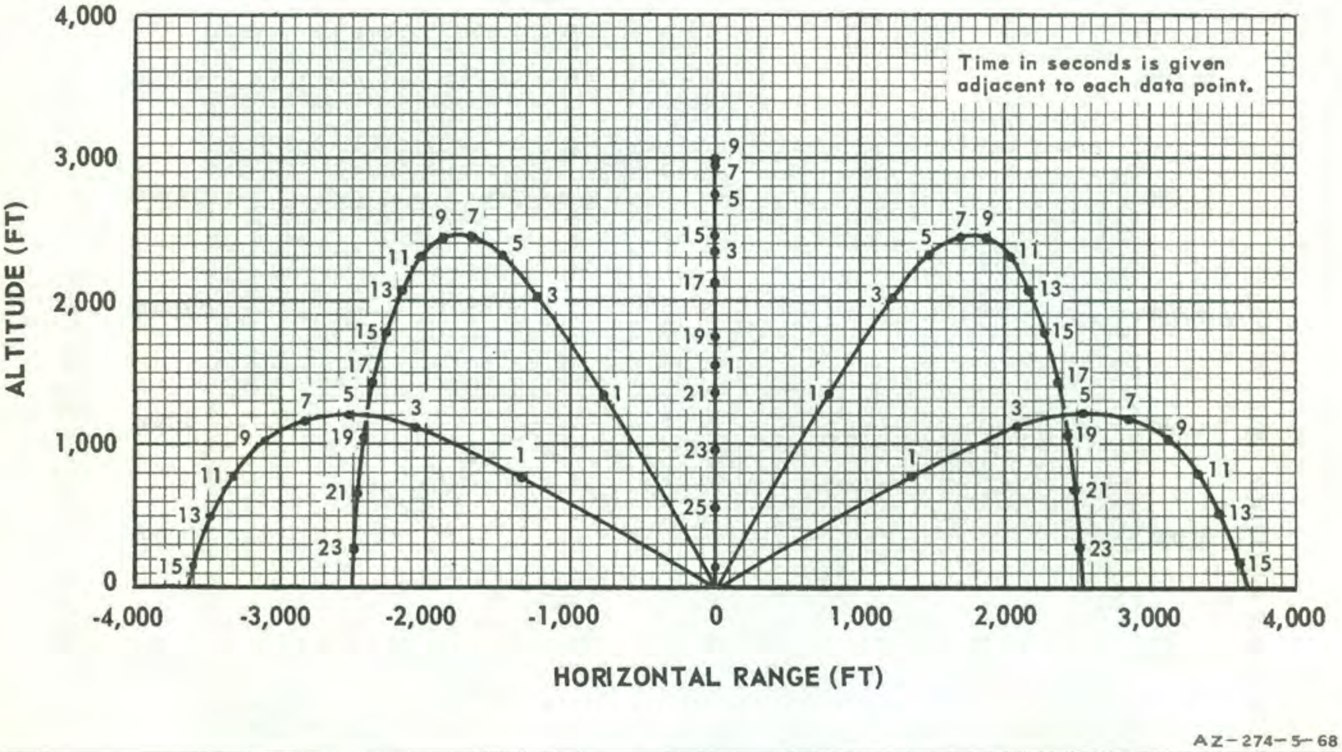


Figure 2–62

Tested Delivery Data

MK 82 CONICAL FIN

DIVE ANGLE	MIL LEAD		ENTRY			RELEASE			CORRECTION PER 10 KT OF DIRECT WIND – MILS		RELEASE ERROR SENSITIVITIES				
	EJECTED MILS	NON-EJECTED (MBR) – MILS	KIAS	ALTITUDE FT AGL	APPROX RPM %	KTAS	ALTITUDE FT AGL	ALTIMETER LAG – FT	Range	Cross	FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE	FT/MIL RANGE	FT/MIL DEFLECTION
30°	112	108	350	7,000	94	500	2,500	250	11	19	2	20	22	8	5
45°	113	108	250	10,000	86	450	3,500	0	16	20	2	10	15	6	5
45°	123	118	250	10,500	86	450	4,000	0	16	20	2	10	15	6	5

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

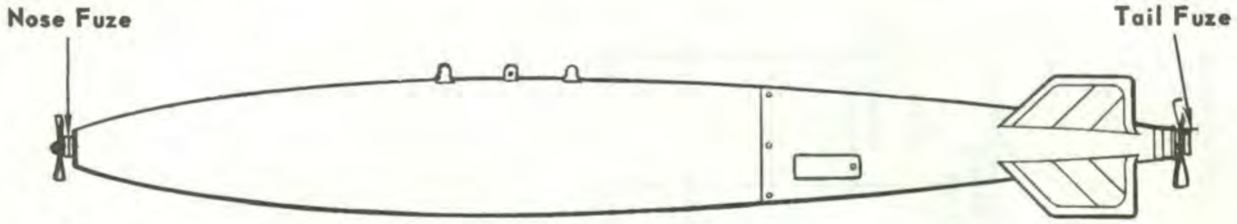
2. Mil lead computed for 28,000 lb aircraft with cruise droop extended.
   Correction – Add/subtract 1 mil for each 1,000 lb over/under 28,000 lb.

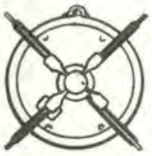
3. 45° dive profiles flown with speed brakes OUT.

AZ-243-2-67

Figure 2–63

MK 83 GP Bomb





PHYSICAL CHARACTERISTICS

Weight Loaded – 985 pounds
Length – 118.42 inches
Diameter – 14 inches
Suspension lugs – 14 inches apart

DESCRIPTION

The MK 83 bomb is a 1000-pound general purpose bomb normally used for demolition operation. The bomb was designed to produce minimum drag featuring a slender body with a conical fin.

DROPPING PROCEDURE	DROPPING PROCEDURE
(Mechanical Fuzing) 1. Master Arm Sw – ON 2. Armament Sel Sw – Wing L or R 3. Mechanical Fuzing Sw – NOSE or TAIL 4. Stores Release Sw – DEPRESS	(Electrical Fuzing) 1. Master Arm Sw – ON 2. Armament Sel Sw – Wing L or R 3. Option Sel Sw – As Desired 4. Safe-Stby-Ready Sw (AWW-1) – STBY for 30 sec then RDY 5. HV DC light – ON 6. Stores Release Sw – DEPRESS

NOTE

For simultaneous release from the Aero 7A-1 racks, the Triple-Multiple Rack Fire Mode switch must be set to the DUAL position and the Arm Sel Sw in the WING, L position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -501 or -521 TER or MER, the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past empty stations.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT
AERO 7A-1 SUSPENSION One Bomb Each Wing 	2 MK 83 1970 2 Aero 7A-1 104 2 Pylons 350 Total 2424 One Wing Only 1212
TER SUSPENSION Two Bombs Each Wing 	4 MK 83 3940 2 TER 210 2 Aero 7A-1 104 2 Pylons 350 Total 4604 One Wing Only 2302
MER SUSPENSION Two Bombs Each Wing 	4 MK 83 3940 2 MER 446 2 Aero 7A-1 104 2 Pylons 350 Total 4840 One Wing Only 2420

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

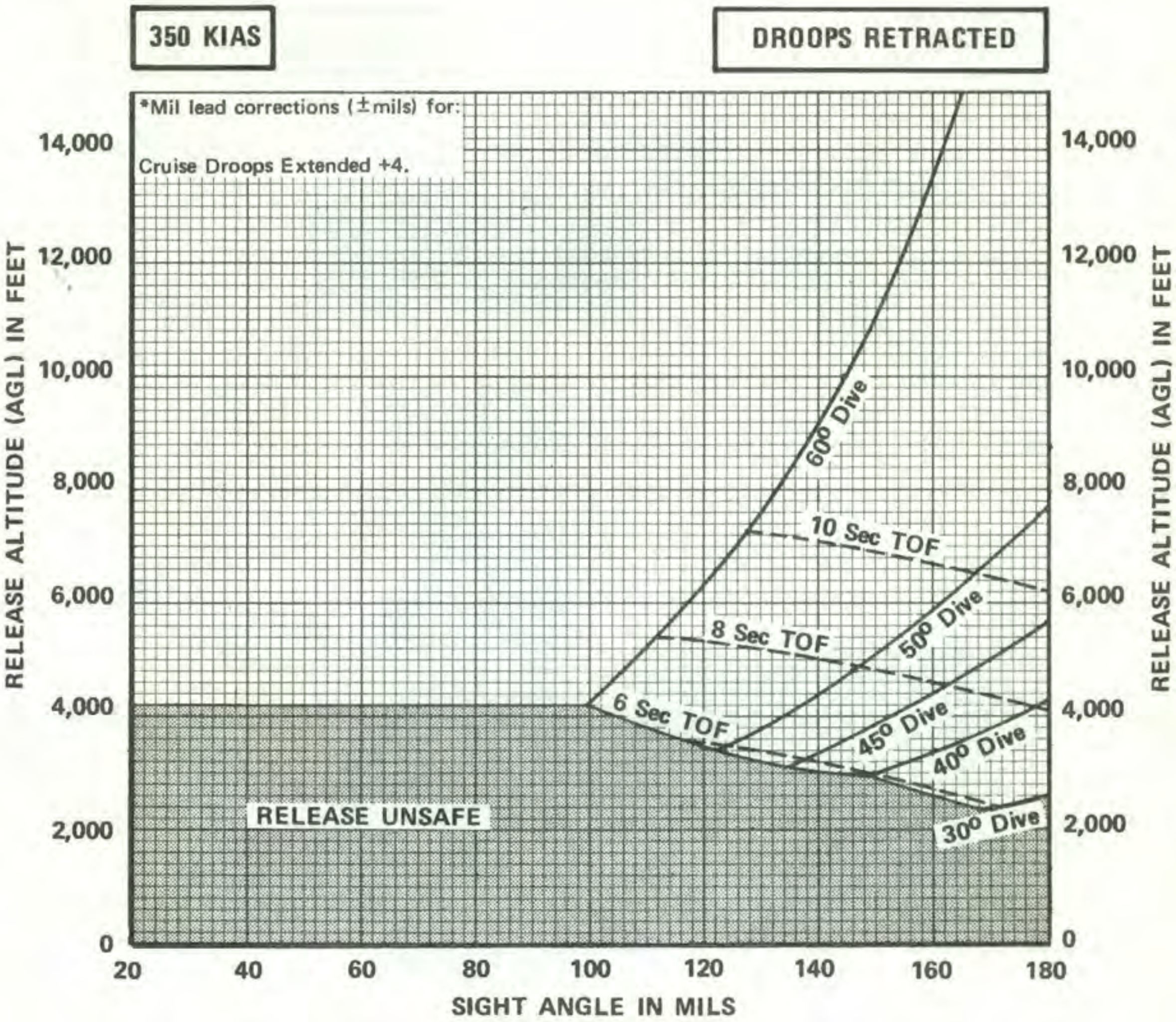
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01- 45HH-75

AZ-94-03-69

Figure 2–64

Mil Lead for Single Delivery

MK 83 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,680	1,580	1,180
10°	1,300	1,260	1,030
20°	1,800	1,710	1,490
30°	2,240	2,190	1,940
40°	2,750	2,670	2,390
45°	2,960	2,890	2,630
50°	3,310	3,310†	3,310†
60°	4,150	4,150†	4,150†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5 ft/sec ejection velocity. Release from MER, TER, or Aero 7A EBR.

*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) mil lead by 3 mils.

†Terrain avoidance is determinging factor for this release altitude limitation.

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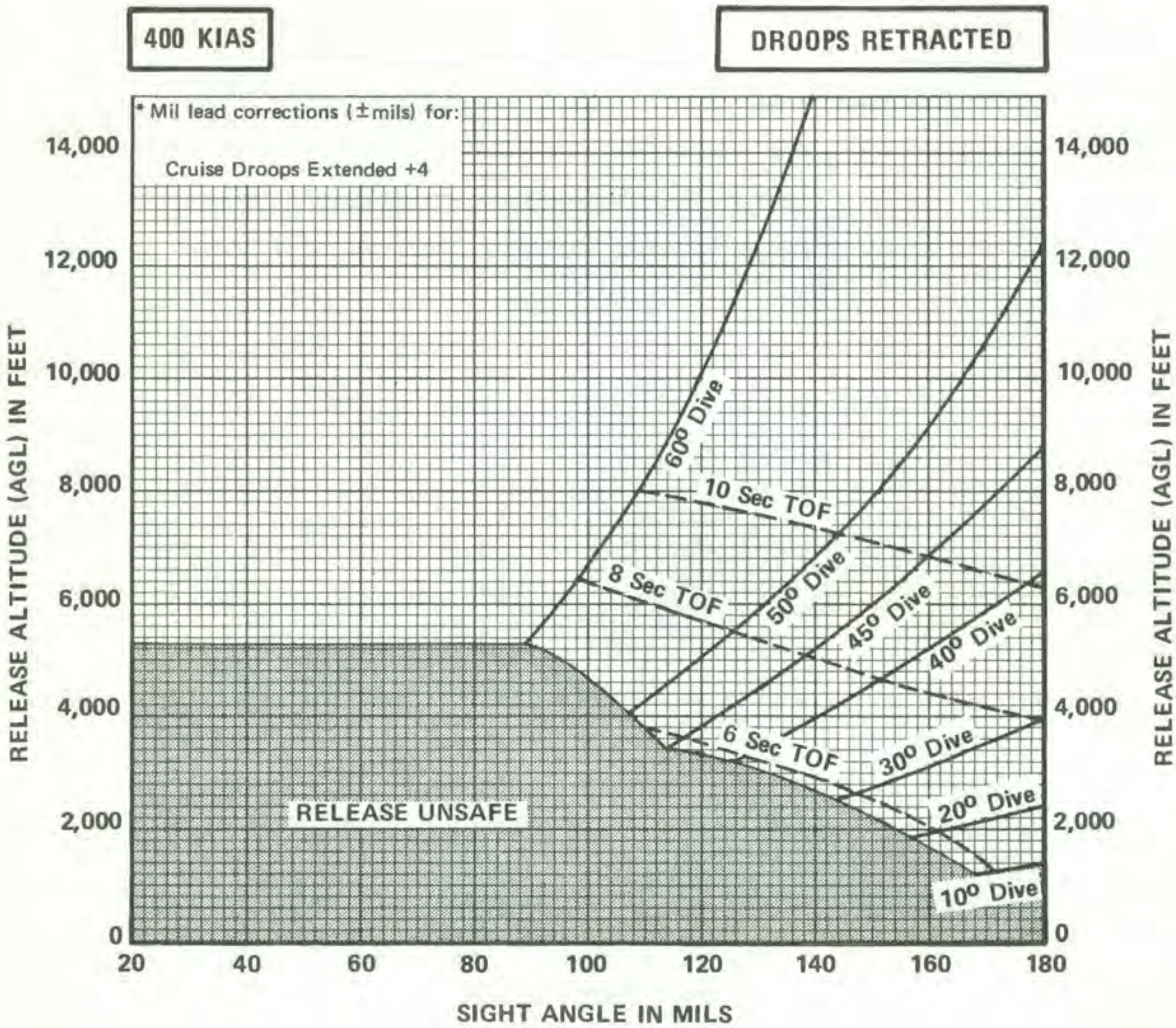
Figure 2-65 (Sheet 1)

Mil Lead for Single Delivery

MK 83 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,570	1,420	1,090
10°	1,300	1,250	1,060
20°	1,820	1,790	1,590
30°	2,430	2,360	2,130
40°	2,960	2,930	2,690
45°	3,200	3,180	3,130
50°	3,930	3,930†	3,930†
60°	5,040	5,040†	5,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5 ft/sec ejection velocity. Released from MER, TER or Aero 7A EBR

* For each 10° C increase (decrease) in release altitude temperature increase (decrease) mil lead by 3 mils.
† Terrain avoidance is determining factor for this release altitude limitation.

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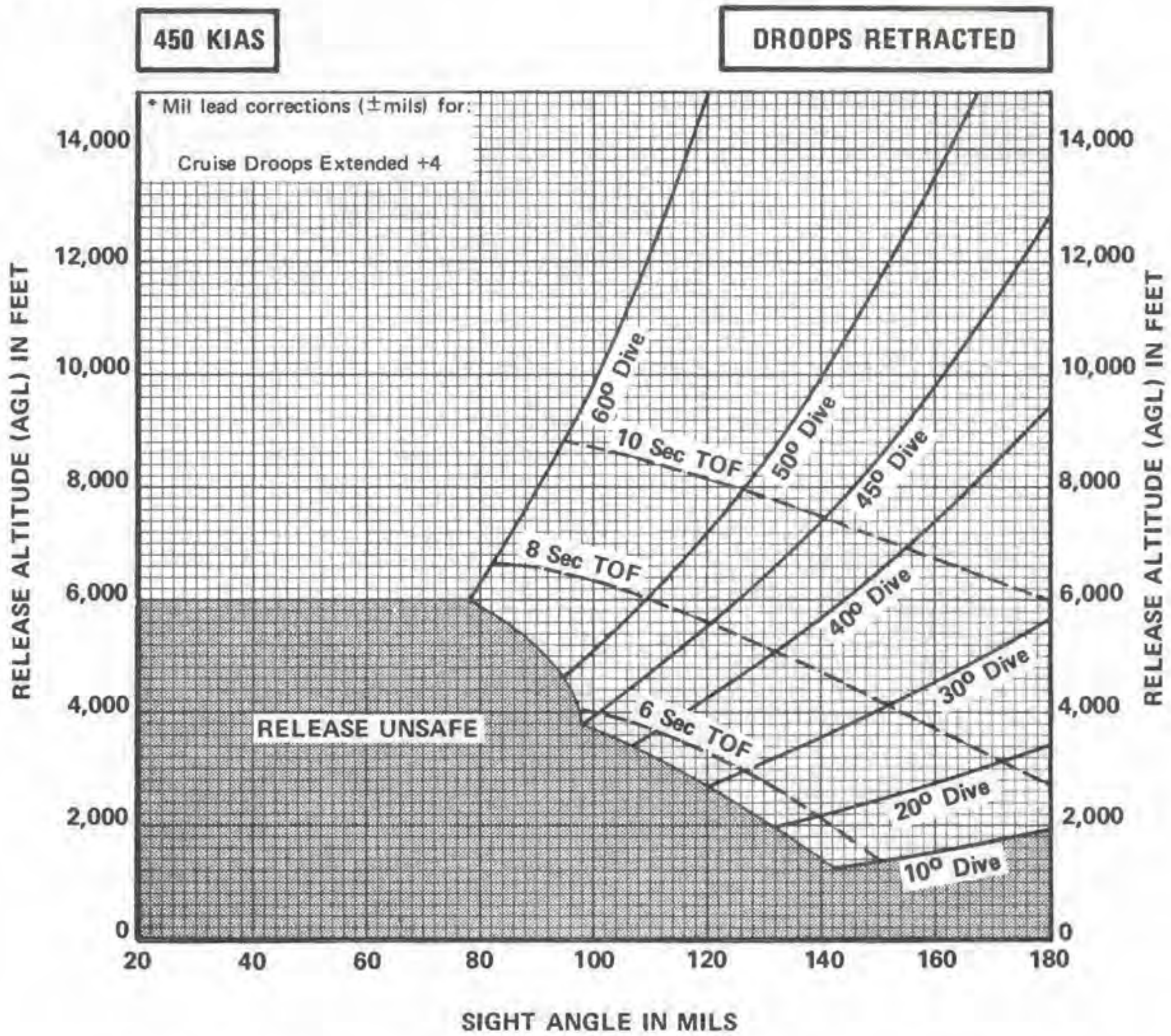
Figure 2-65 (Sheet 2)

Mil Lead for Single Delivery

MK 83 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,380	1,280	1,010
10°	1,300	1,250	1,090
20°	1,920	1,890	1,700
30°	2,560	2,540	2,300
40°	3,210	3,160	3,130
45°	3,680	3,680†	3,680†
50°	4,610	4,610†	4,610†
60°	6,030	6,030†	6,030†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5 ft/sec ejection velocity. Release from MER, TER or Aero 7A EBR

*** For each 10° C increase (decrease) in release altitude temperature increase (decrease) mil lead by 3 mils.**

† Terrain avoidance is determining factor for this release altitude limitation.

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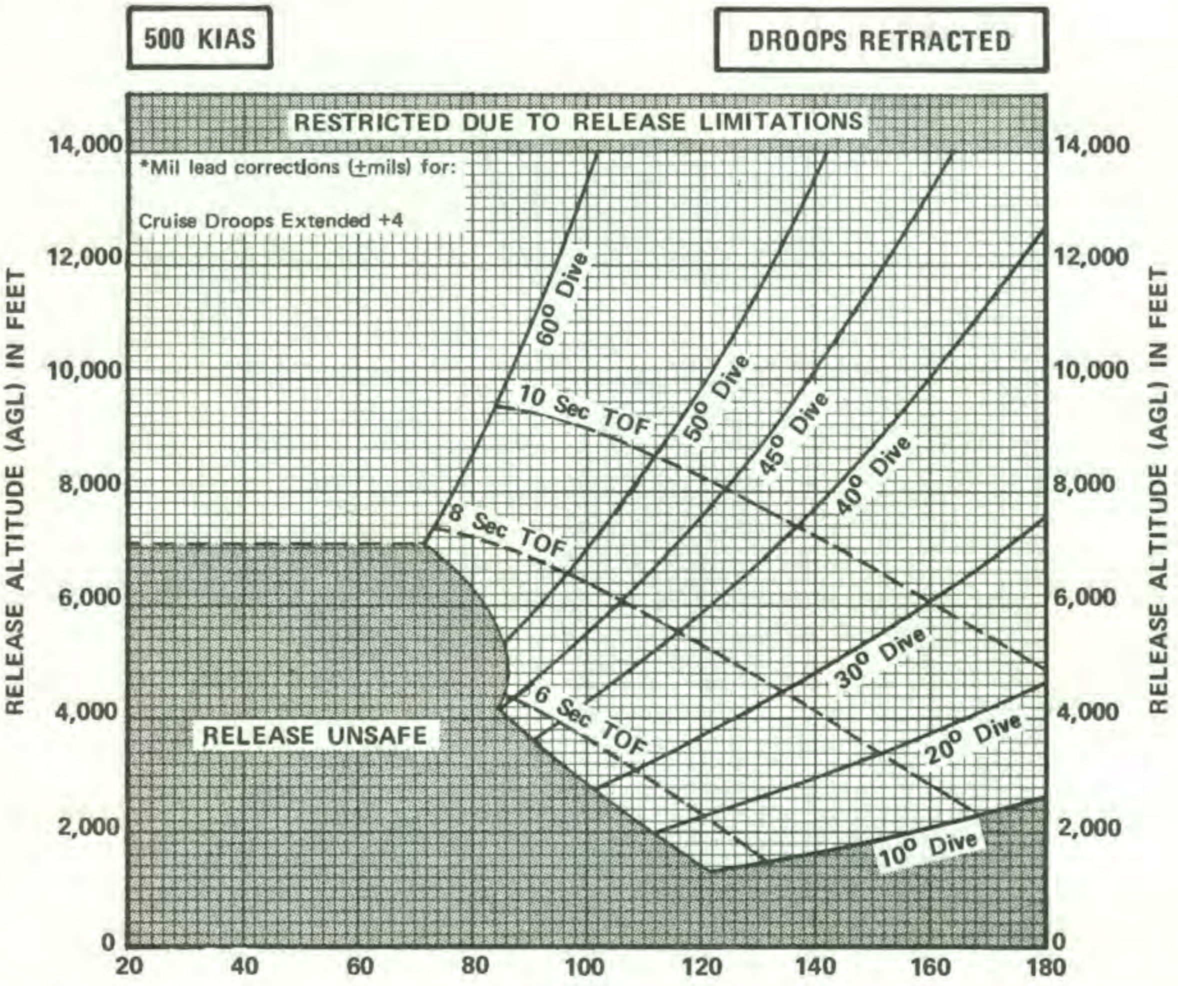
Figure 2-65 (Sheet 3)

Mil Lead for Single Delivery

MK 83 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,280	1,160	920
10°	1,320	1,270	1,110
20°	2,050	2,000	1,800
30°	2,770	2,730	2,470
40°	3,610	3,610†	3,610†
45°	4,270	4,270†	4,270†
50°	5,340	5,340†	5,340†
60°	7,040	7,040†	7,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5 ft/sec ejection velocity. Released from MER, TER or Aero 7A EBR

*For each 10°C increase (decrease) in release altitude temperature increase (decrease) mil lead by 3 mils.
†Terrain avoidance is determing factor for this release altitude limitation.

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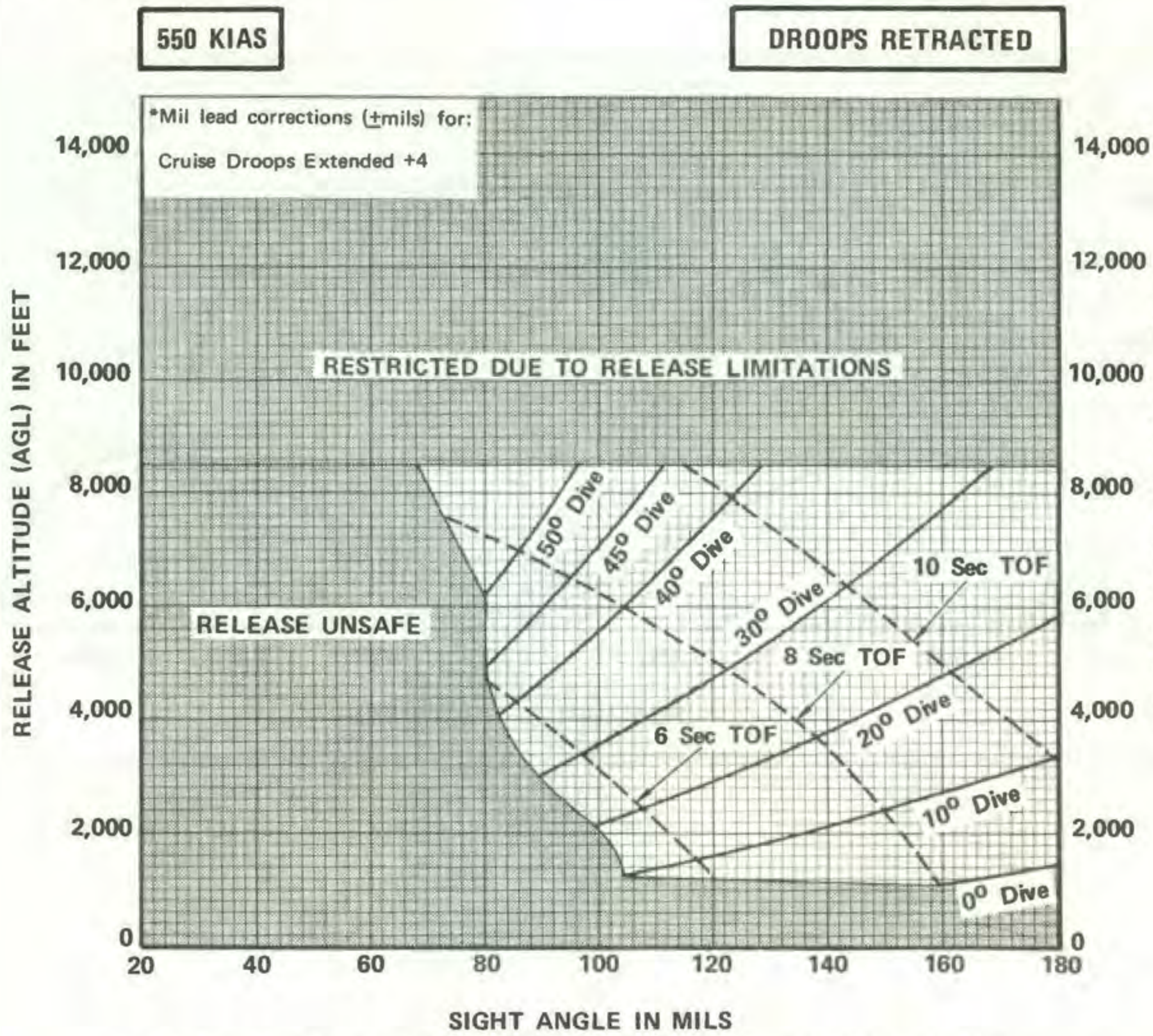
Figure 2-65 (Sheet 4)

Mil Lead for Single Delivery

MK 83 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,170	1,000	850
10°	1,400	1,290	1,150
20°	2,230	2,110	1,910
30°	2,980	2,900	2,640
40°	4,080	4,080†	4,080†
45°	4,840	4,840†	4,840†
50°	6,000	6,000†	6,000†
60°	7,920	7,920†	7,920†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.0 ft sec ejection velocity. Release from MER, TER or Aero 7A EBR

*For each 10°C increase (decrease) in release altitude temperature increase (decrease) mil lead by 3 mils.

†Terrain avoidance is determining factor for this release altitude limitation.

AZ-218(5)-3-69

Figure 2-65 (Sheet 5)

Maximum Fragment Envelope

MK 83 GENERAL PURPOSE BOMB

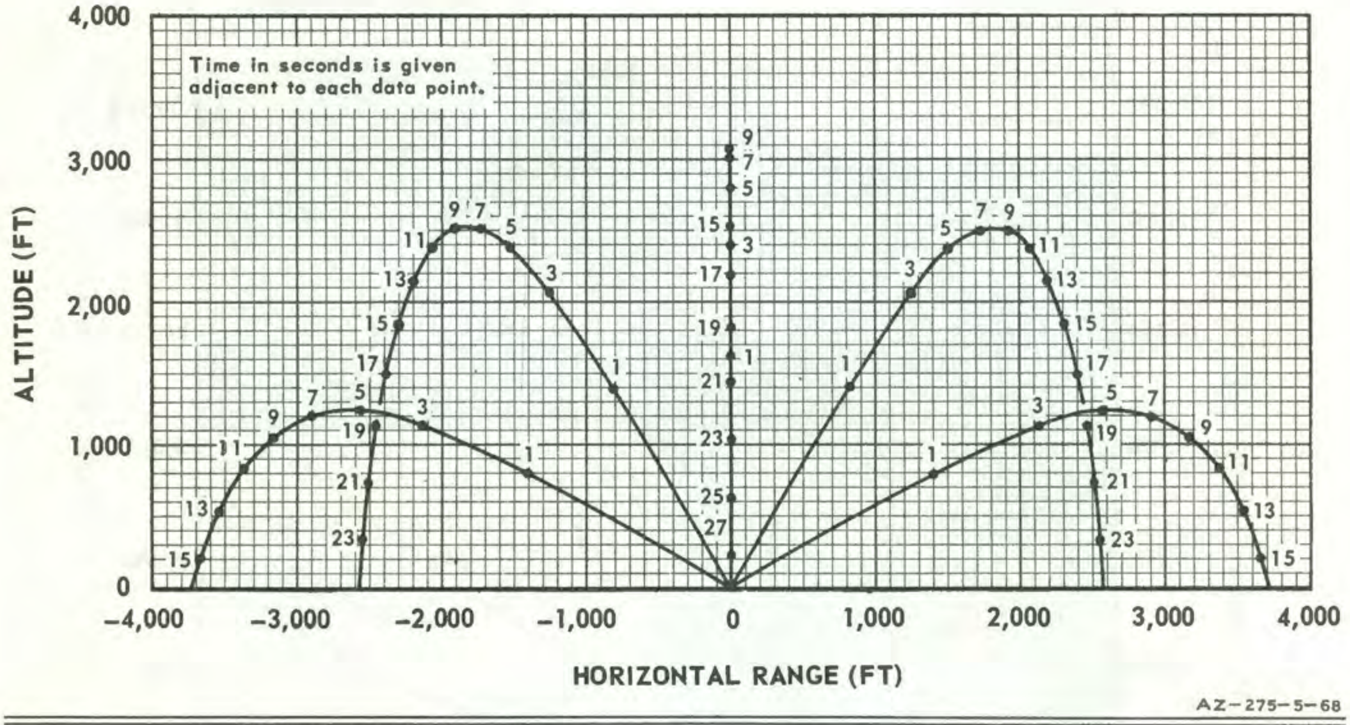


Figure 2-66

Tested Delivery Data

MK 83 CONICAL FIN

DIVE ANGLE	MIL LEAD EJECTED MILS	MIL LEAD NON-EJECTED (MBR) – MILS	ENTRY KIAS	ENTRY ALTITUDE FT AGL	ENTRY APPROX RPM %	RELEASE KTAS	RELEASE ALTITUDE FT AGL	RELEASE ALTIMETER LAG – FT	CORRECTION PER 10 KT OF DIRECT WIND – MILS Range	CORRECTION PER 10 KT OF DIRECT WIND – MILS Cross	RELEASE ERROR SENSITIVITIES FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE	FT/MIL RANGE	FT/MIL DEFLECTION
30°	123	NA	350	7,500	94	500	3,000	250	11	19	2	20	22	8	5
45°	120	NA	250	10,500	96	450	4,000	0	16	20	2	10	15	6	5

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

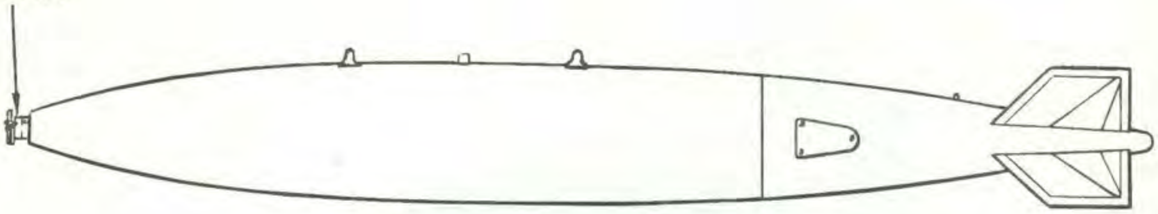
2. Mil lead computed for 28,000 lb aircraft with cruise droop extended.
   Correction – Add/subtract 1 mil for each 1,000 lb over/under 28,000 lb.

3. 45° dive profiles flown with speed brakes OUT.

AZ–244–2–67

Figure 2–67

MK 84 GP Bomb



PHYSICAL CHARACTERISTICS

Weight	– 1970 pounds
Length	– 151.5 inches
Diameter	– 18 inches
Suspension lugs	– 30 inches apart

DESCRIPTION

The Mk 84 bomb is a 2000-pound general purpose bomb normally used for demolition operation. The bomb was designed to produce minimum drag by using a slender body, a long nose, and a conical fin.

DROPPING PROCEDURE

(Mechanical Fuzing)

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Mechanical Fuzing Sw – NOSE or TAIL
4. Stores Release Sw – DEPRESS

DROPPING PROCEDURE

(Electrical Fuzing)

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Option Sel Sw (AWW-1) – As Desired
4. Safe-Stdy-Ready Sw (AWW-1) – STDY for 30 seconds then RDY
5. HV DC Light (AWW-1) – ON
6. Stores Release Sw – DEPRESS

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A SUSPENSION One Bomb Each Wing 	2 MK 84 2 Aero 7A-1 2 Pylons Total One Wing Only	3940 104 350 4394 2197

NOTE

For simultaneous release from the Aero 7A-1 racks the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

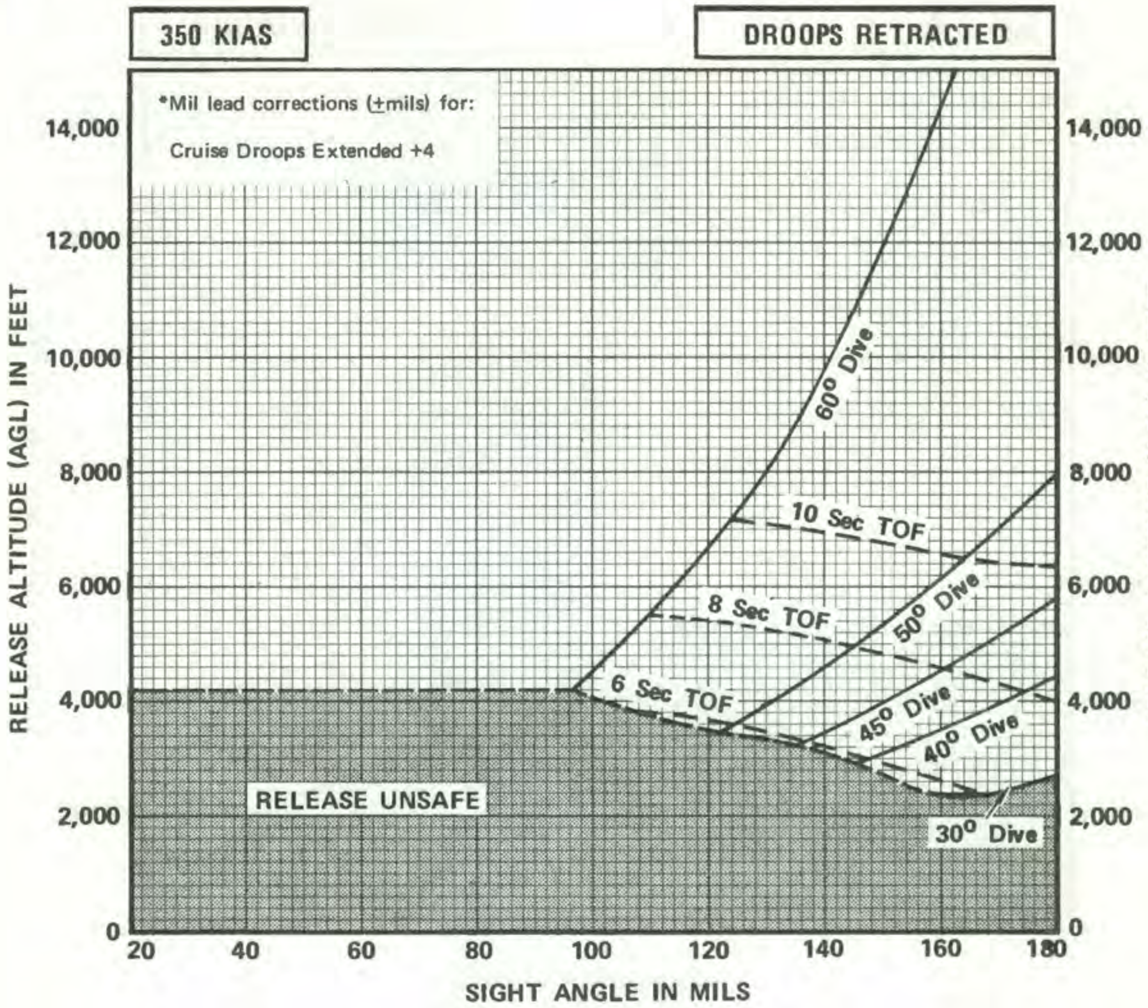
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ–95–03–70

Figure 2–68 (U)

Mil Lead for Single Delivery

MK 84 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,680		
10°	1,310		
20°	1,800		
30°	2,240		
40°	2,750		
45°	2,960		
50°	3,310		
60°	4,150		

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 3 ft/sec ejection velocity. Released from Aero 7A EBR. Fragmentation data estimated from Mk 81, 82 and 83 general purpose low drag bombs.

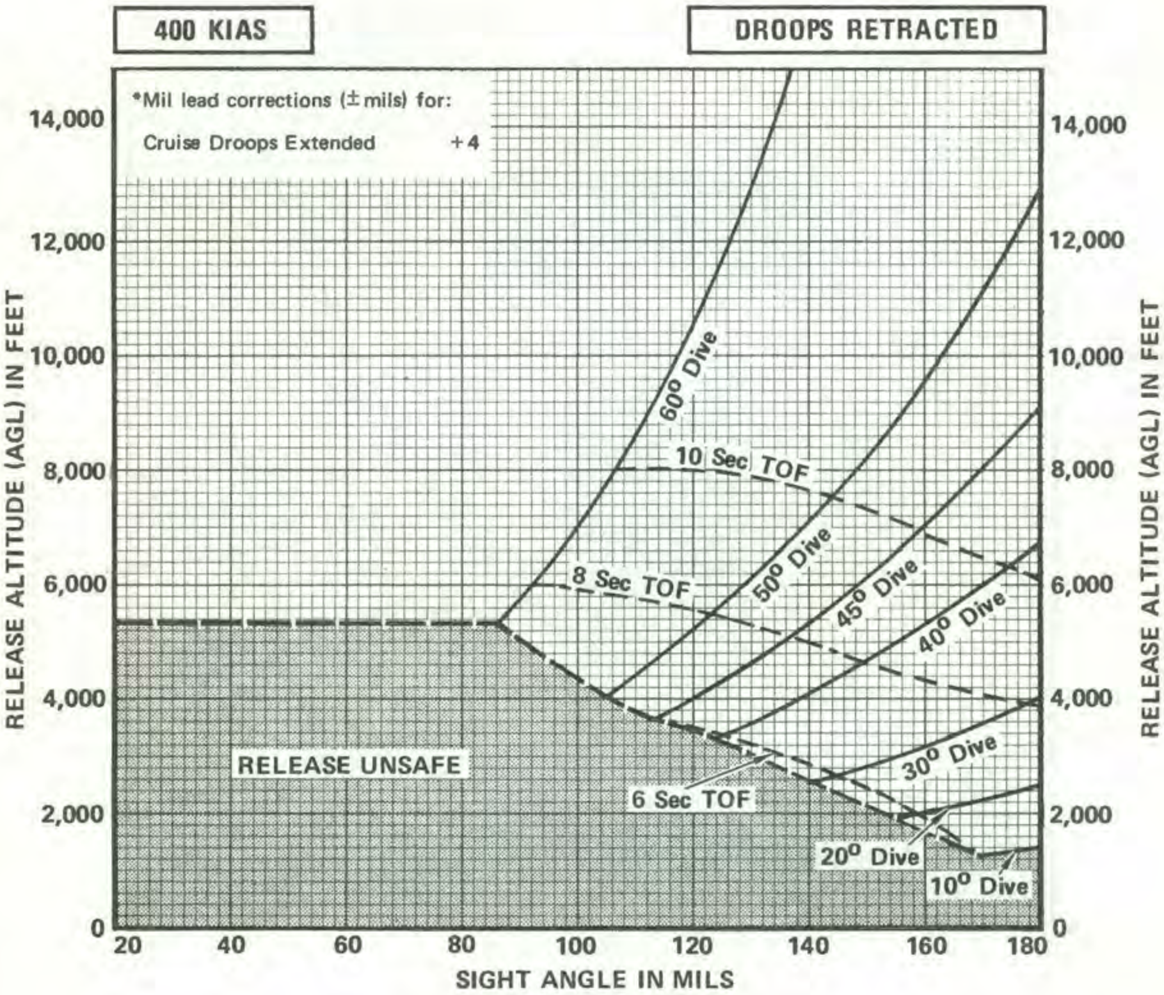
***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) mil lead by 3 mils.**

AZ-219(1)-03-69

Figure 2-69 (Sheet 1)

Mil Lead for Single Delivery

MK 84 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,580		
10°	1,390		
20°	1,820		
30°	2,450		
40°	2,960		
45°	3,200		
50°	3.930		
60°	5,040		

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 3 ft/sec ejection velocity. Released from Aero 7A EBR. Fragmentation data estimated from Mk 81, 82 and 83 general purpose low drag bombs.

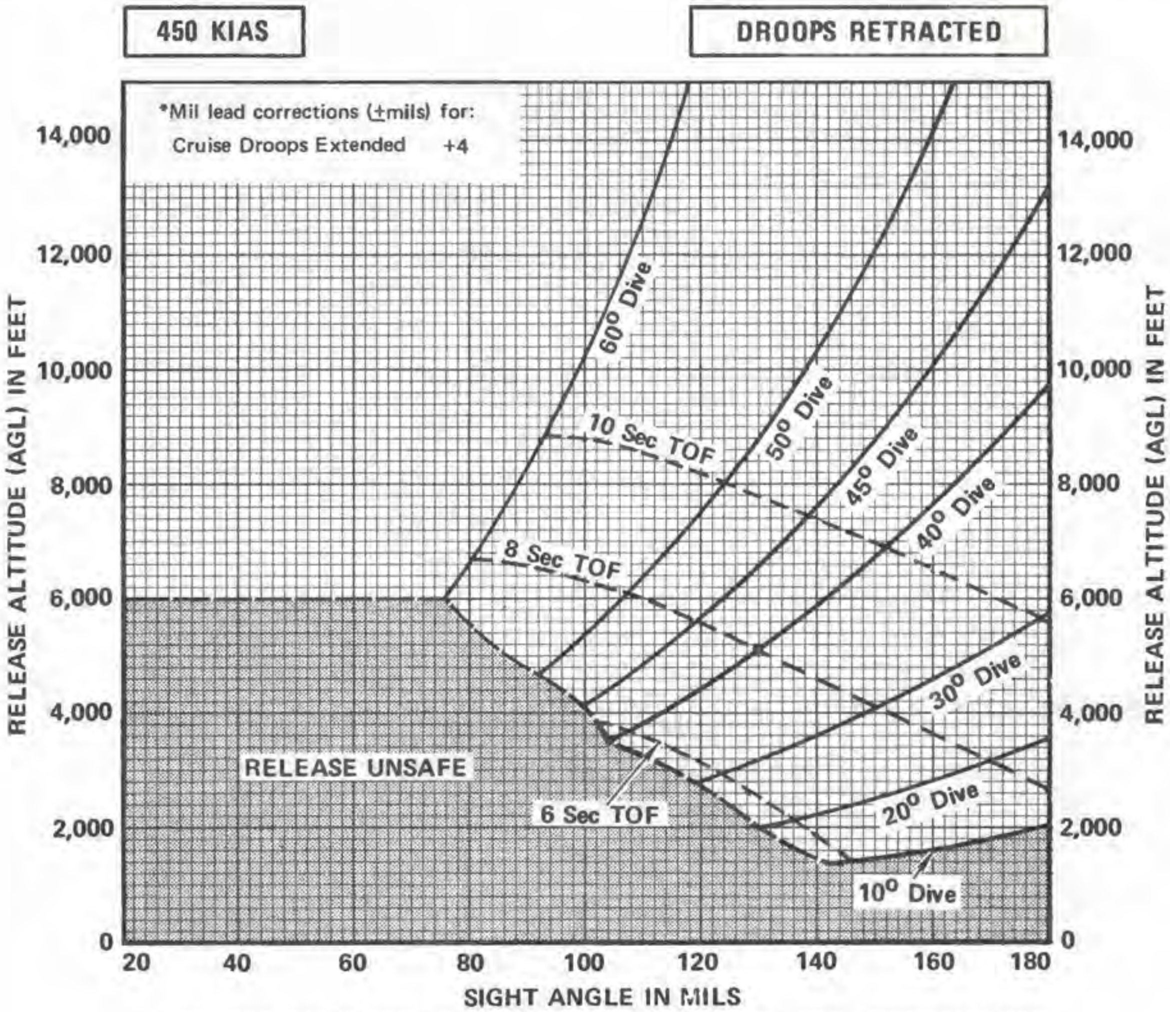
*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) mil lead by 3 mils.

AZ-219(2)-03-69

Figure 2-69 (Sheet 2)

Mil Lead for Single Delivery

MK 84 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,470		
10°	1,300		
20°	1,950		
30°	2,630		
40°	3,210		
45°	3,680		
50°	4,610		
60°	6,030		

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 3 ft/sec ejection velocity. Released from Aero 7A EBR. Fragmentation data estimated from Mk 81, 82 and 83 general purpose low drag bombs.

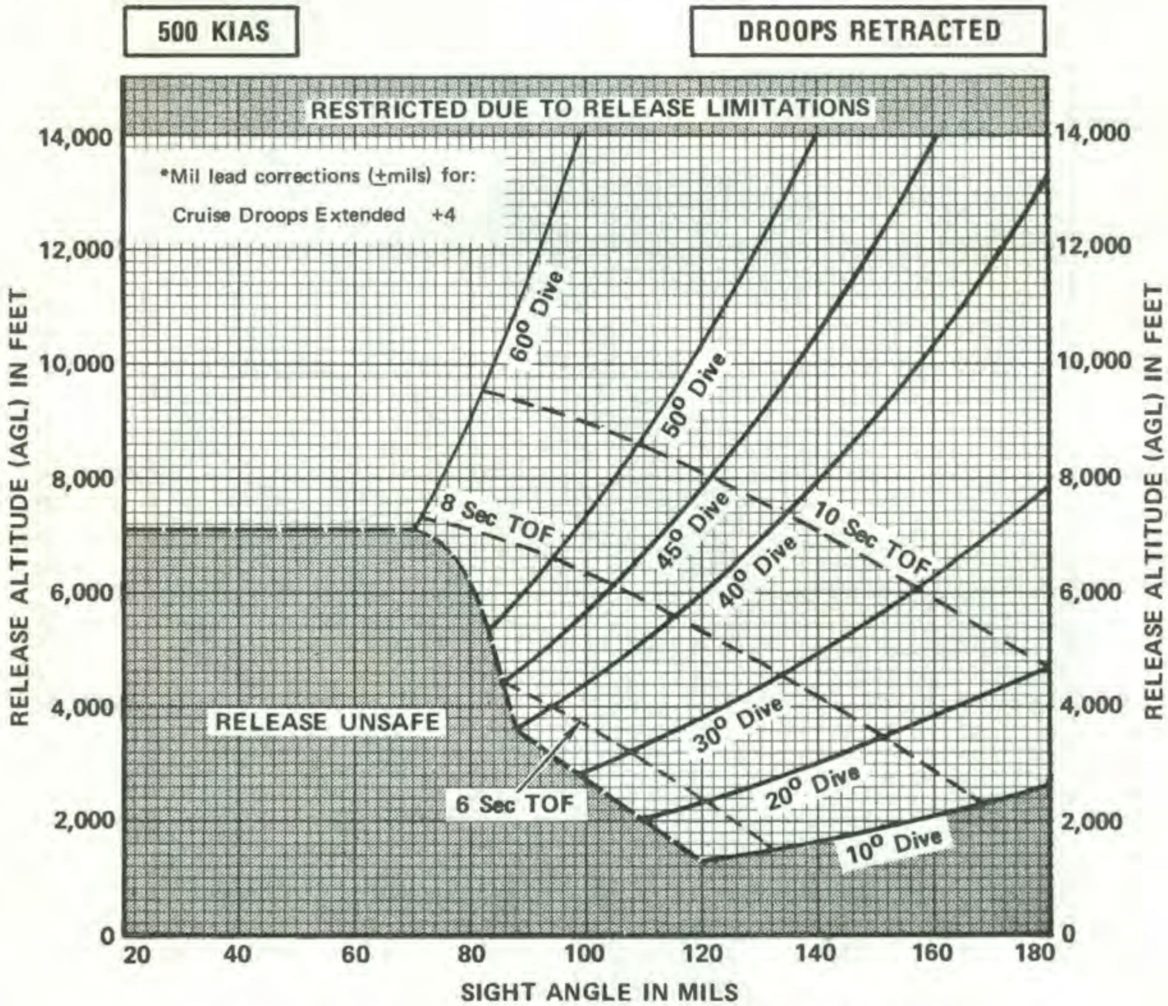
***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) mil lead by 3 mils.**

AZ-219(3)-03-69

Figure 2-69 (Sheet 3)

Mil Lead for Single Delivery

MK 84 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,280		
10°	1,320		
20°	2,130		
30°	2,770		
40°	3,610		
45°	4,270		
50°	5,340		
60°	7,040		

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 3 ft/sec ejection velocity. Released from Aero 7A EBR. Fragmentation data estimated from Mk 81, 82 and 83 general purpose low drag bombs.

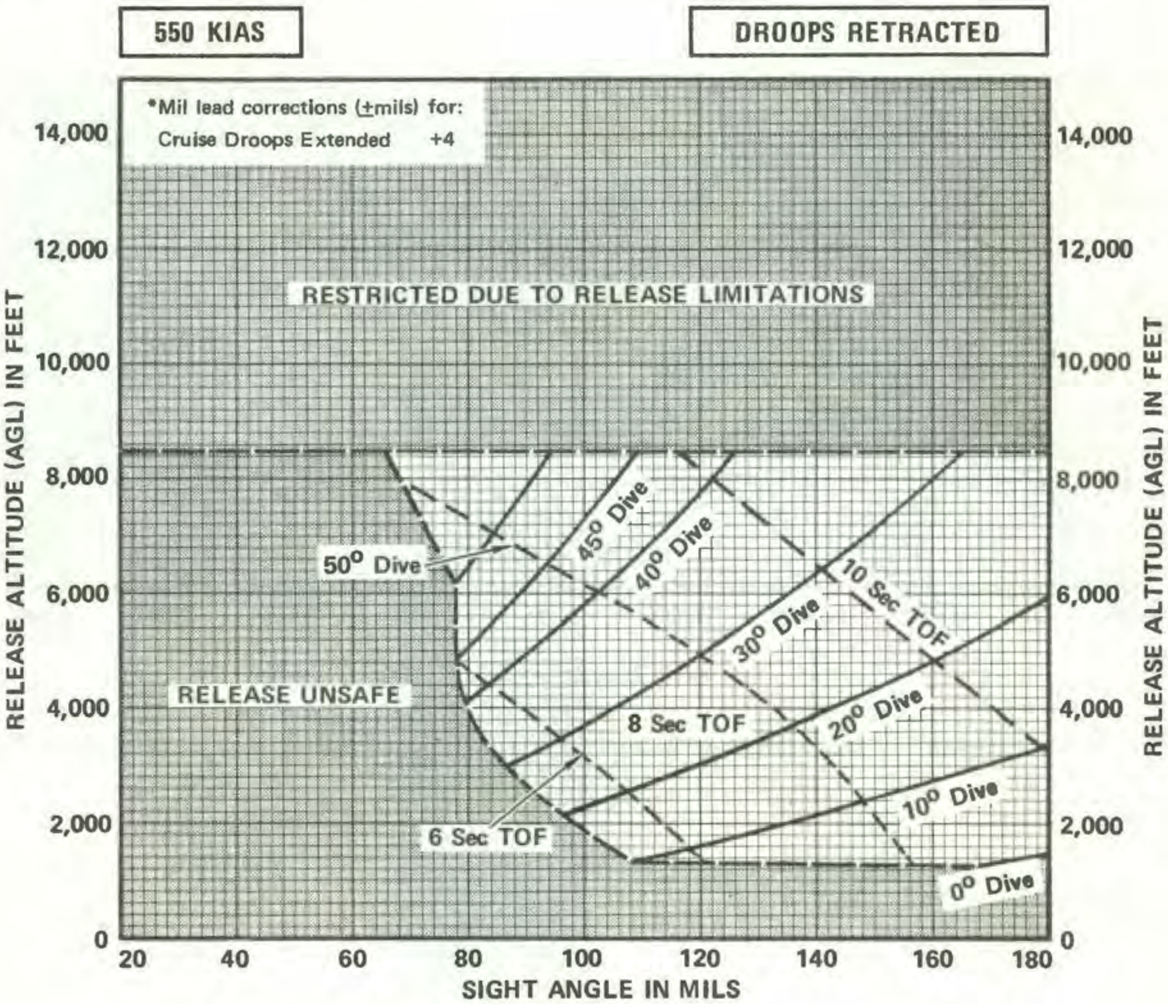
***For each 10° C increase (decrease) in release altitude temperature, increase (decrease) mil lead by 3 mils.**

AZ-219(4)-03-69

Figure 2-69 (Sheet 4)

Mil Lead for Single Delivery

MK 84 CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,180		
10°	1,400		
20°	2,230		
30°	2,980		
40°	4,080		
45°	4,840		
50°	6,000		
60°	7,920		

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 3 ft/sec ejection velocity. Released from Aero 7A EBR. Fragmentation data estimated from Mk 81, 82 and 83 general purpose low drag bombs.

*For each 10° C increase (decrease) in release altitude temperature, increase (decrease) mil lead by 3 mils.

AZ-219(5)-03-69

Figure 2-69 (Sheet 5)

Maximum Fragment Envelope

MK 84 GENERAL PURPOSE BOMB

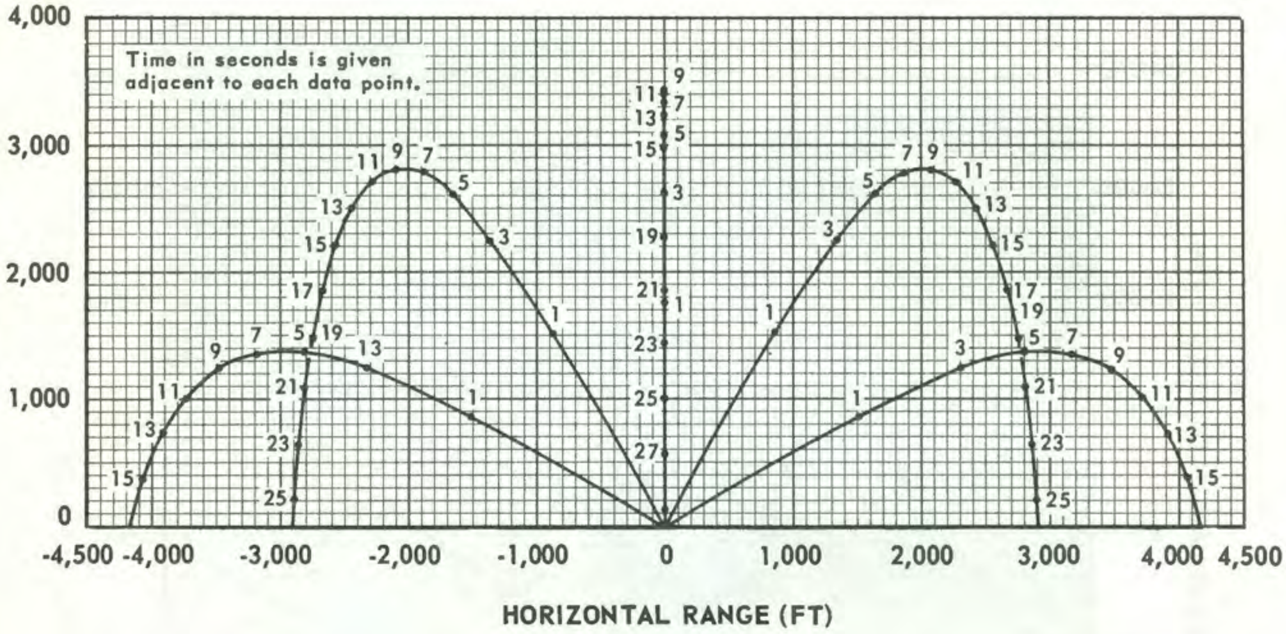


Figure 2-70

Tested Delivery Data

MK 84 CONICAL FIN

DIVE ANGLE	MIL LEAD		ENTRY			RELEASE			CORRECTION PER 10 KT OF DIRECT WIND – MILS		RELEASE ERROR SENSITIVITIES				
	EJECTED MILS	NON-EJECTED (MBR) – MILS	KIAS	ALTITUDE FT AGL	APPROX RPM %	KTAS	ALTITUDE FT AGL	ALTIMETER LAG – FT	Range	Cross	FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE	FT/MIL RANGE	FT/MIL DEFLECTION
30°	128	NA	350	7,500	94	500	3,000	250	11	19	2	20	22	8	5
45°	126	NA	250	10,500	86	450	4,000	0	16	20	2	10	15	6	5

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

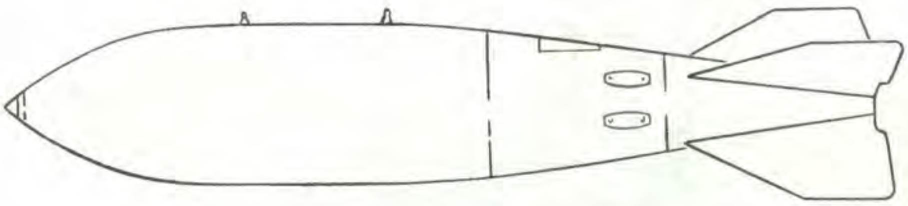
2. Mil lead computed for 28,000 lb aircraft with cruise droop extended.
   Correction – Add/subtract 1 mil for each 1,000 lb over/under 28,000 lb.

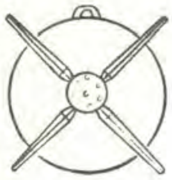
3. 45° dive profile flown with speed brakes OUT.

AZ-245-2-67

Figure 2-71

M117A1 Demolition Bomb





PHYSICAL CHARACTERISTICS

Weight Loaded	– 823 pounds
Length	– 87.4 inches
Diameter	– 16 inches
Suspension lugs	– 14 inches

DESCRIPTION

The M117A1 is a general purpose bomb normally used for demolition operations. The bomb has a cylindrical body with an ogival nose and a tapered aft section, which can be adapted for delivery either retarded or unretarded. The conical fin improves the aerodynamic performance of the bomb and permits greater accuracy. The bomb is designed primarily for electric fuzing, however, mechanical fuzes can be used provided adapter-boosters are installed in fuze cavities.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Bomb Each Wing 	2 M117A1 2 Aero 7A-1 2 Pylons Total One Wing Only	1646 104 350 2100 1050
TER SUSPENSION Two Bombs Each Wing 	4 M117A1 2 TER 2 Aero 7A-1 2 Pylons Total One Wing Only	3292 210 104 350 3956 1978
MER SUSPENSION Two Bombs Each Wing 	4 M117A1 2 MER 2 Aero 7A-1 2 Pylons Total One Wing Only	3292 446 104 350 4192 2096

DROPPING PROCEDURE (Mechanical Fuzing)	DROPPING PROCEDURE (Electrical Fuzing)
1. Master Arm Sw – ON 2. Armament Sel Sw – Wing L or R 3. Mechanical Fuzing Sw – Nose or TAIL 4. Stores Release Sw – DEPRESS	1. Master Arm Sw – ON 2. Armament Sel Sw – Wing L or R 3. Option Sel Sw – As Desired 4. Safe-Stby-Ready Sw (AWW-1) – STBY for 30 sec then RDY 5. HVDC light – ON 6. Stores Release Sw – DEPRESS

NOTE

For simultaneous release from the Aero 7A-1 racks, the Triple-Multiple Rack Fire Mode switch must be set to the DUAL position and the Arm Sel Sw in the WING, L position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -501 or -521 TER or MER, the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past the empty stations.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

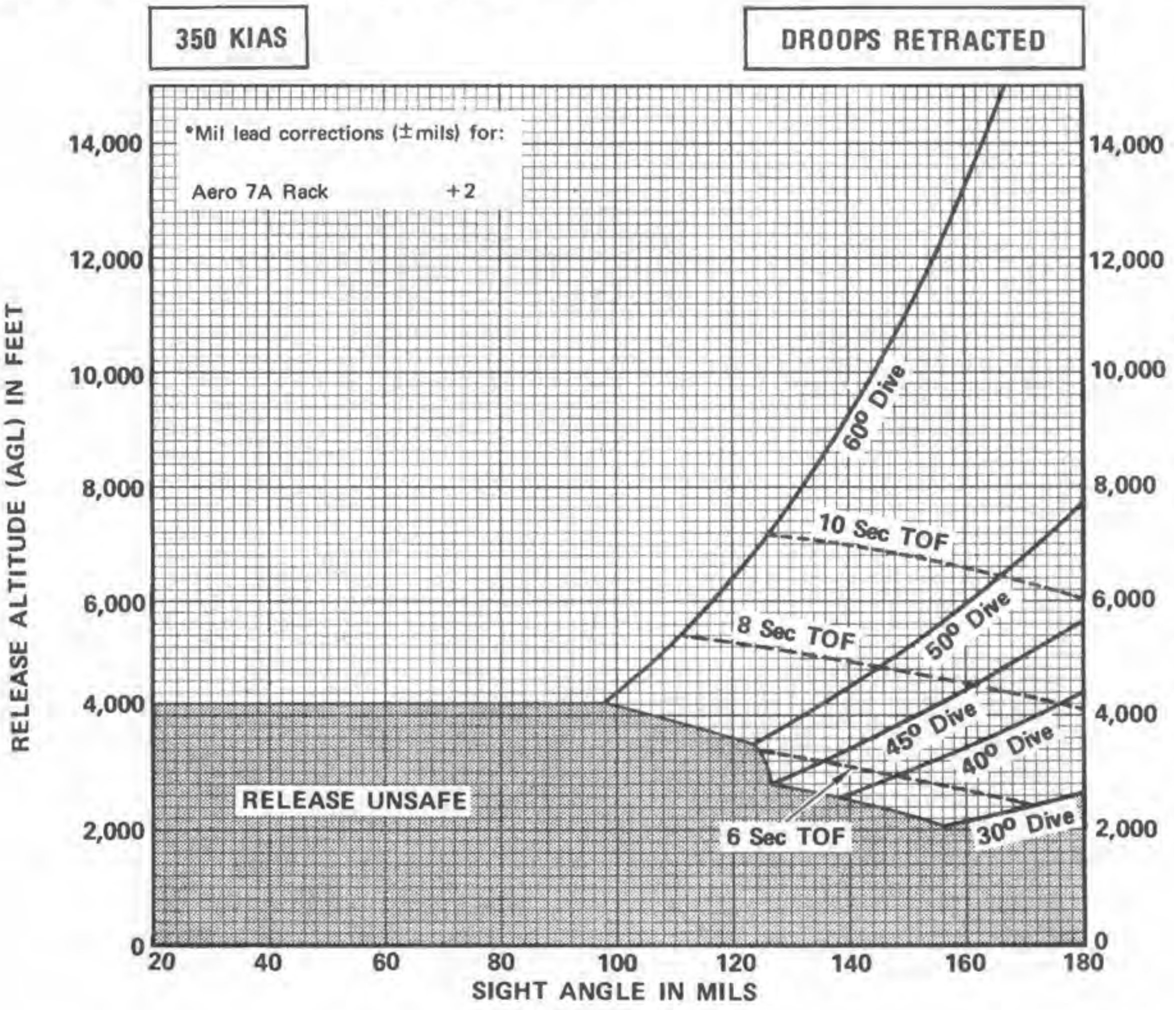
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 01-45HH-75 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ-264-03-69

Figure 2–72

Mil Lead for Single Delivery

M117A1 DEMOLITION BOMB CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	2,240	1,360	1,090
10°	1,680	1,210	1,010
20°	2,200	1,690	1,440
30°	2,650	2,180	1,920
40°	3,160	2,680	2,360
45°	3,400	2,910	2,630
50°	3,610	3,310	3,310†
60°	4,150	4,150†	4,150†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 4.2 ft/sec average ejection velocity. Released from MER or TER.

*For each 10° C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

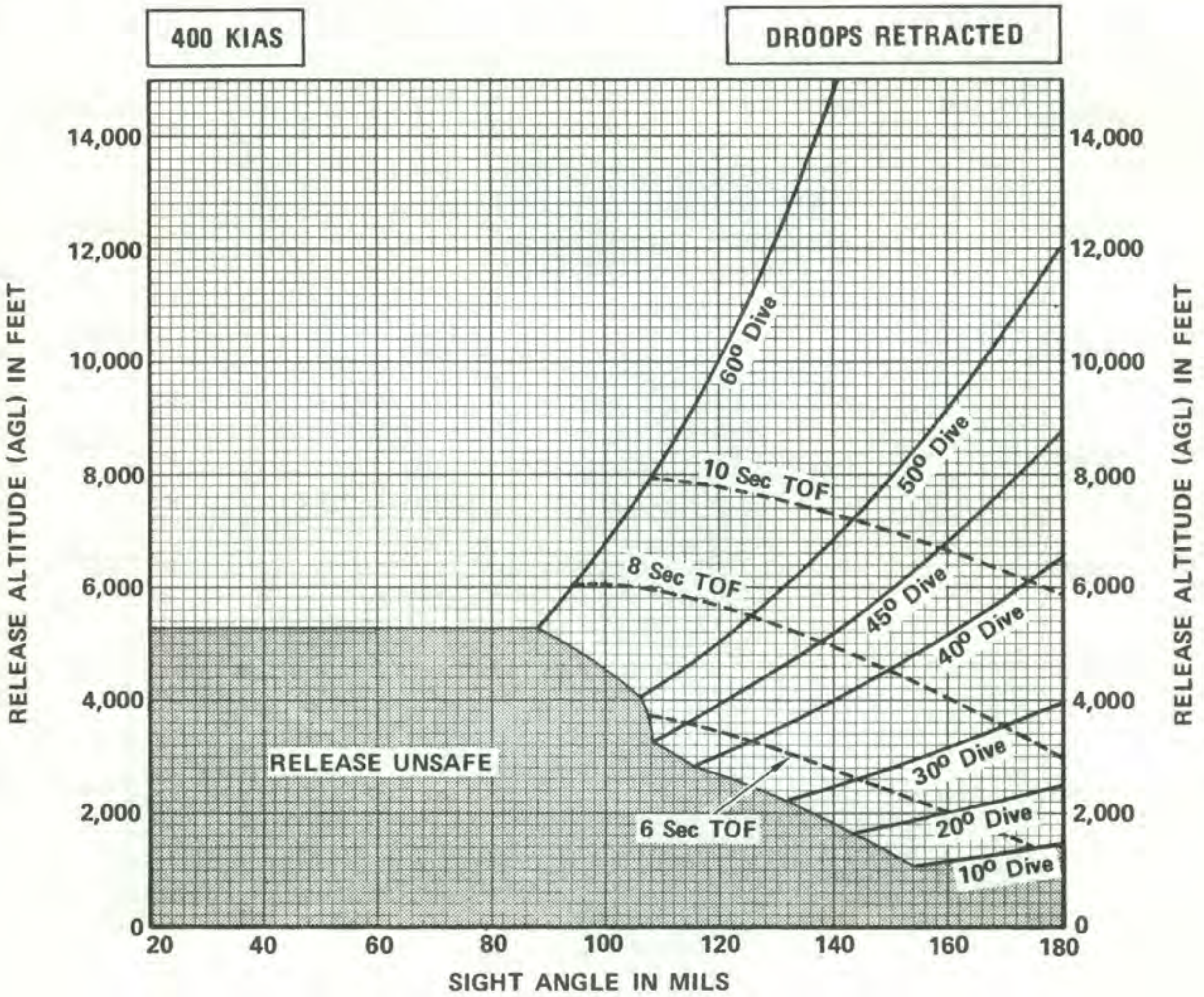
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-276(1)-03-69

Figure 2-73 (Sheet 1)

Mil Lead for Single Delivery

M117A1 DEMOLITION BOMB CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,960	1,330	980
10°	1,600	1,130	990
20°	2,220	1,750	1,540
30°	2,830	2,360	2,060
40°	3,370	2,910	2,690
45°	3,680	3,170	3,130
50°	3,930	3,930†	3,930†
60°	5,040	5,040†	5,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 4.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

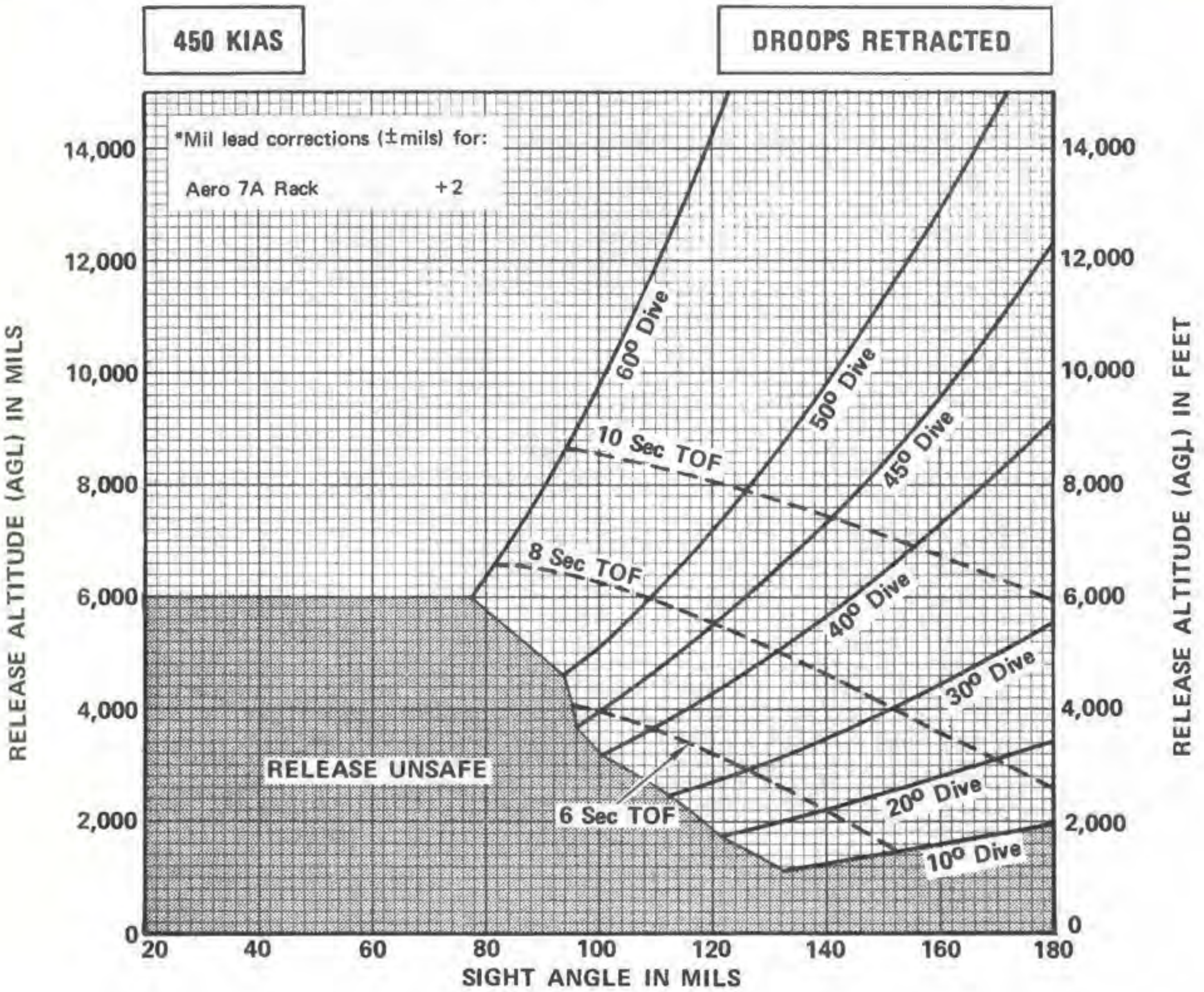
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-276(2)-03-69

Figure 2-73 (Sheet 2)

Mil Lead for Single Delivery

M117A1 DEMOLITION BOMB CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,760	1,230	890
10°	1,600	1,280	1,000
20°	2,300	1,920	1,600
30°	2,970	2,610	2,190
40°	3,630	3,240	3,130
45°	3,940	3,680	3,680†
50°	4,610	4,610†	4,610†
60°	6,030	6,030†	6,030†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 4.2 ft/sec average ejection velocity. Released from MER or TER.

*For each 10° C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

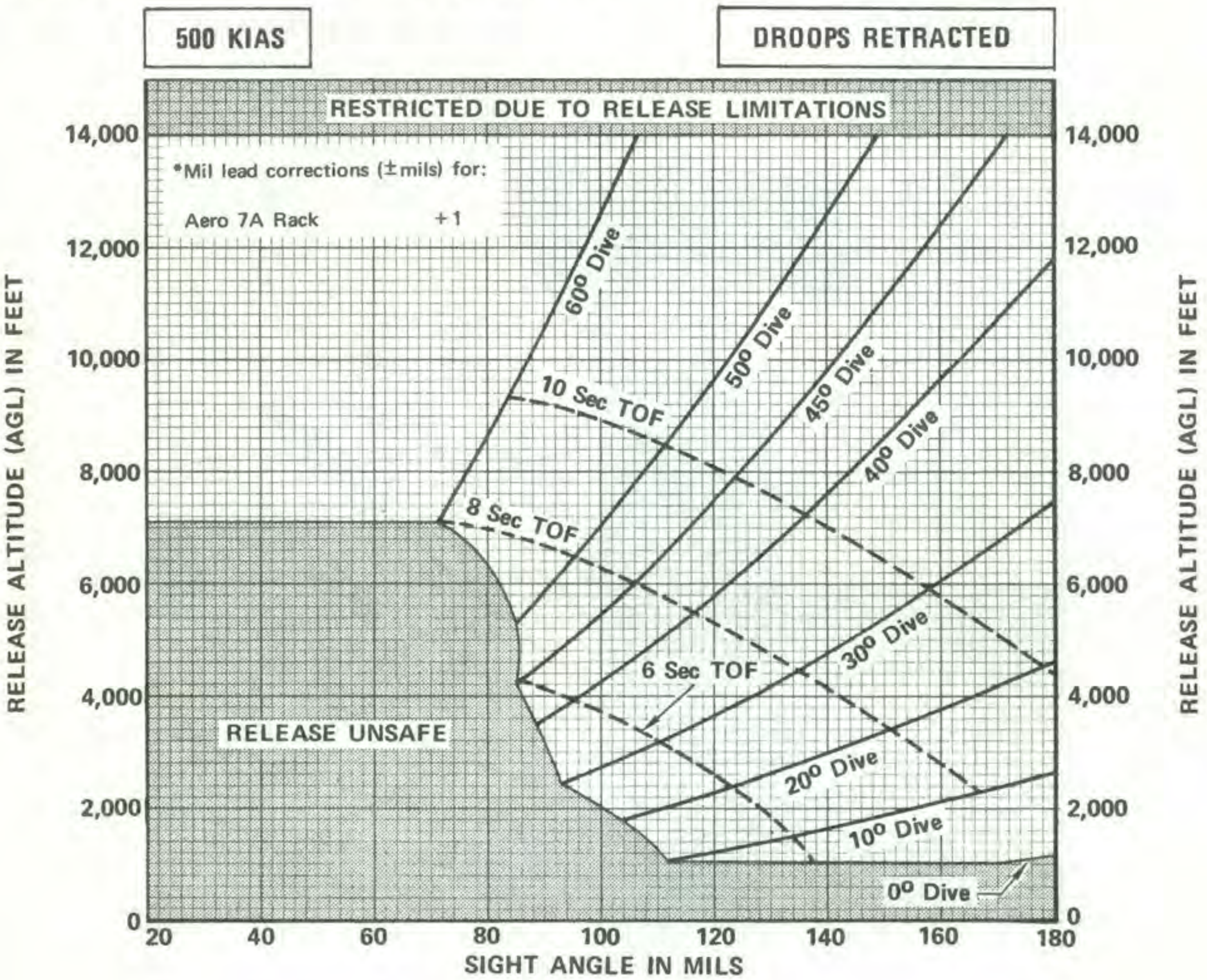
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-276(3)-03-69

Figure 2-73 (Sheet 3)

Mil Lead for Single Delivery

M117A1 DEMOLITION BOMB CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,560	1,230	840
10°	1,600	1,290	1,050
20°	2,330	2,050	1,690
30°	3,140	2,770	2,320
40°	3,900	3,610	3,610†
45°	4,270	4,270†	4,270†
50°	5,340	5,340†	5,340†
60°	7,040	7,040†	7,040†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 4.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

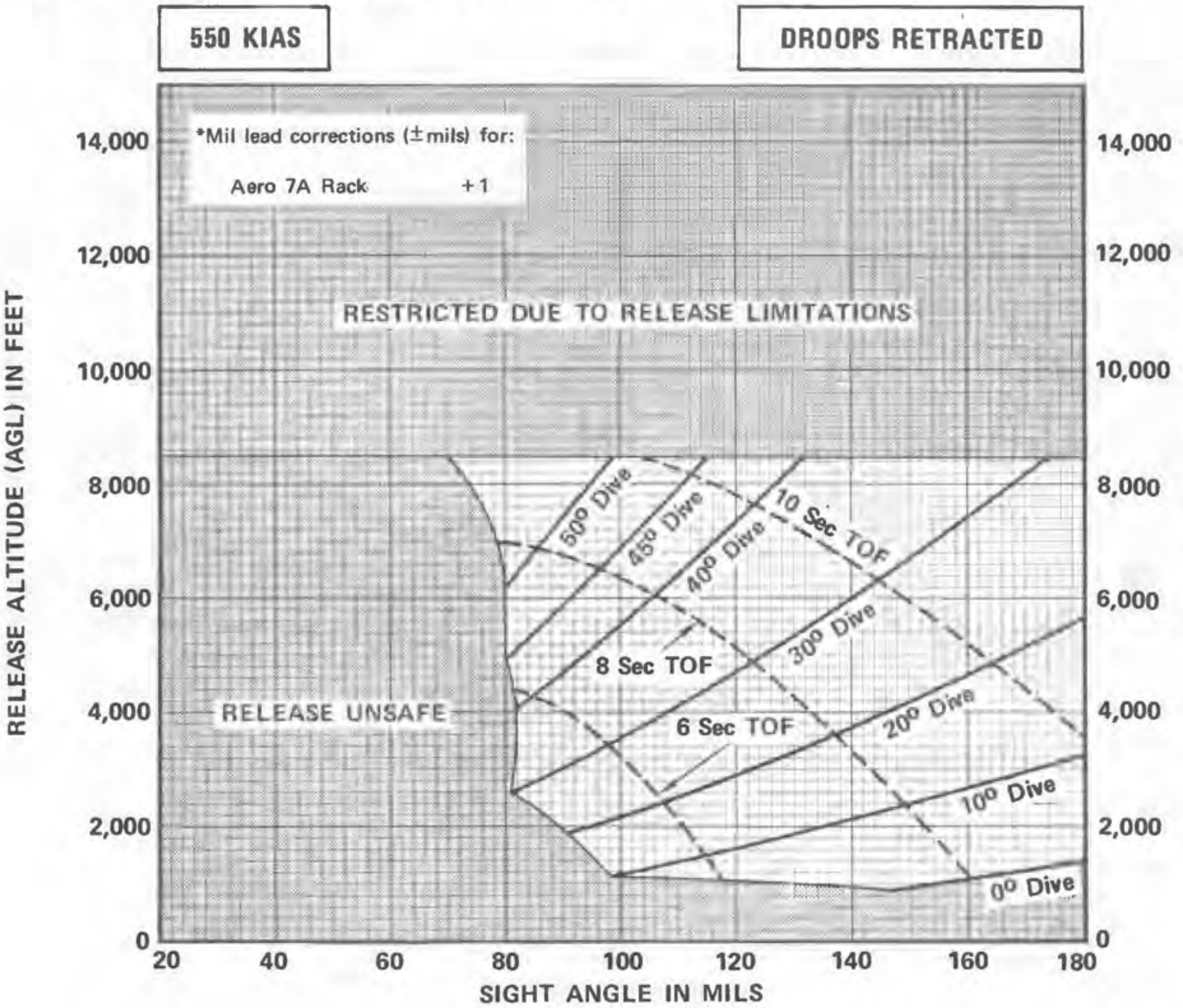
†Terrain avoidance is determining factor for this release altitude limitation.

AZ-276(4)-03-69

Figure 2-73 (Sheet 4)

Mil Lead for Single Delivery

M117A1 DEMOLITION BOMB CONICAL FIN



RELEASE ALTITUDES FOR SPECIFIED FRAGMENT HIT PROBABILITIES

DROP ANGLE	0.000 PROBABILITY	0.001 PROBABILITY	0.010 PROBABILITY
0°	1,360	1,060	760
10°	1,600	1,300	1,080
20°	2,430	2,130	1,780
30°	3,290	2,940	2,570
40°	4,110	4,080	4,080†
45°	4,840	4,840†	4,840†
50°	6,000	6,000†	6,000†
60°	7,920	7,920†	7,920†

NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft targer elevation, and 4.2 ft/sec average ejection velocity. Released from MER or TER.

***For each 10° C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

†Terrain avoidance is determining factor for this release altitude limitation.

AZ-276(5)-03-69

Figure 2-73 (Sheet 5)

Maximum Fragment Envelope

M117A1 DEMOLITION BOMB

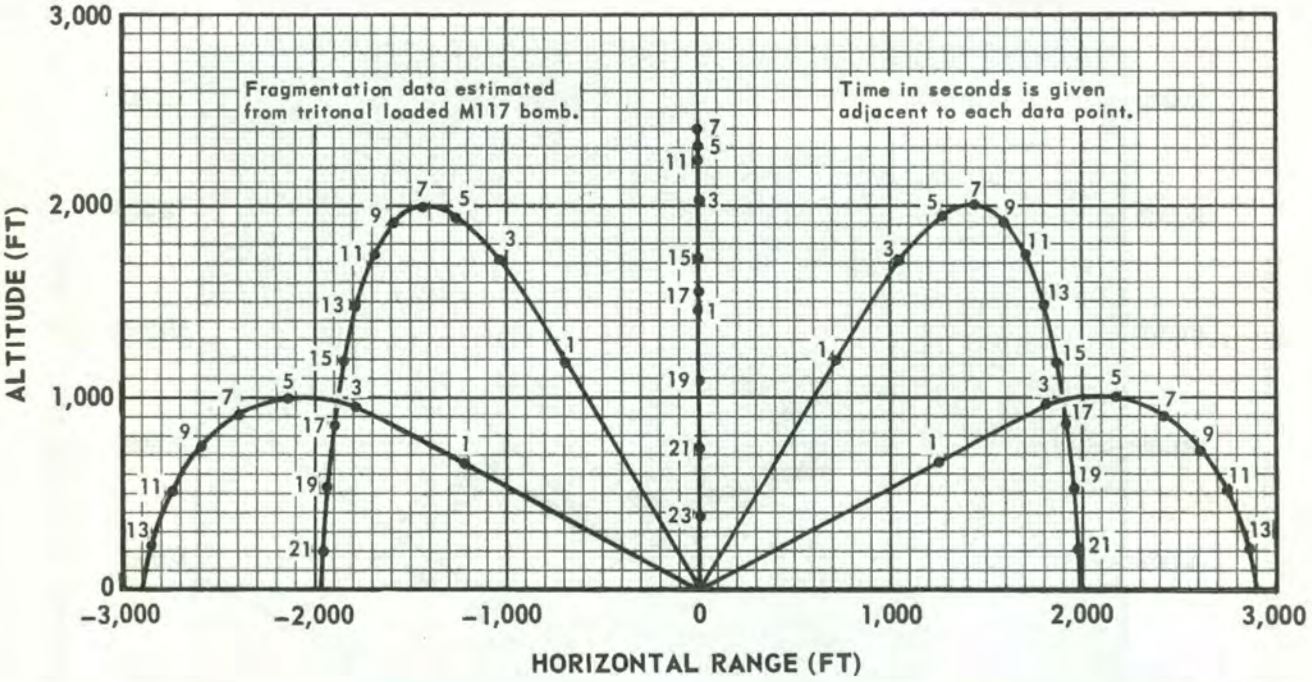
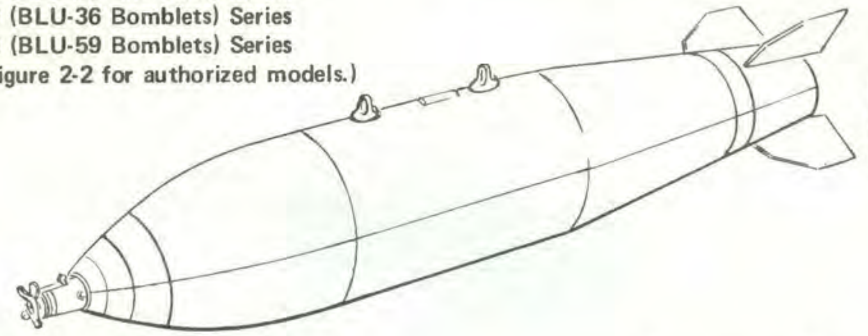
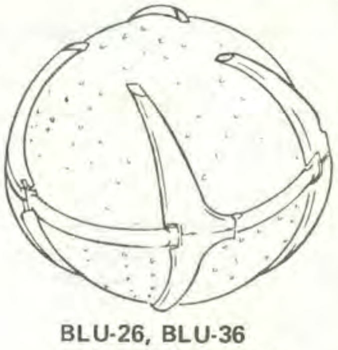


Figure 2-74

SUU-30/B, -30A/B, -30C/B Dispensers

CBU-24 (BLU-26 Bomblets) Series
CBU-29 (BLU-36 Bomblets) Series
CBU-49 (BLU-59 Bomblets) Series
(See figure 2-2 for authorized models.)





BLU-26, BLU-36
or BLU-59 Bomblets

PHYSICAL CHARACTERISTICS

Weight (Loaded	– 830 pounds
Length	– 92.6 inches
Diameter	– 16.0 inches
Suspension lugs	– 14 inches apart

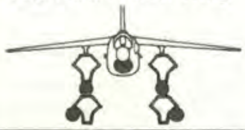
DESCRIPTION

The SUU-30/B, -30A/B and -30C/B dispensers are used to make up the cluster bomb units (CBU) shown above. Each CBU consists of a SUU-30 dispenser, fuzed bomblets, and a mechanical time nose fuze.

The dispensers are divided in half longitudinally. The two halves are locked together by a nose locking cap and a ring and plate assembly at the aft end. The SUU-30A/B and the SUU-30C/B dispensers are basically a SUU-30/B which has been modified to eliminate tension members and incorporates a modified fin assembly that provides improved aerodynamics. Canted aluminum alloy fins impart spin to the dispenser when released.

The BLU-26, -36 and -59 bomblets are identical except for the type of fuze used. BLU-26 bomblets detonate instantaneously on impact. BLU-36 bomblets provide random delays which range from 0 to 120 minutes with about 50 percent detonating within 10 minutes after impact. BLU-59 bomblets provide random delays which range from 0 to 30 minutes with about 50 percent detonating within 8 minutes after impact. There is no external feature that indicates the bomblet is armed.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION **One Bomb Each Wing** 	**2 CBU-24, -29, -49** **2 Aero 7A-1** **2 Pylons** **Total** **One Wing Only**	**1,660** **104** **350** **2,114** **1,057**
TER SUSPENSION **Two Bombs Each Wing** 	**4 CBU-24, -29, -49** **2 Aero 7A-1** **2 Pylons** **2 TER** **Total** **One Wing Only**	**3,320** **104** **350** **210** **3,984** **1,992**
MER SUSPENSION **Two Bombs Each Wing** 	**4 CBU-24, -29, -49** **2 Aero 7A-1** **2 Pylons** **2 MER** **Total** **One Wing Only**	**3,320** **104** **350** **446** **4,220** **2,110**

DROPPING PROCEDURES

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – Wing L or R**
3. **Mechanical Fuzing Sw – NOSE and TAIL**
4. **Stores Release Sw – DEPRESS**

NOTE

For simultaneous release from Aero 7A-1 racks from both pylons, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position and the Arm Sel Sw to the WING L position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -505 or -521 TER or MER, the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past the empty station.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

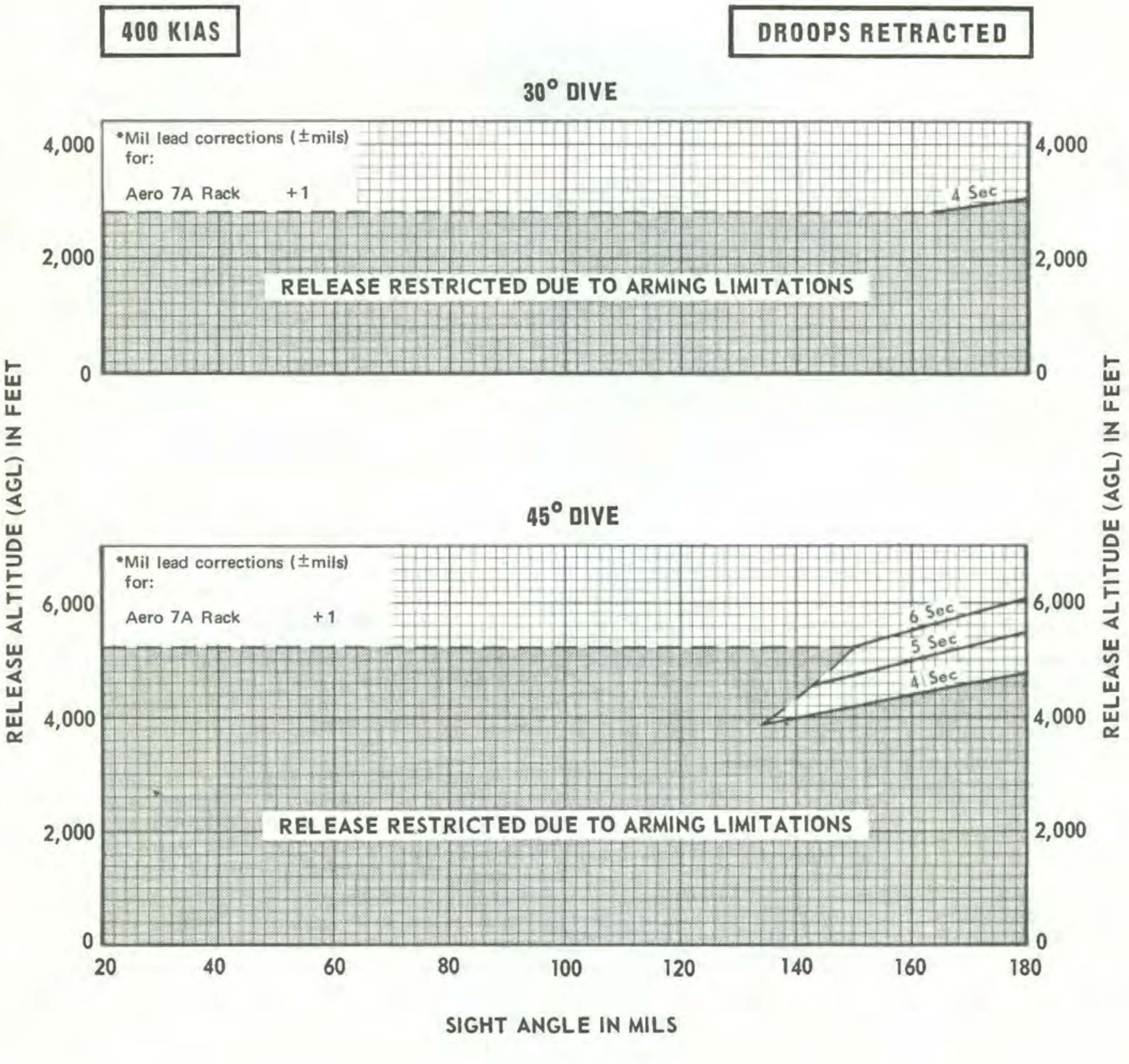
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspections – NAVAIR 01-45HH-75
4. Bomb Arming – NAVAIR 01-45HH-75
5. Dispensers – NAVAIR 11-5A-1

AZ-267-03-70

Figure 2–75 (U)

Mil Lead for Single Delivery

SUU-30 DISPENSER, CBU-24, -29, -49 SERIES



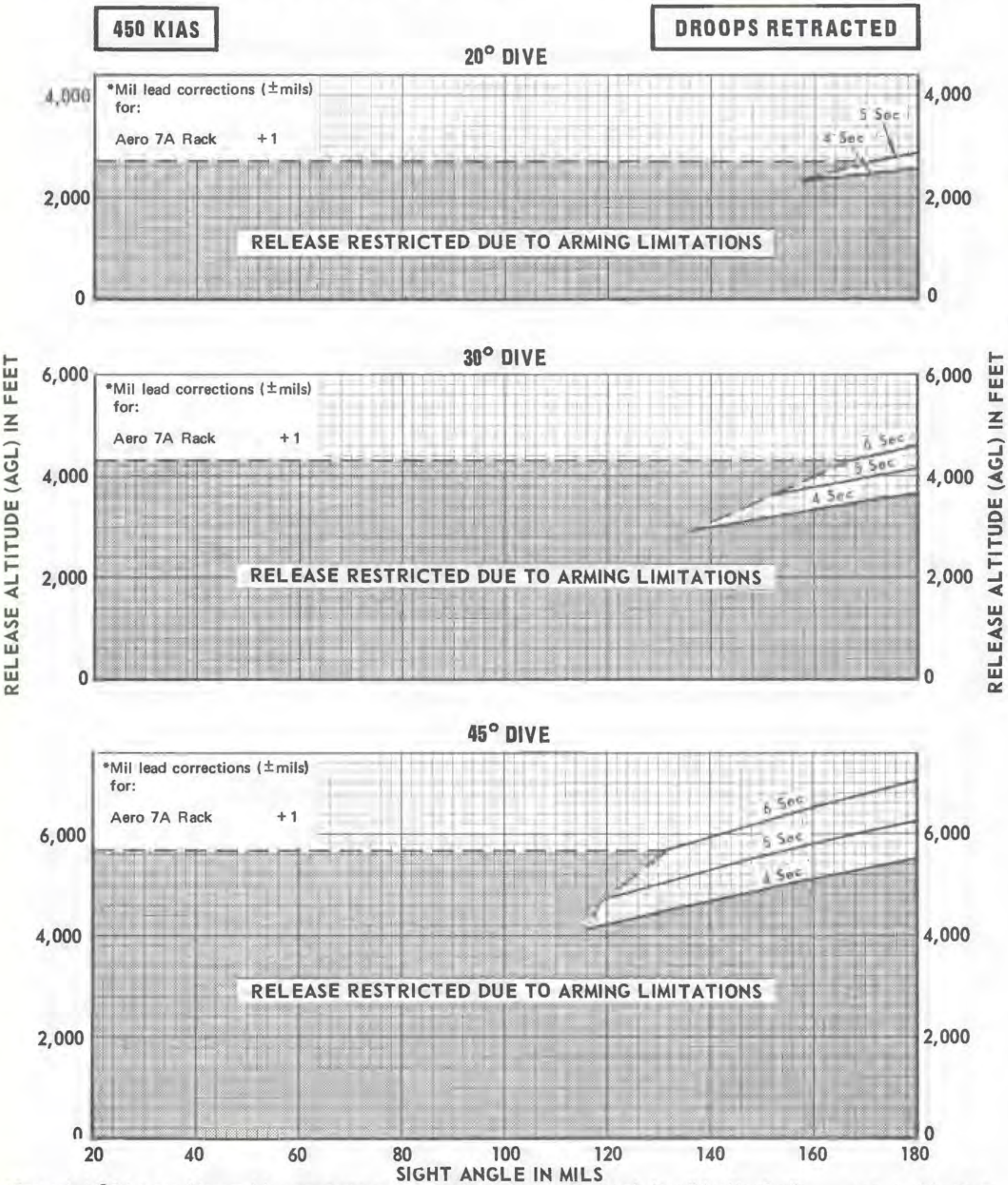
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 6 mils.

AZ-278(1)-03-69

Figure 2-76 (Sheet 1)

Mil Lead for Single Delivery

SUU-30 DISPENSER, CBU-24, -29, -49 SERIES

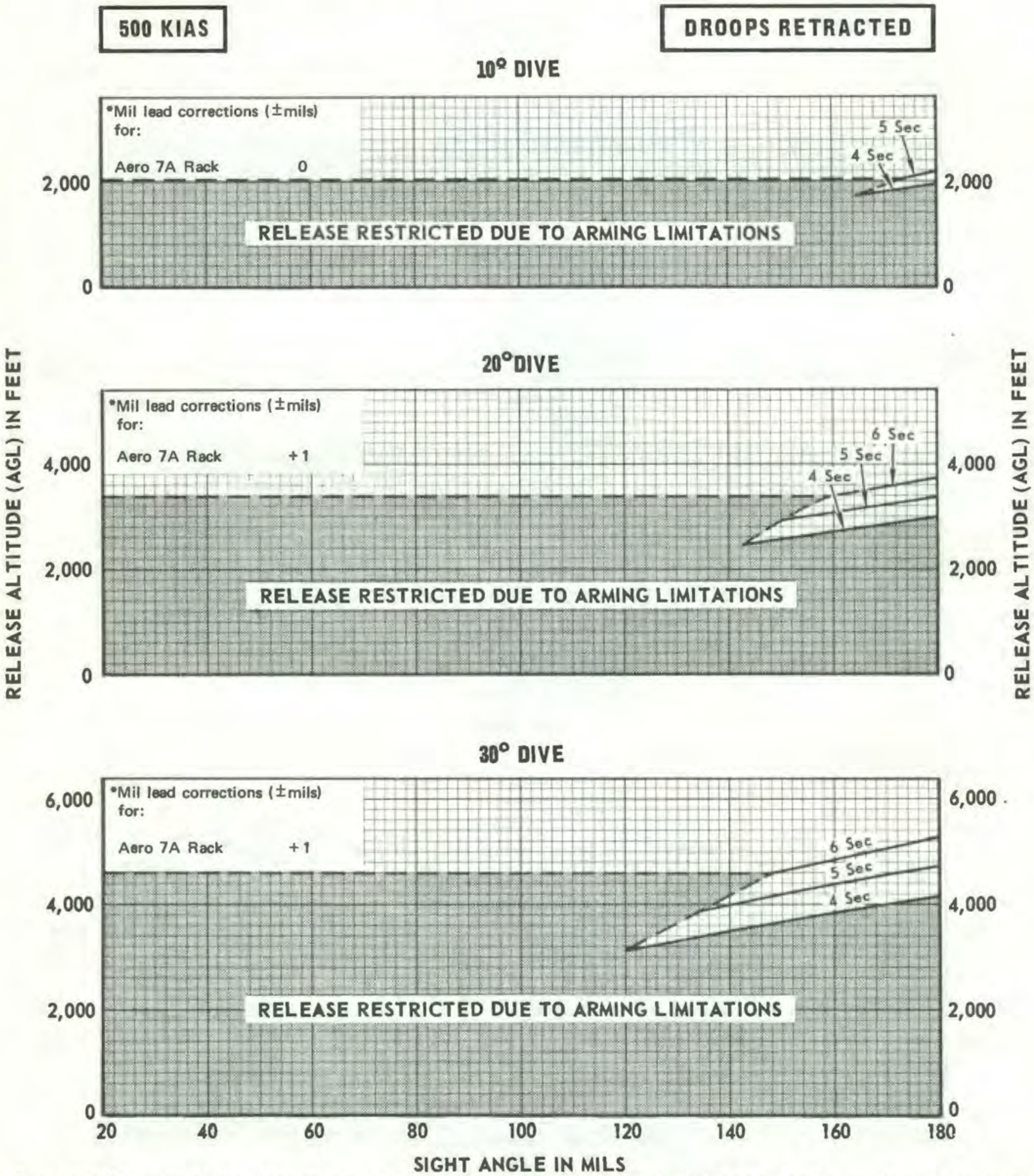


*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 6 mils. AZ-278(2)-03-69

Figure 2-76 (Sheet 2)

Mil Lead for Single Delivery

SUU-30 DISPENSER, CBU-24, -29, -49 SERIES

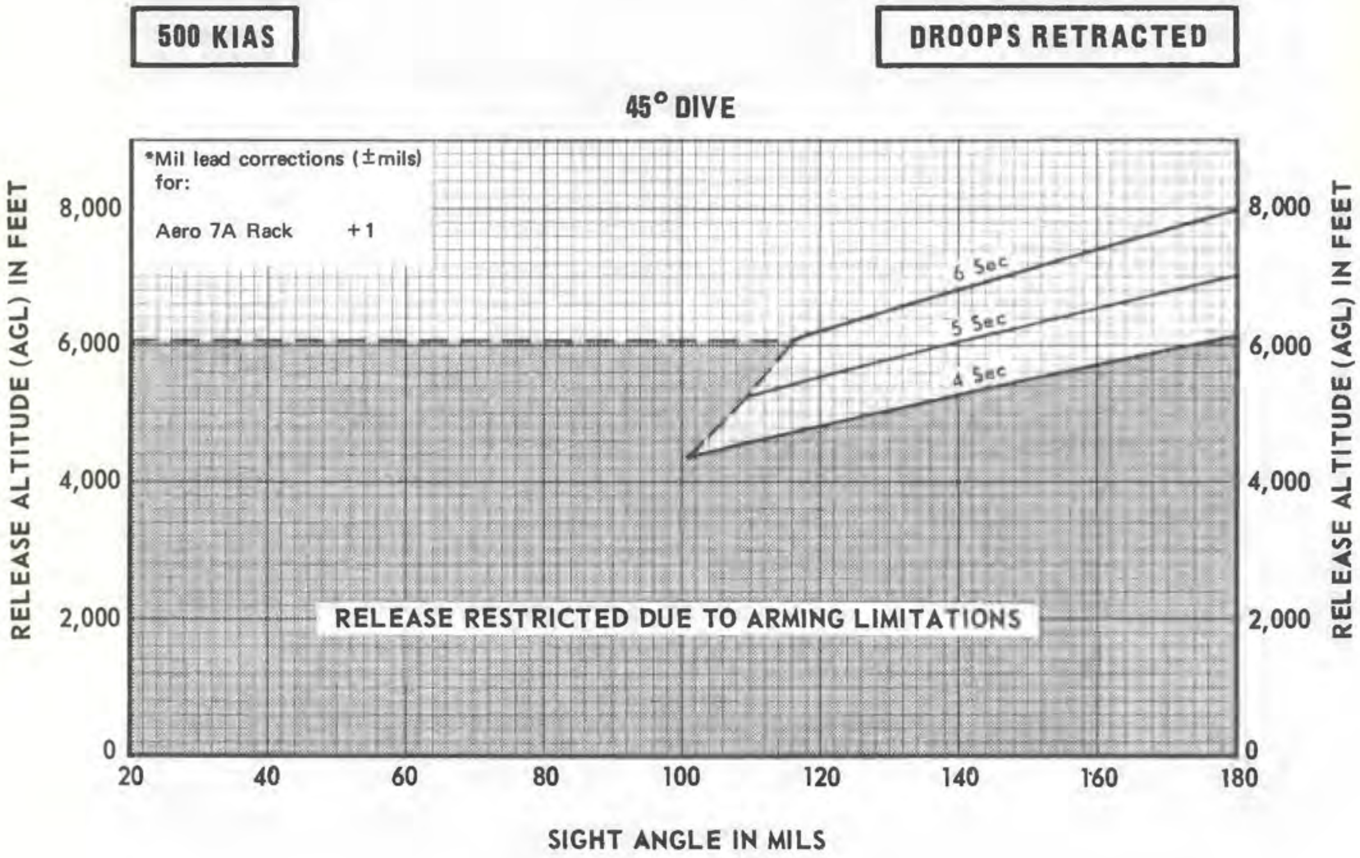


*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 6 mils. AZ-278(3)-03-69

Figure 2-76 (Sheet 3)

Mil Lead for Single Delivery

SUU-30 DISPENSER, CBU-24, -29, -49 SERIES



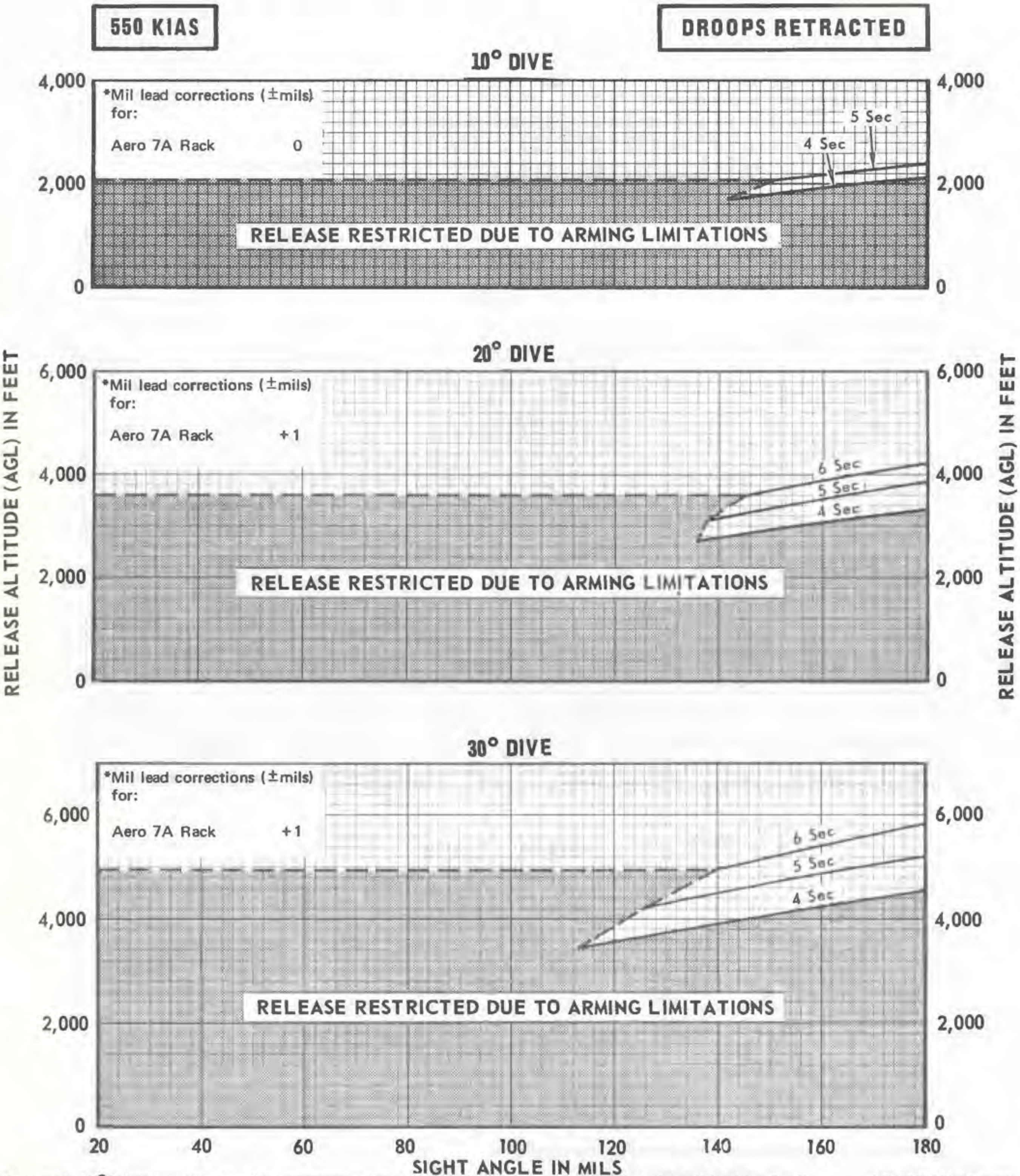
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 6 mils.

AZ-278(4)-03-69

Figure 2–76 (Sheet 4)

Mil Lead for Single Delivery

SUU-30 DISPENSER, CBU-24, -29, -49 SERIES

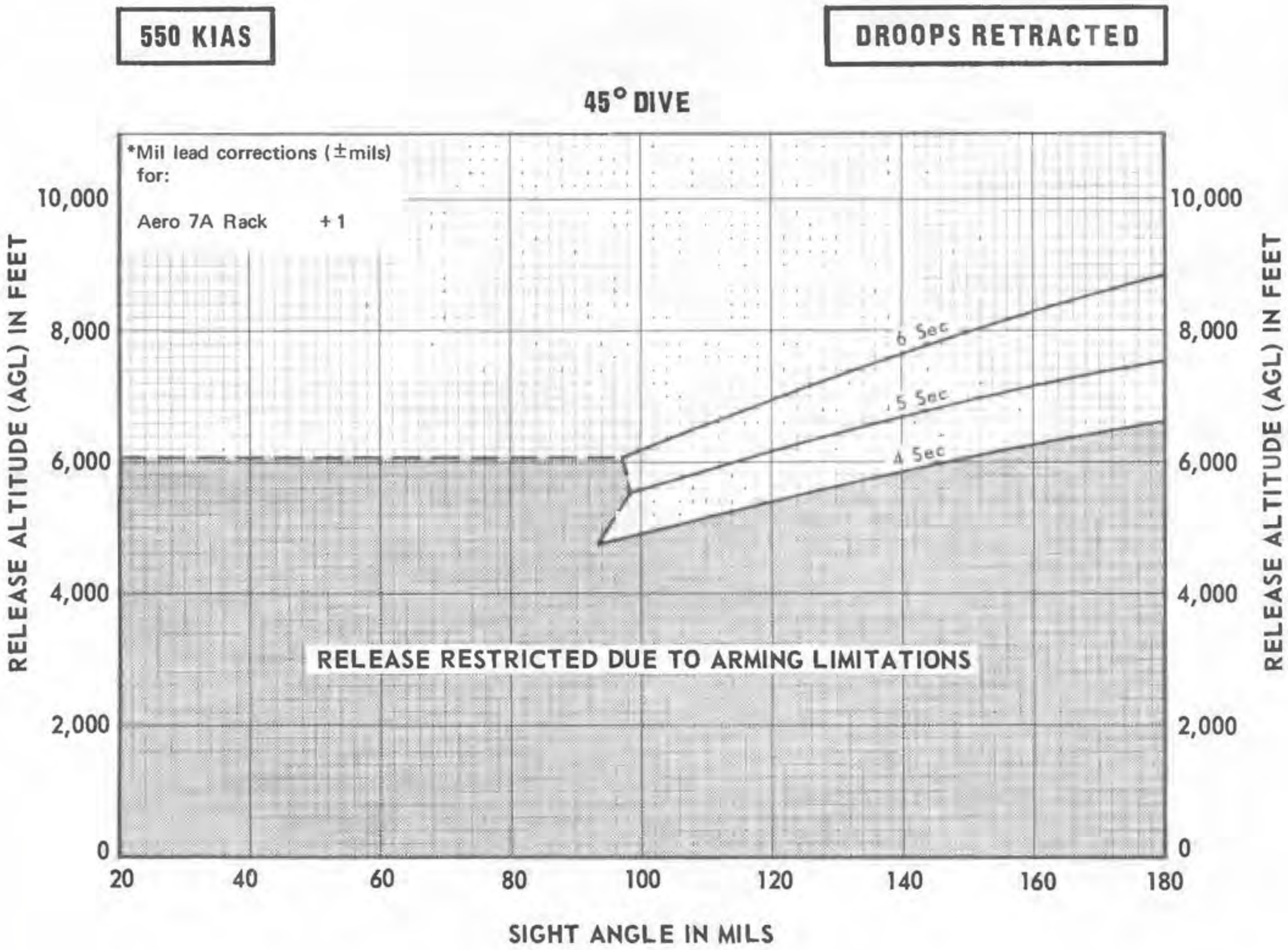


*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 6 mils. AZ-278(5)-03-69

Figure 2-76 (Sheet 5)

Mil Lead for Single Delivery

SUU-30 DISPENSER, CBU-24, -29, -49 SERIES



NOTE

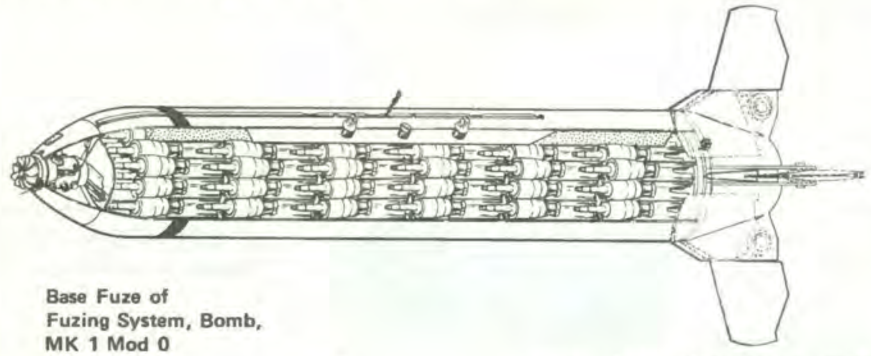
Sight angles are based on 27,000-lb aircraft gross weight, 0-ft burst altitude, 0-ft target elevation, and 4.8 ft/sec average ejection velocity.

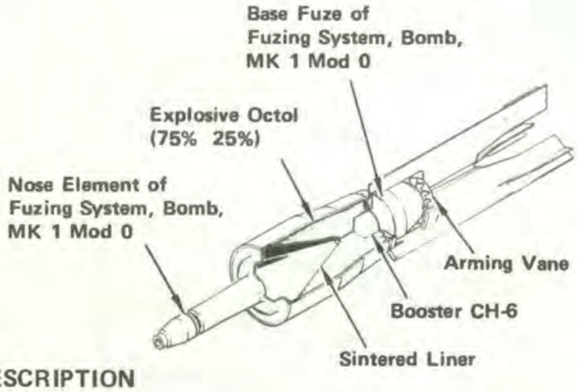
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 6 mils.

AZ-278(6)-03-69

Figure 2-76 (Sheet 6)

MK 20 Mod 2 (Rockeye II) Bomb





PHYSICAL CHARACTERISTICS

ROCKEYE II	
Weight of loaded dispenser	–460.0 Pounds
Length (with fuze)	–92.0 Inches
Diameter	–13.2 Inches
MK 118 MOD 0 BOMBLET	
Weight	–1.32 Pounds
Length	–13.50 Inches
Diameter	–2.10 Inches
Weight of explosive	–0.39 Pounds

DESCRIPTION

The ROCKEYE II is an unguided cluster bomb designed for tactical use against tanks and armored vehicles. The major components of the ROCKEYE II are the Mk 7 Mod 2 dispenser, the MK 339 Mod 0 dispenser fuze, and 247 MK 118 Mod 0 antitank/antipersonnel bomblets.

The MK 118 bomblet utilizes the MK 1 Mod 0 Fuzing System. This system contains a small tail mounted arming vane which arms the bomblet in about 1.5 seconds after release from the dispenser. An airspeed of 200 KIAS or greater is required for reliable arming of the bomblet. A nose element in the fuze detonates the bomblet instantaneously and with a shaped charge effect on impact with hard targets (steel, concrete). The tail fuze detonates the bomblet after a very short delay on impact with softer targets. A discriminating feature of the fuze permits penetration of light material (vegetation, camouflage nets, light plywood) without detonation.

A small observation window in the side of the tail fuze shows RED if armed, GREEN if safe.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION **One Bomb Each Wing** 	**2 Mk 20 Mod 2** **2 Aero 7A-1** **2 Pylons** **Total** **One Wing Only**	**920** **104** **350** **1,374** **687**
TER SUSPENSION **Two Bombs Each Wing** 	**4 Mk 20 Mod 2** **2 TER** **2 Aero 7A-1** **2 Pylons** **Total** **One Wing Only**	**1,840** **210** **104** **350** **2,504** **1,252**
MER SUSPENSION **Four Bombs Each Wing** 	**8 Mk 20 Mod 2** **2 MER** **2 Aero 7A-1** **2 Pylons** **Total** **One Wing Only**	**3,680** **446** **104** **350** **4,580** **2,290**

DROPPING PROCEDURE

(Mechanical Fuzing)

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – Wing L or R**
3. **Mechanical Fuzing Sw – NOSE or TAIL**
4. **Stores Release Sw – DEPRESS**

NOTE

For simultaneous releases from the Aero 7A-1 racks, the Triple–Multiple Rack Fire Mode switch must be set to the DUAL position and the Arm Sel Sw in the WING, L position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -505 or -521 TER or MER, the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past empty stations.

JETTISONING PROCEDURES

See JETTISONING, this section.

REFERENCES

1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ-341-03-70

Figure 2–77 (C)(Gp-4)

Mil Lead for Single Delivery

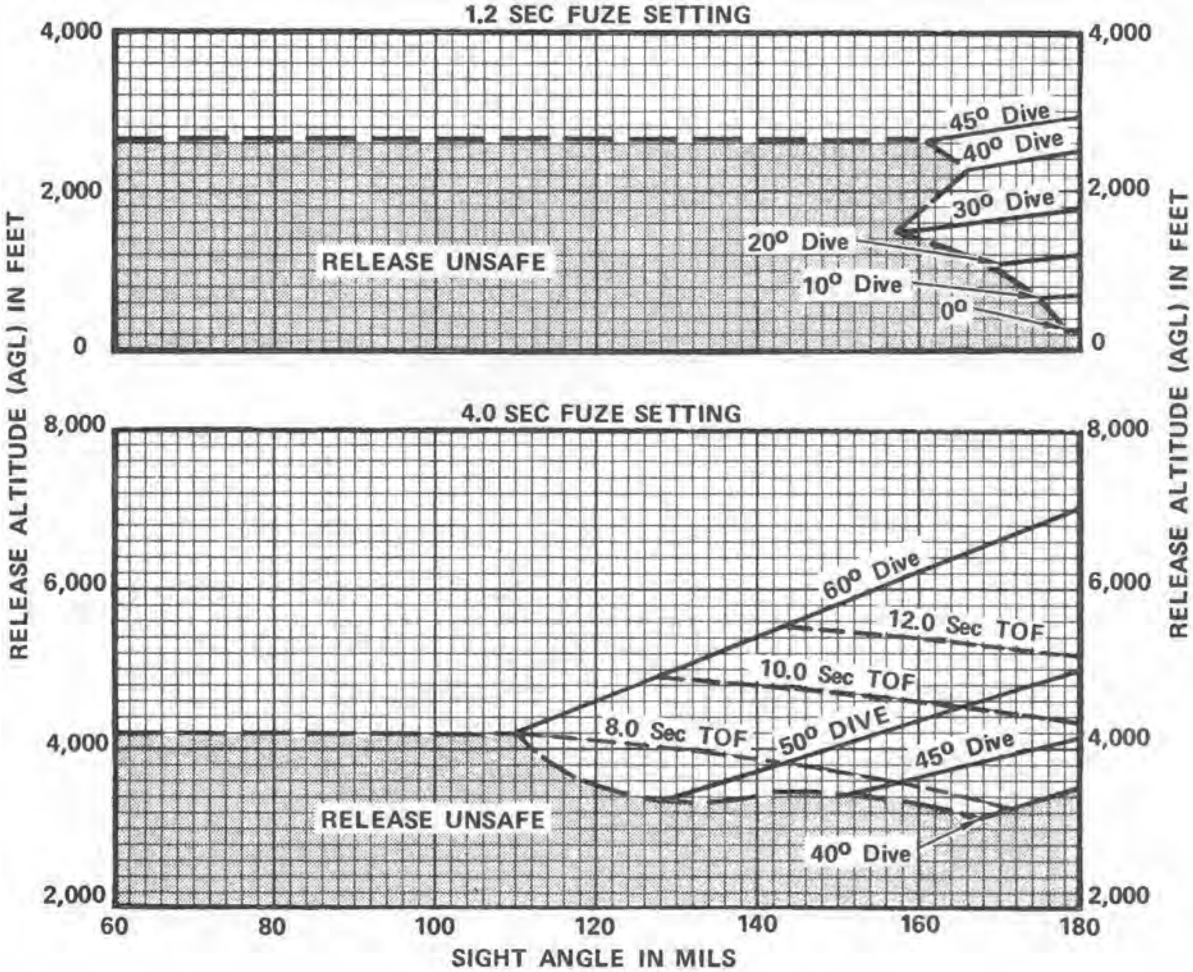
MK 20 MOD 2 (ROCKEYE)

MIL LEAD CORRECTIONS (± MILS) FOR:

AERO 7A	+2								
RELEASE ALTITUDE TEMP - VARIATION	DIVE ANGLE	0°	10°	20°	30°	40°	45°	50°	60°
±10°C		±2	±4	±4	±5	±5	±5	±5	±5 MILS
±30°C		±7	±11	±12	±14	±16	±16	±14	±14 MILS

350 KIAS

DROOPS RETRACTED



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity of MER and TER. For increase (decrease) in temperature, increase (decrease) the mil lead; linear interpolation shall be used for nonstandard temperatures other than those given.

AZ-318(1)-03-69

Figure 2-78 (Sheet 1)

Mil Lead for Single Delivery

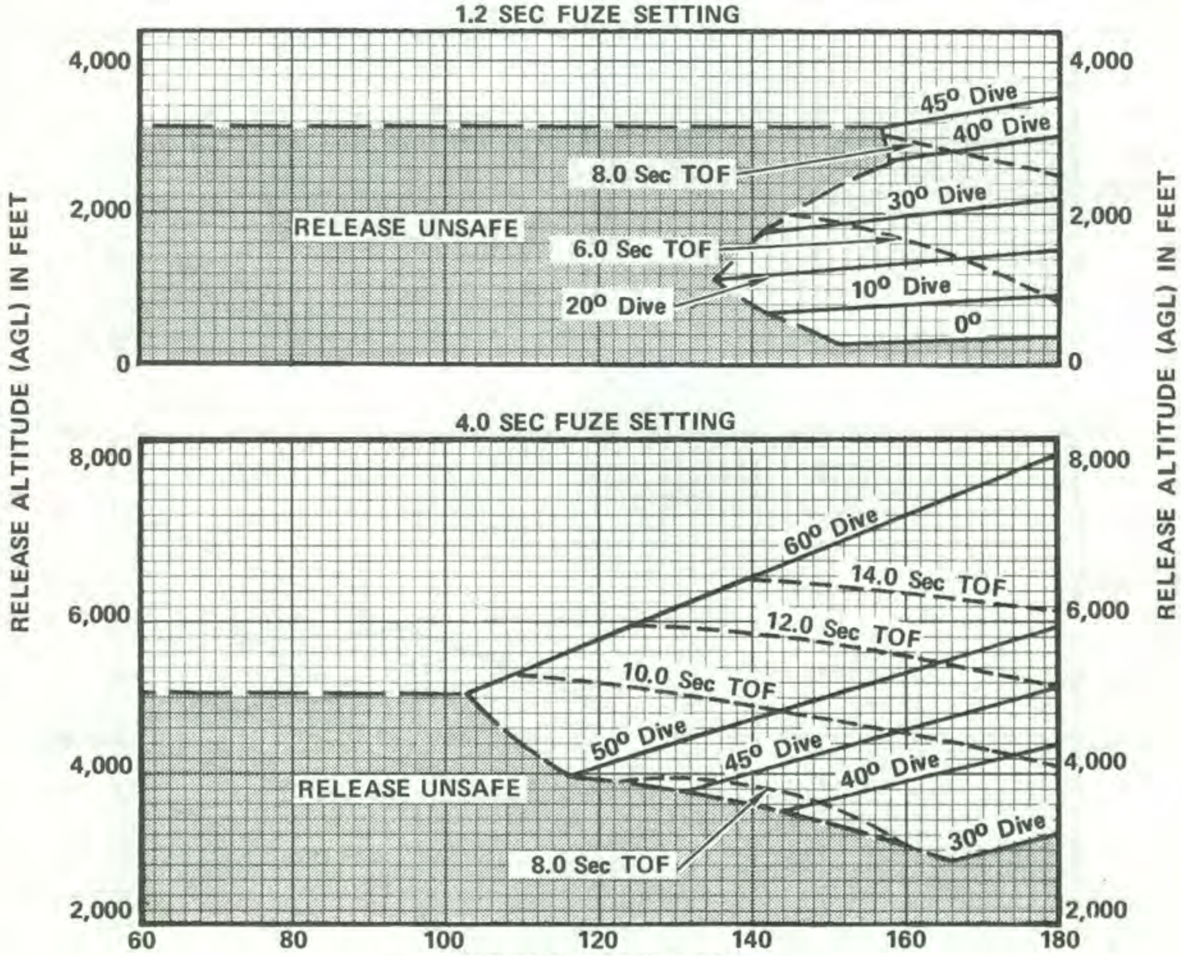
MK 20 MOD 2 (ROCKEYE)

MIL LEAD CORRECTIONS (± MILS) FOR:

AERO 7D	+2								
RELEASE ALTITUDE TEMP-VARIATION	DIVE ANGLE	0°	10°	20°	30°	40°	45°	50°	60°
±10°C		±2	±4	±4	±5	±5	±5	±5	±5 MILS
±30°C		±7	±11	±12	±14	±16	±16	±14	±14 MILS

400 KIAS

DROOPS RETRACTED



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity of MER and TER. For increase (decrease) in temperature increase (decrease) the mil lead; linear interpolation shall be used for nonstandard temperatures other than those given.

AZ-318(2)-03-69

Figure 2-78 (Sheet 2)

Mil Lead for Single Delivery

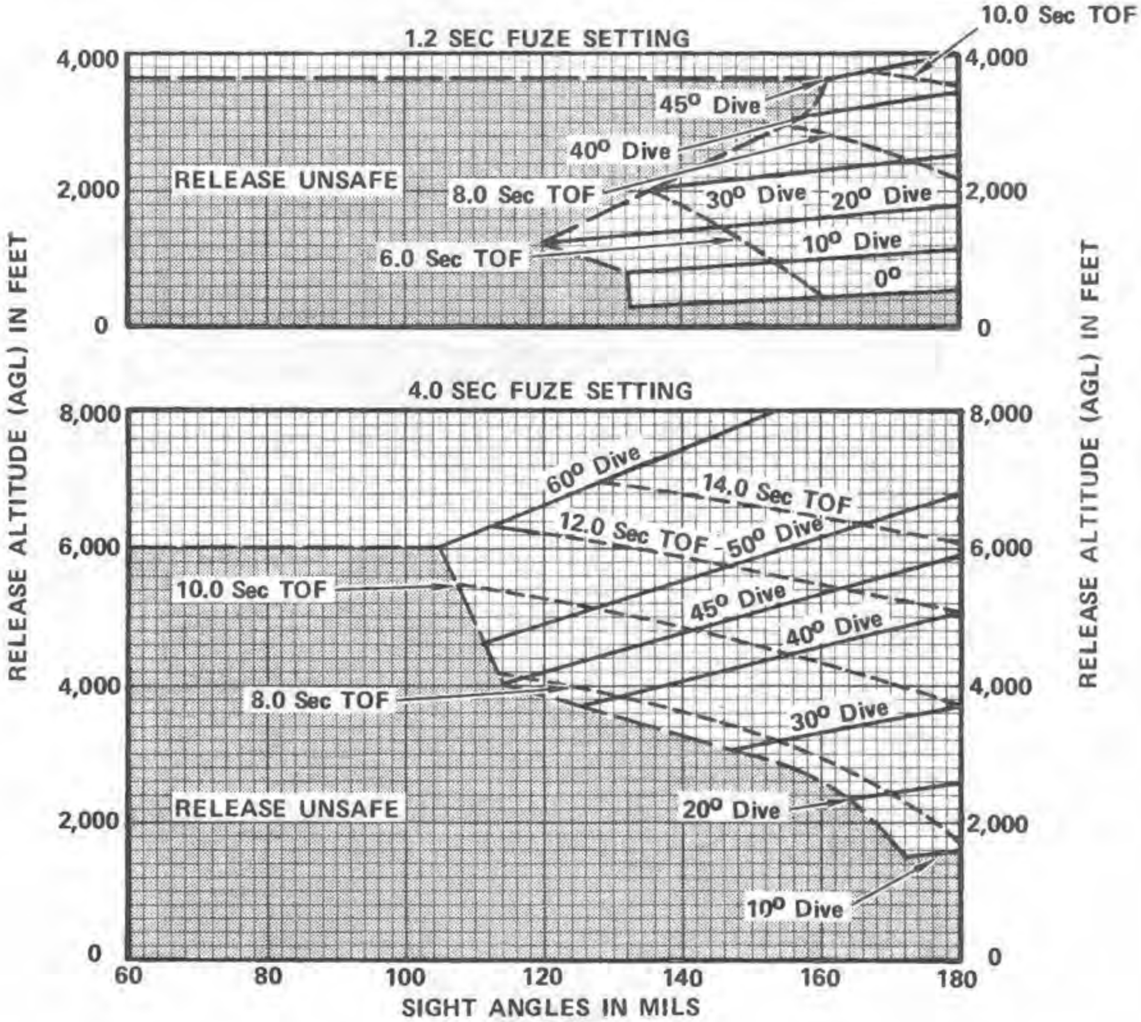
MK 20 MOD 2 (ROCKEYE)

MIL LEAD CORRECTIONS (± MILS) FOR:

AERO 7A	1.2 FUZE, +1: 4.0 FUZE, +2								
RELEASE ALTITUDE TEMP - VARIATION	DIVE ANGLE	0°	10°	20°	30°	40°	45°	50°	60°
±10°C		±2	±4	±4	±5	±5	±5	±5	±5 MILS
±30°C		±7	±11	±12	±14	±16	±16	±14	±14

450 KIAS

DROOPS RETRACTED



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity of MER and TER. For increase (decrease) in temperature, increase (decrease) the mil lead; linear interpolation shall be used for nonstandard temperatures other than those given.

AZ-318(3)-03-69

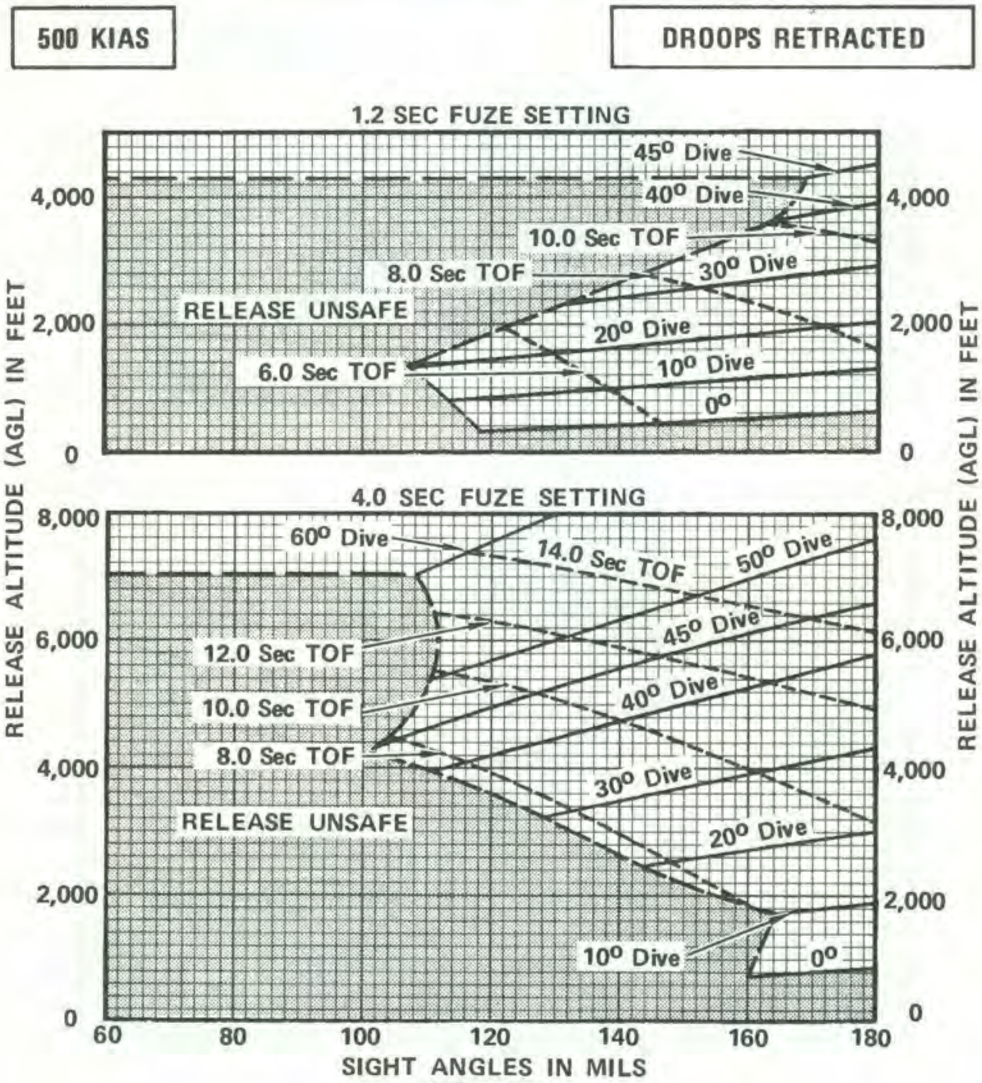
Figure 2-78 (Sheet 3)

Mil Lead for Single Delivery

MK 20 MOD 2 (ROCKEYE)

MIL LEAD CORRECTIONS (± MILS) FOR:

AERO 7A	+1								
RELEASE ALTITUDE TEMP-VARIATION	DIVE ANGLE	0°	10°	20°	30°	40°	45°	50°	60°
±10°C		±2	±4	±4	±5	±5	±5	±5	±5 MILS
±30°C		±7	±11	±12	±14	±16	±16	±14	±14 MILS



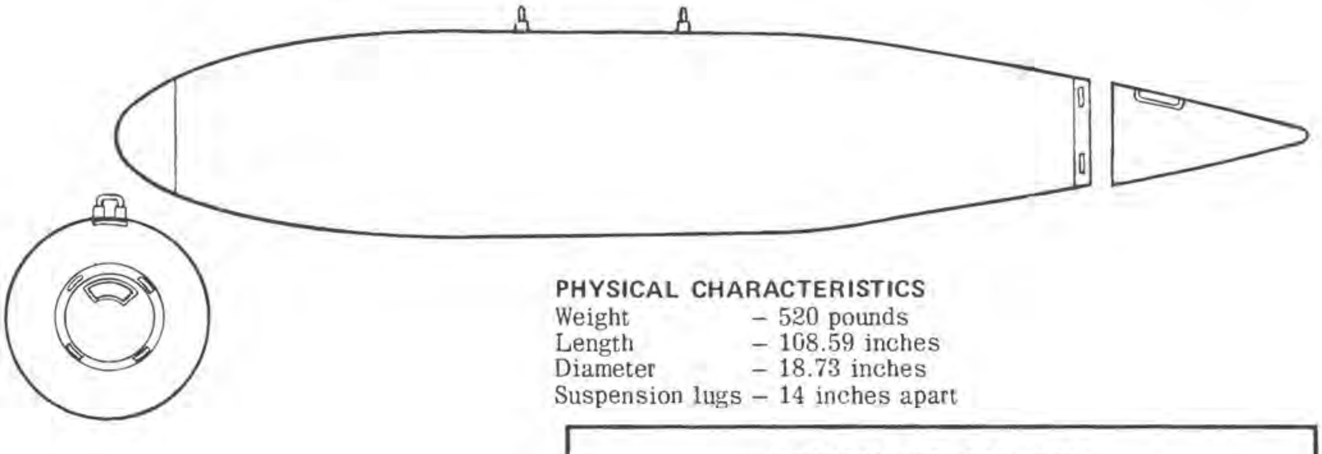
NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 6.0 ft/sec average ejection velocity of MER and TER. For increase (decrease) in temperature, increase (decrease) the mil lead; linear interpolation shall be used for non-standard temperatures other than those given.

AZ-318(4)-03-69

Figure 2-78 (Sheet 4)

MK 77 Mod 2 and 4 Fire Bomb



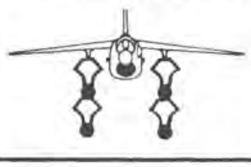
PHYSICAL CHARACTERISTICS

Weight – 520 pounds
Length – 108.59 inches
Diameter – 18.73 inches
Suspension lugs – 14 inches apart

DESCRIPTION

The Mk 77 Mod 2 or Mod 4 is a 500-pound fire bomb. The bomb is constructed of thin aluminum and has detachable nose and tail cones. These cones are ejected by springs when the cone release wires are withdrawn at weapon release. The bomb container capacity is 75 gallons of gasoline and napalm mix. Once filled the bomb must be expended or jettisoned.

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT
AERO 7A-1 SUSPENSION One Bomb Each Wing 	2 MK 77 1040 2 Aero 7A-1 104 2 Pylons 350 Total 1494 One Wing Only 747
TER SUSPENSION One Bomb Each Wing 	2 MK 77 1040 2 Aero 7A-1 104 2 Pylons 350 2 TER 210 Total 1704 One Wing Only 852
MER SUSPENSION Two Bombs Each Wing 	4 MK 77 2080 2 Aero 7A-1 104 2 Pylons 350 2 MER 446 Total 2980 One Wing Only 1490

DROPPING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Mechanical Fuzing Sw – NOSE and TAIL
4. Stores Release Sw – DEPRESS

NOTE

For simultaneous releases from Aero 7A-1 racks, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position and the Arm Sel Sw to the WING L position.

To step the MER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between bombs. With the -501 or -521 MER the mechanical fuzing switch must also be placed in the NOSE position to obtain automatic stepping past empty stations.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

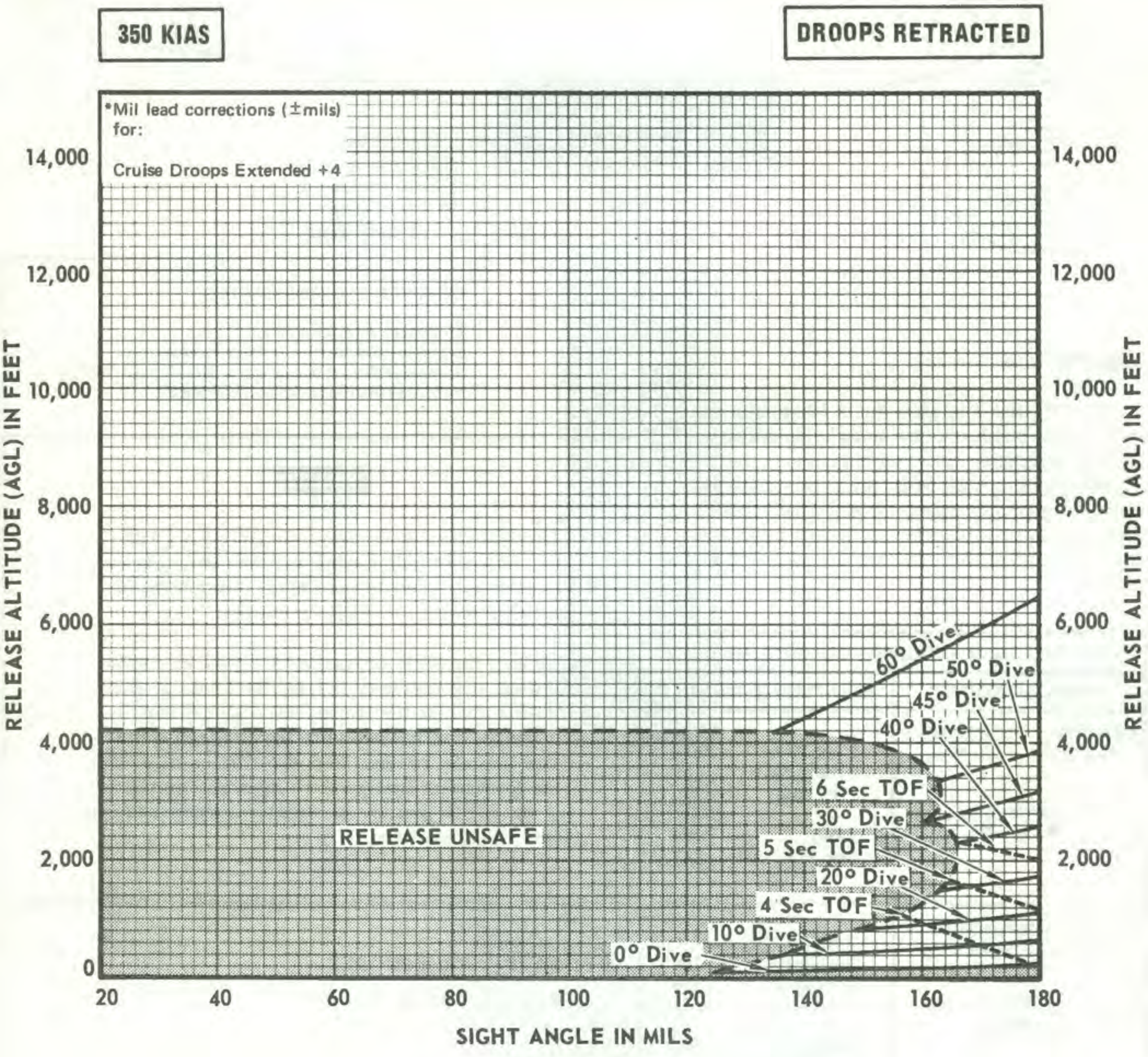
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspections – NAVAIR 01-45HH-75
4. Bomb Arming – NAVAIR 01-45HH-75

AZ-102-03-69

Figure 2–79

Mil Lead for Single Delivery

MK 77 FIRE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.0 ft/sec ejection velocity. Released from Aero 7A ER.

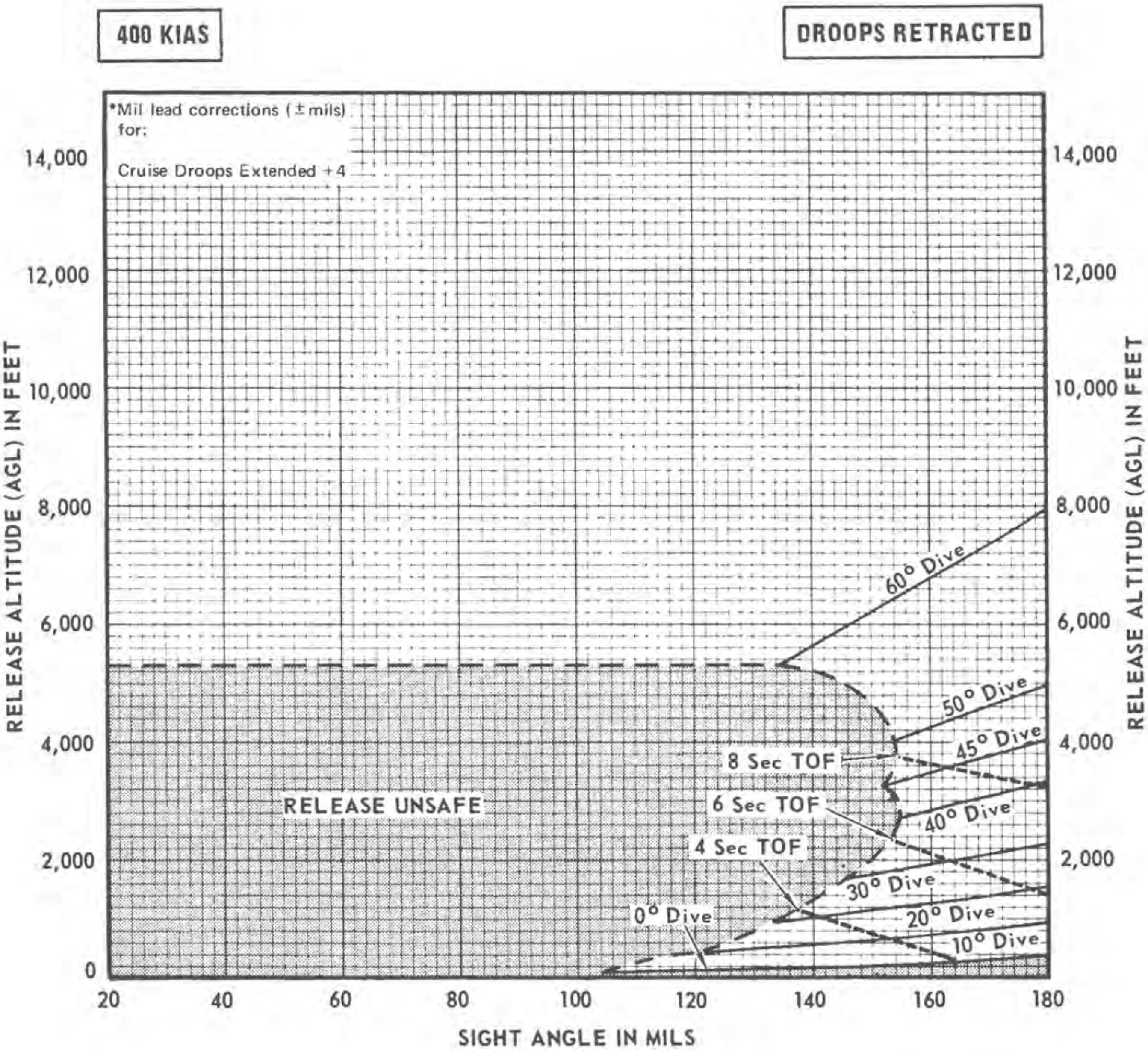
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-223(1)-03-69

Figure 2-80 (Sheet 1)

Mil Lead for Single Delivery

MK 77 FIRE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.0 ft/sec ejection velocity. Released from Aero 7A ER.

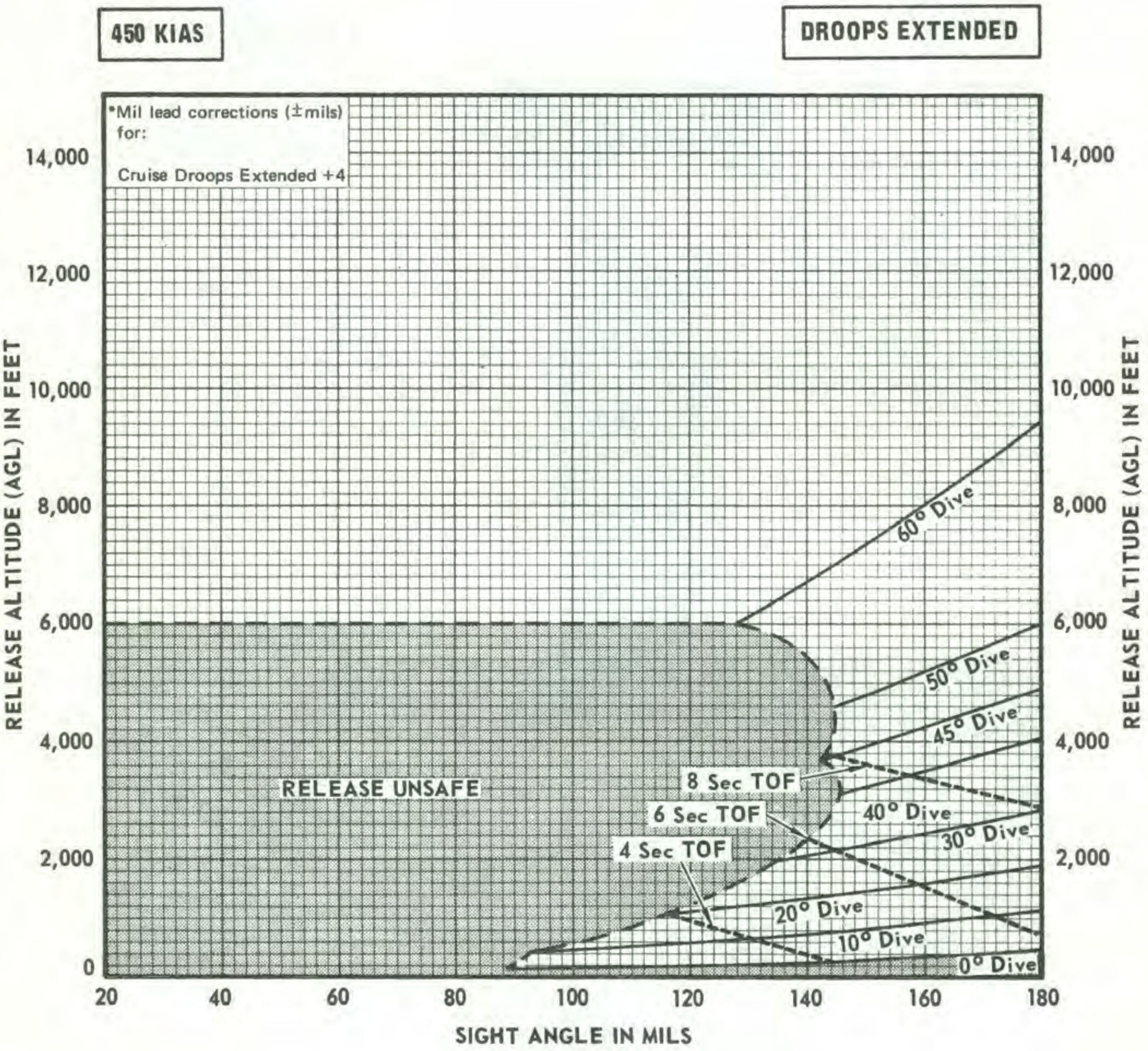
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-223 (2)-03-69

Figure 2–80 (Sheet 2)

Mil Lead for Single Delivery

MK 77 FIRE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 7.0 ft/sec ejection velocity. Released from Aero 7A ER.

***For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-223 (3)-03-69

Figure 2-80 (Sheet 3)

Tested Delivery Data

MK 77 FIRE BOMB

DIVE ANGLE	MIL LEAD		ENTRY			RELEASE			CORRECTION PER 10 KT OF DIRECT WIND – MILS		RELEASE ERROR SENSITIVITIES		
	EJECTED MILS	NON-EJECTED (MBR) – MILS	KIAS	ALTITUDE FT AGL	APPROX RPM %	KTAS	ALTITUDE FT AGL	ALTIMETER LAG – FT	Range	Cross	FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE
LEVEL	105	——	435	100	94	450	100	0	2	27	3	700	Climb -400 Dive +150
10°	103	——	400	3,000	91	450	400	125	2	27	1.5	100	35

NOTES

1. Error sensitivities are applied as follows:

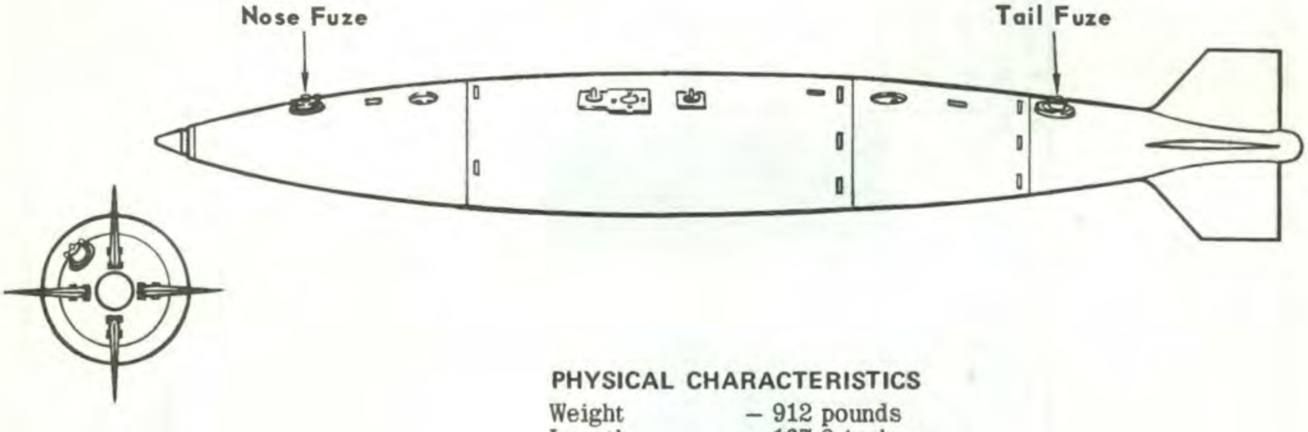
   Airspeed – Fast impacts long
   Slow impacts short
   Altitude – High impacts short
   Low impacts long
   Dive Angle – Steep impacts long
   Shallow impacts short

2. F-8 used in test was flown with cruise droop extended.

AZ-240-2-67

Figure 2–81

MK 79 Mod 1 Fire Bomb



PHYSICAL CHARACTERISTICS

Weight	– 912 pounds
Length	– 167.9 inches
Diameter	– 19.6 inches
Suspension lugs	– 14 inches apart

DESCRIPTION

The Mk 79 Mod 1 is a 1,000-pound fire bomb. The bomb is a low-drag design using thin metal. The bomb capacity is 112 gallons of gasoline and napalm mix. Once filled the bomb must be expended or jettisoned.

DROPPING PROCEDURES

(Mechanical)
1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Mechanical Fuzing Sw – NOSE and TAIL
4. Stores Release Sw – DEPRESS

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Bomb Each Wing 	2 MK 79 2 Aero 7A-1 2 Pylons Total One Wing Only	1824 104 350 2278 1139

NOTE

For simultaneous releases from Aero 7A-1 racks, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position and the Arm Sel Sw in the WING-L position.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

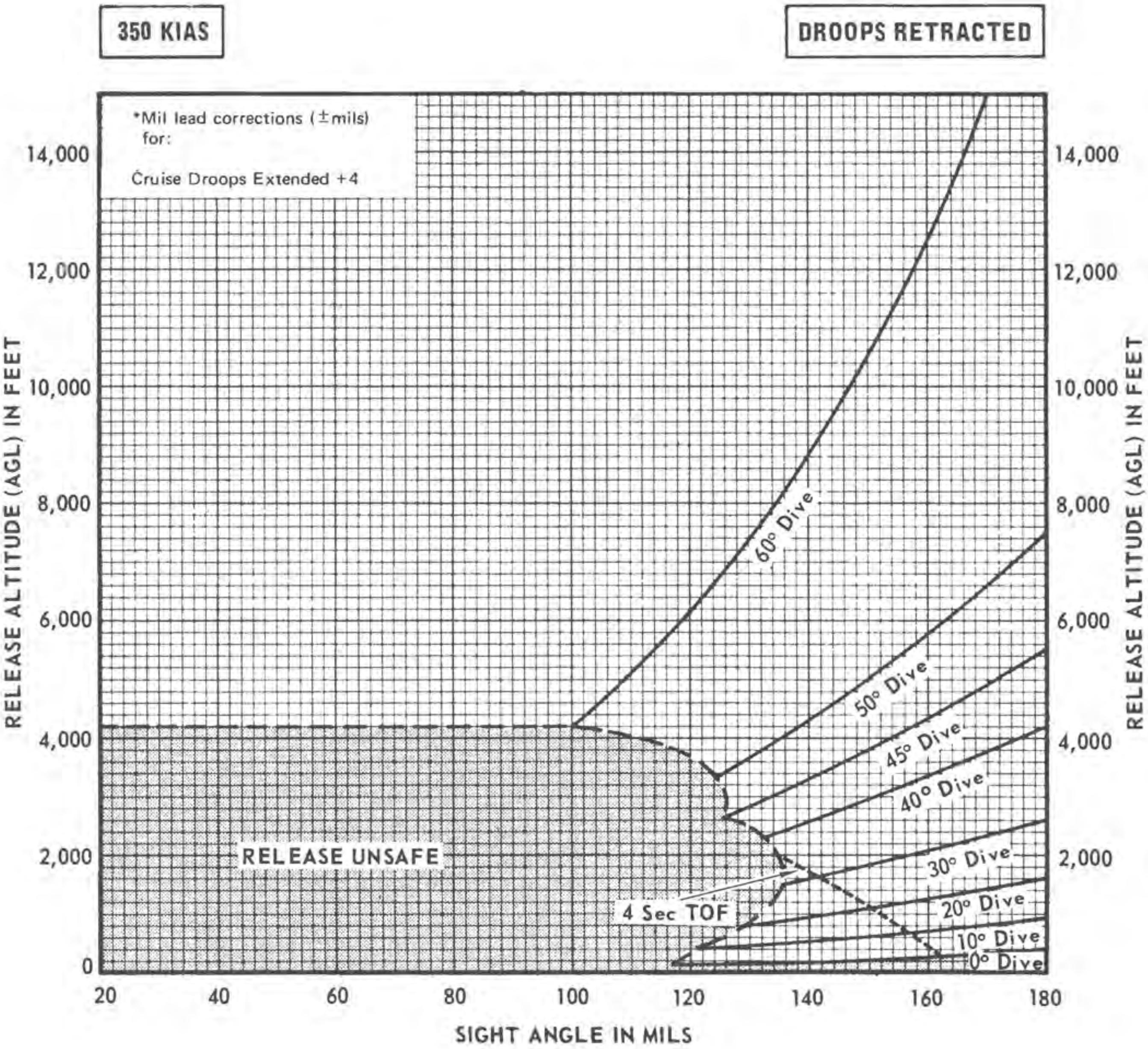
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspections – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ-103-02-69

Figure 2-82

Mil Lead for Single Delivery

MK 79 MOD 1 FIRE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.0 ft/sec ejection velocity.

Released from Aero 7A ER.

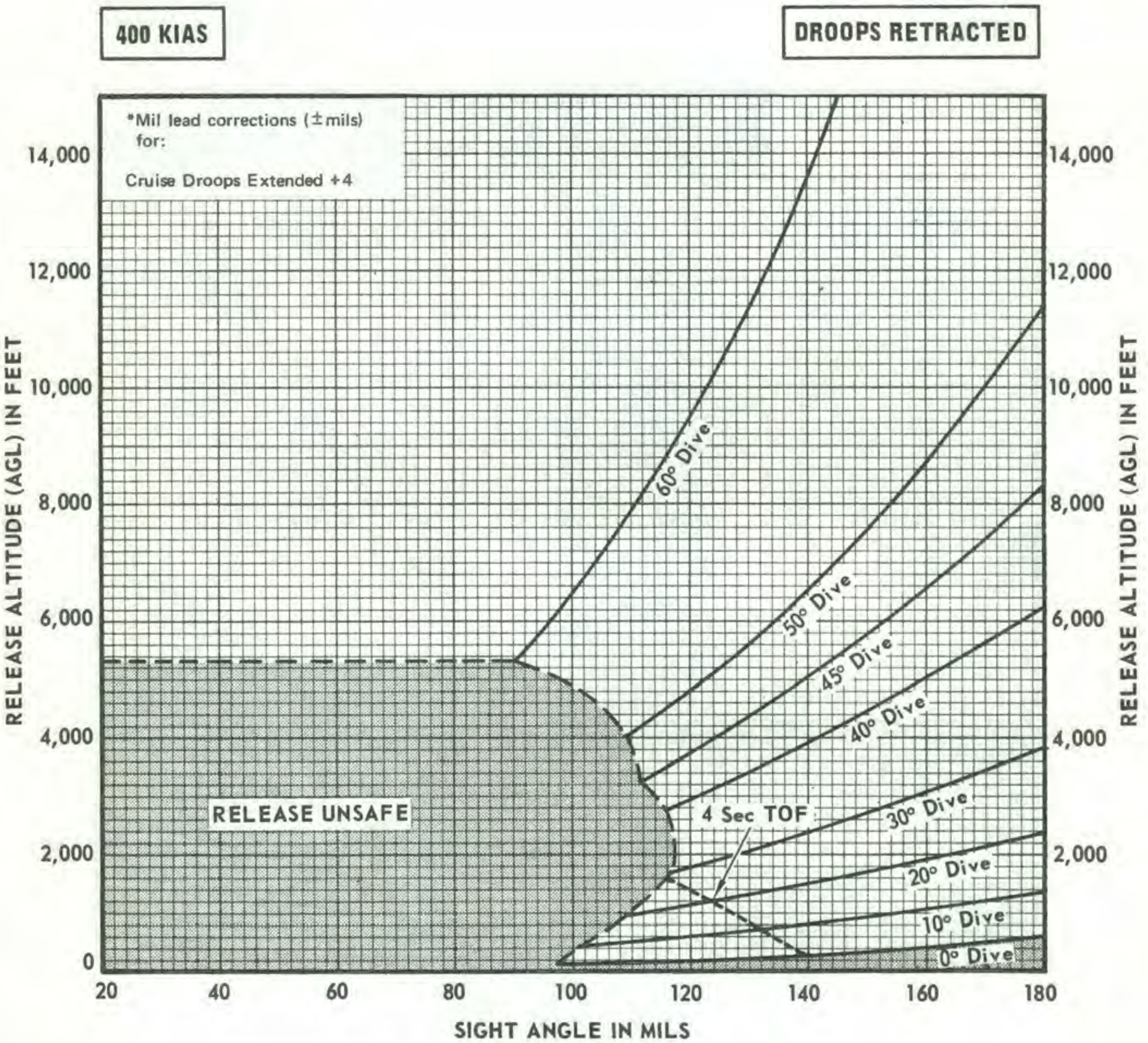
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-202(1)-03-69

Figure 2–83 (Sheet 1)

Mil Lead for Single Delivery

MK 79 MOD 1 FIRE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.0 ft/sec ejection velocity.

Released from Aero 7A ER.

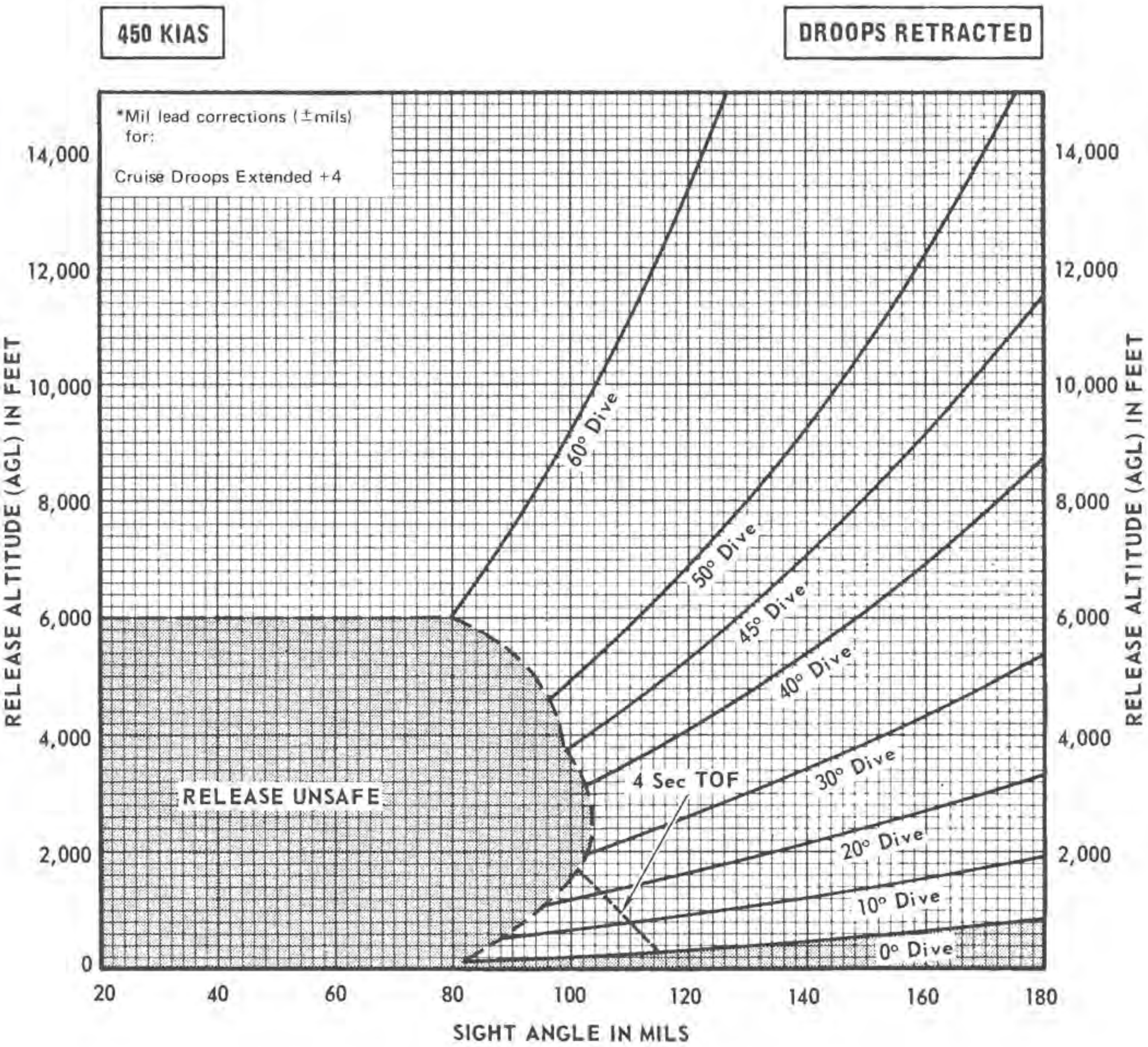
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-202(2)-03-69

Figure 2–83 (Sheet 2)

Mil Lead for Single Delivery

MK 79 MOD 1 FIRE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 5.0 ft/sec ejection velocity.

Released from Aero 7A ER.

*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-203(3)-03-69

Figure 2-83 (Sheet 3)

Tested Delivery Data

MK 79 FIRE BOMB

DIVE ANGLE	MIL LEAD		ENTRY			RELEASE			CORRECTION PER 10 KT OF DIRECT WIND – MILS		RELEASE ERROR SENSITIVITIES		
	EJECTED MILS	NON-EJECTED (MBR) – MILS	KIAS	ALTITUDE FT AGL	APPROX RPM %	KTAS	ALTITUDE FT AGL	ALTIMETER LAG – FT	Range	Cross	FT/KT KIAS	FT/100 FT ALTITUDE	FT/DEG DIVE ANGLE
LEVEL	115	——	435	100	94	450	100	0	2	27	3	700	Climb -400 Dive +150
10°	110	——	400	3,000	91	450	400	125	2	27	1.5	100	35

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

   Dive Angle – Steep impacts long
   Shallow impacts short

2. F-8 used in test was flown with cruise droop extended.

AZ-241-2-67

Figure 2–84

MK 76 Practice Bomb

PHYSICAL CHARACTERISTICS

Weight – 24 pounds
Length – 22.5 inches

PRACTICE BOMB SIGNAL

Mk 4 Mod 3
Firing Pin
Mk 1 Mod 0

DESCRIPTION

The Mk 76 is a 25-pound practice bomb. The bomb has a teardrop-shaped cast-metal body which is centrally bored. The fins are welded to a tail tube assembly which fits into the bored body. The firing pin assembly and signal are retained in the bore of the body by a cotter pin. This practice bomb is used to simulate many free-fall weapons. The Mod 2 bomb is illustrated; however the Mods 4 and 5 are currently in use.

DROPPING PROCEDURES

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – Wing L or R**
3. **Stores Release Sw – DEPRESS**

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
PMBR SUSPENSION **Six Bombs Each Wing**	12 MK 76	288
	2 Aero 7A-1	104
	2 Pylons	350
	2 PMBR	174
	Total	916
	One Wing Only	458

REFERENCES

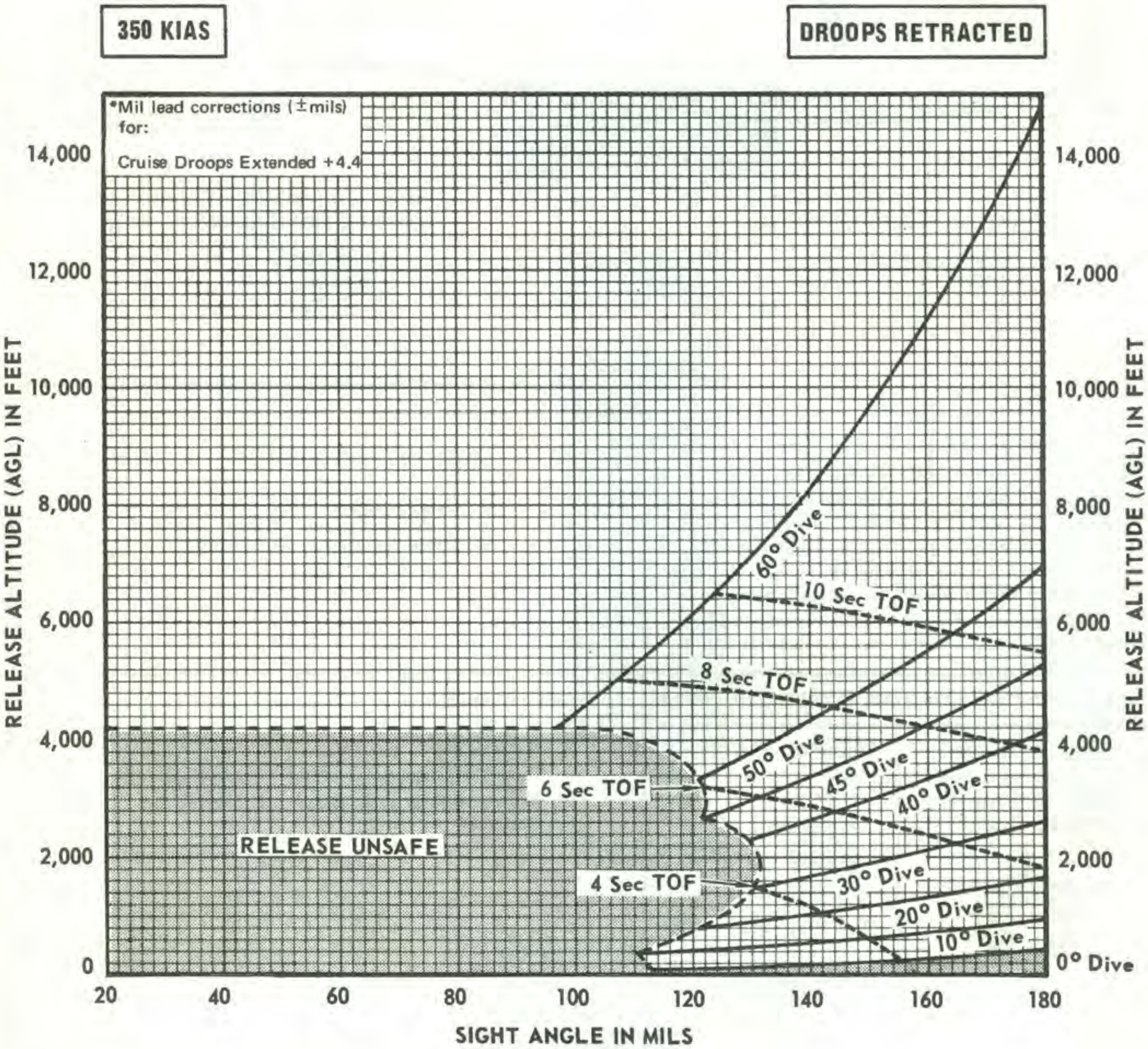
1. Restrictions – See Figure 2-2
2. Preflight Inspection – NAVAIR 01-45HH-75
3. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ–130–03–69

Figure 2–85

Mil Lead for Single Delivery

MK 76 MOD 5 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

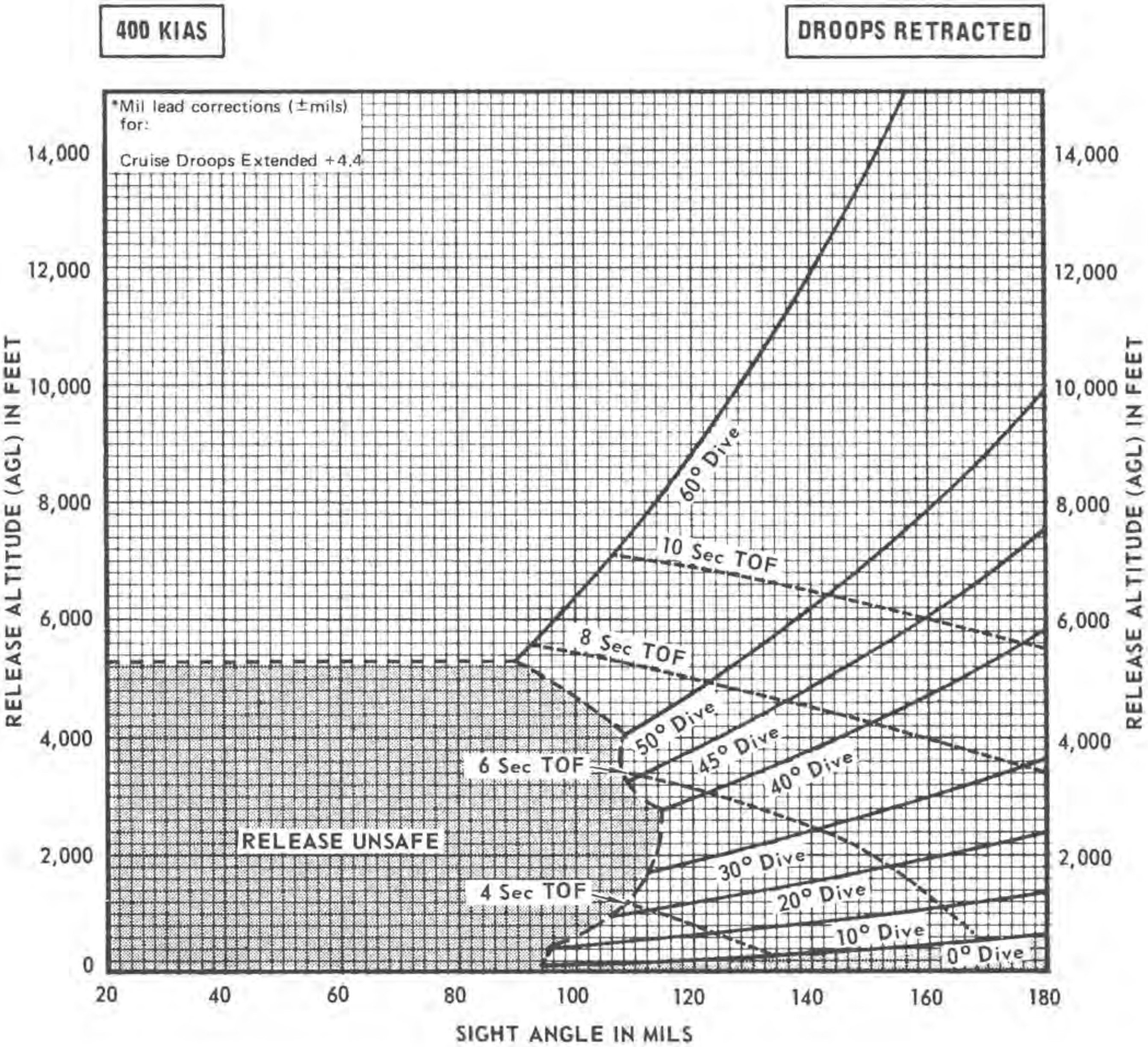
***For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-203(1)-03-69

Figure 2–86 (Sheet 1)

Mil Lead for Single Delivery

MK 76 MOD 5 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

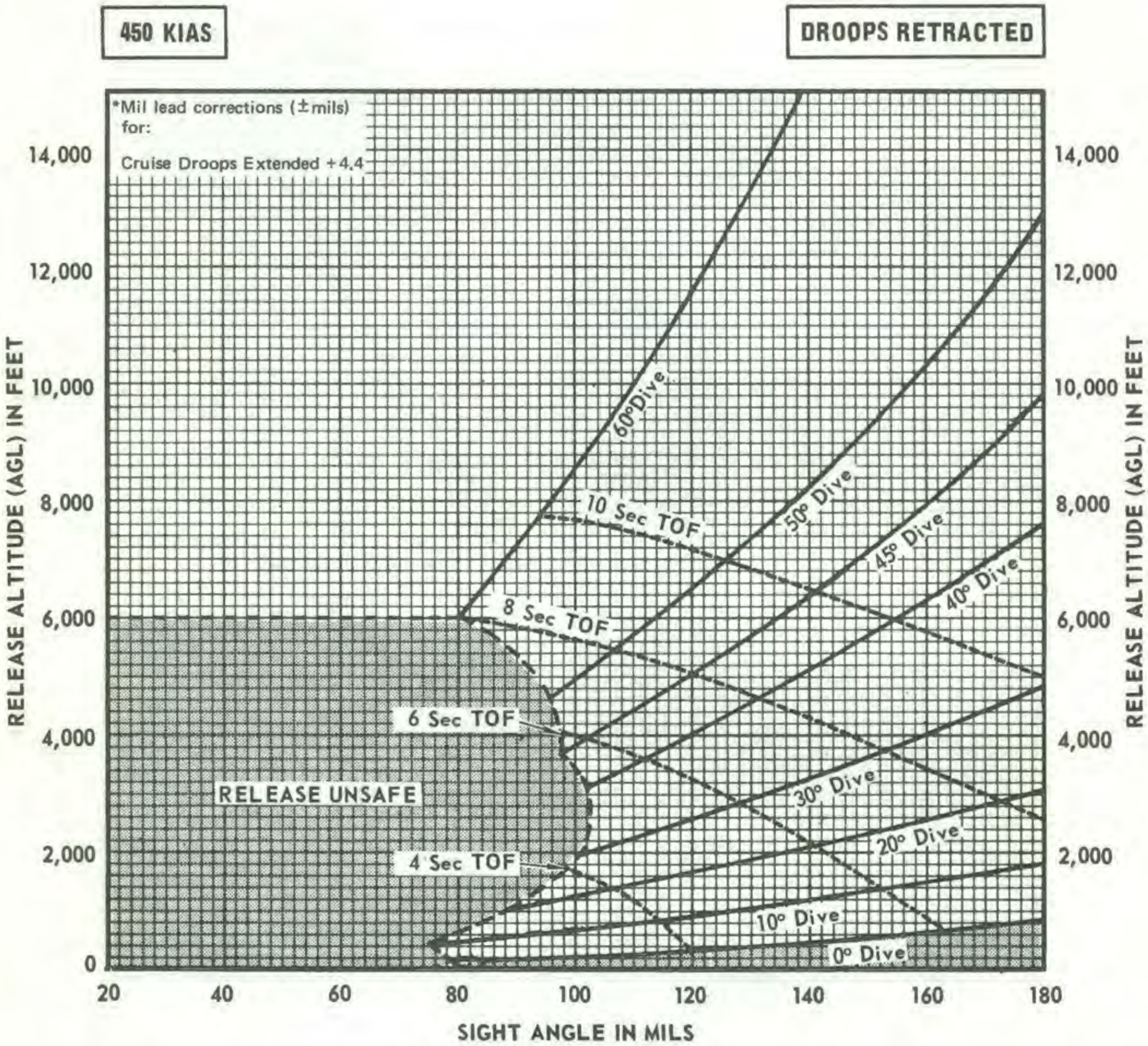
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-203(2)-03-69

Figure 2-86 (Sheet 2)

Mil Lead for Single Delivery

MK 76 MOD 5 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

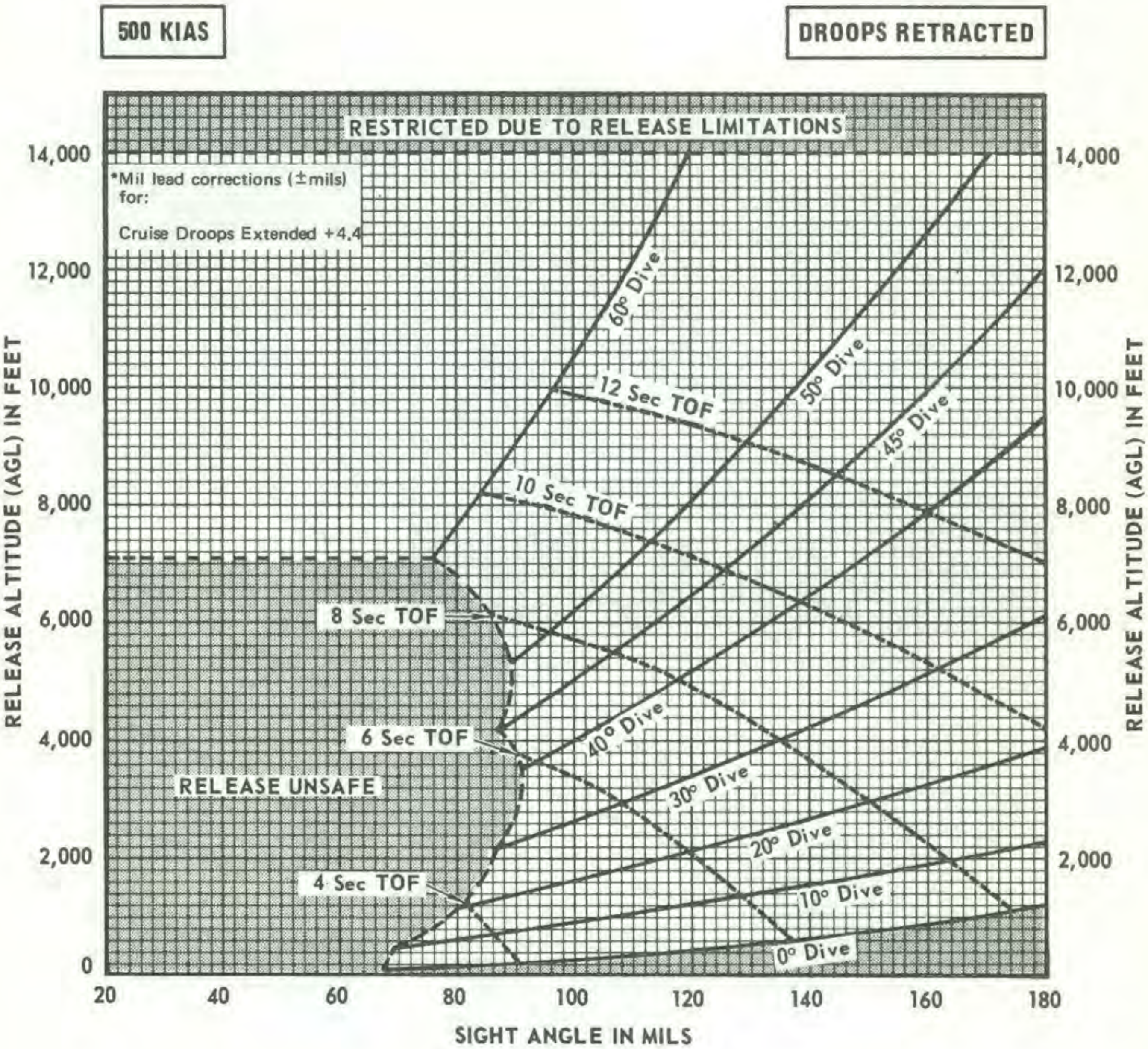
***For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-203(3)-03-69

Figure 2-86 (Sheet 3)

Mil Lead for Single Delivery

MK 76 MOD 5 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

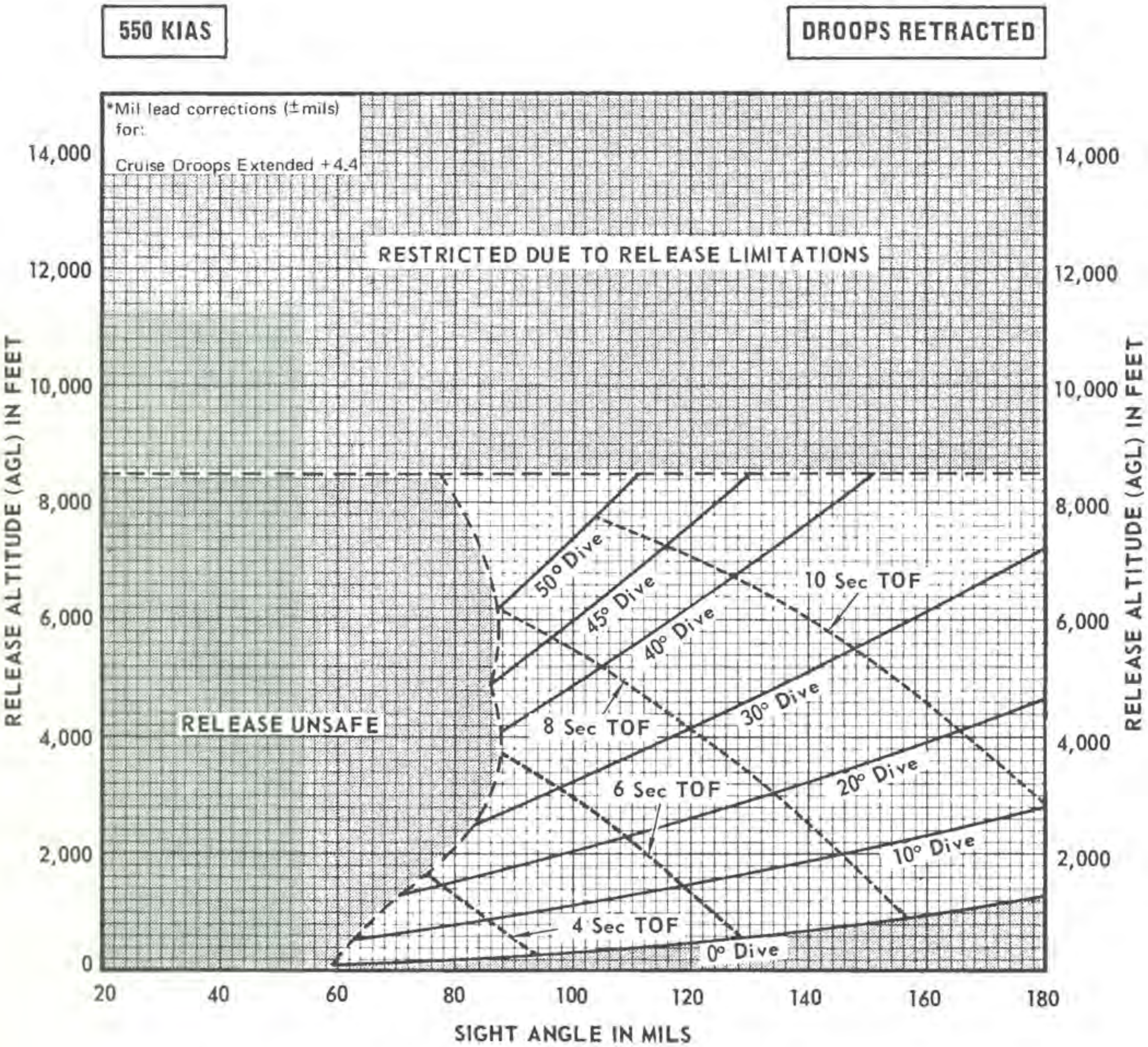
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-203 (4)-03-69

Figure 2-86 (Sheet 4)

Mil Lead for Single Delivery

MK 76 MOD 5 PRACTICE BOMB



NOTE

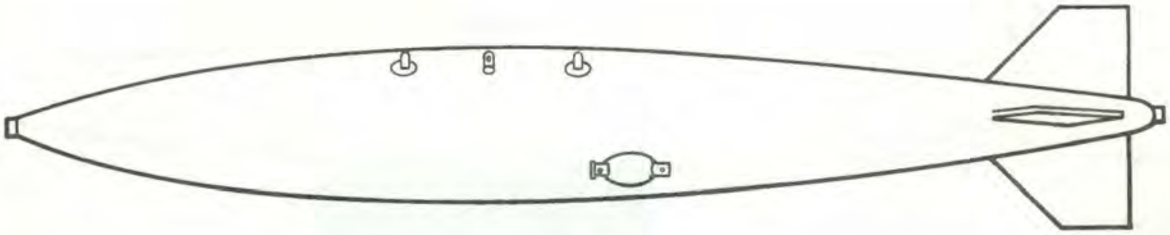
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-203(5)-03-69

Figure 2-86 (Sheet 5)

MK 86 Practice Bomb



PHYSICAL CHARACTERISTICS

Weight
- (Loaded – Wet Sand) – 217 pounds
- (Loaded – Water) – 141 pounds

Length – 76 inches
Diameter – 9 inches
Suspension lugs – 14 inches apart

PRACTICE BOMB SIGNAL

MK 4 MOD 3

Firing Pin
MK 1 MOD 0

DESCRIPTION

The MK 86 is a low-drag practice bomb of similar size and shape as the MK 80 series low-drag general purpose bombs. The bomb is of thin-case construction with internal reinforcement for the sway brace and ejection areas.

For delivery data refer to the MK 81 conical fin delivery data tables.

DROPPING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – WING L or R
3. Stores Release Sw – DEPRESS

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT
AERO 7A SUSPENSION One Bomb Each Wing 	2 MK 86 434 (282) 2 Aero 7A-1 104 104 2 Pylons 350 350 Total 888 (736) One Wing Only 444 (368)
MBR SUSPENSION Two Bombs Each Wing 	4 MK 86 868 (564) 2 Aero 7A-1 104 104 2 Pylons 350 350 2 MBR 318 318 Total 1640 (1326) One Wing Only 820 (663)

NOTE

For simultaneous releases from the Aero 7A-1 racks the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

JETTISONING PROCEDURES

See JETTISONING this section

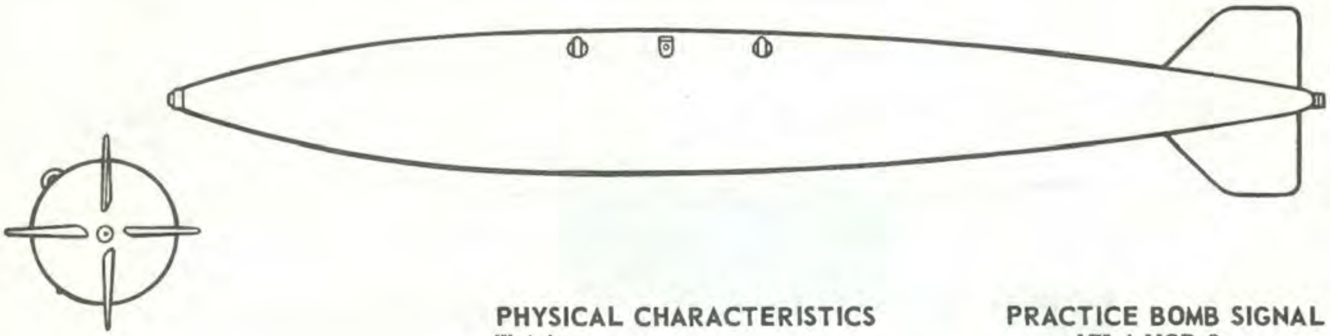
REFERENCES

1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ–104–03–69

Figure 2–87

MK 87 Practice Bomb



PHYSICAL CHARACTERISTICS

Weight
  (Loaded – Wet Sand) – 333 pounds
  (Loaded – Water) – 221 pounds
Length – 90.89 inches
Diameter – 10.75 inches
Suspension lugs – 14 inches apart

PRACTICE BOMB SIGNAL

MK 4 MOD 3

Firing Pin
MK 1 MOD 0

DESCRIPTION

The MK 87 is a low-drag practice bomb of similar size and shape as the MK 82 general purpose bomb. The bomb is of thin case construction with internal reinforcement for the sway brace and ejection areas. For delivery data refer to the MK 82 conical fin delivery data tables.

WING STATION LOADING CONFIGURATIONS	
WING LOADING	**EQUIPMENT-WEIGHT**
AERO 7A SUSPENSION One Bomb Each Wing 	2 MK 87 666 (442) 2 Aero 7A 104 104 2 Pylons 350 350 Total 1120 (896) One Wing Only 560 (448)
MBR SUSPENSION Two Bombs Each Wing 	4 MK 87 1332 (884) 2 Aero 7A 104 104 2 Pylons 350 350 2 MBR 318 318 Total 2104 (1656) One Wing Only 1052 (828)

DROPPING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – WING L or R
3. Stores Release Sw – DEPRESS

NOTE

For simultaneous releases from the Aero 7A-1 racks the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

JETTISONING PROCEDURES

See JETTISONING this section.

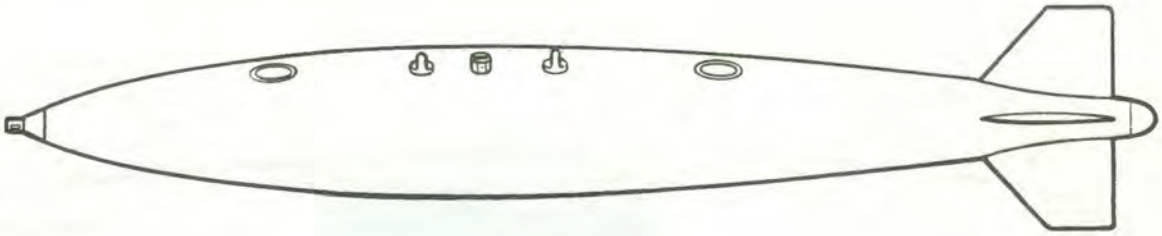
REFERENCES

1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Proceudres – NAVAIR 01-45HH-75

AZ–105–03–69

Figure 2–88

MK 88 Practice Bomb



PHYSICAL CHARACTERISTICS

Weight (Loaded – Wet Sand) – 783 pounds
(Loaded – Water) – 458 pounds
Length – 119.8 inches
Diameter – 14 inches
Suspension lugs – 14 inches apart

PRACTICE BOMB SIGNAL

MK 4 MOD 3

Firing Pin
MK 1 MOD 0

DESCRIPTION

The MK 88 is a low-drag practice bomb of the same size and shape as the MK 83 general purpose bomb. The bomb is of thin case construction with internal reinforcement for the sway brace and ejection areas.
For delivery data refer to the MK 83 conical fin delivery data tables.

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT
AERO 7A SUSPENSION **One Bomb Each Wing** 	2 MK 88 1566 (916) 2 Aero 7A 104 104 2 Pylons 350 350 Total 2020 (1370) One Wing 1010 (685)
TER SUSPENSION **Two Bombs Each Wing** 	4 MK 88 3132 (1832) 2 Aero 7A 104 104 2 Pylons 350 350 Total 3586 (2286) One Wing 1798 (1143)
MER SUSPENSION **Two Bombs Each Wing** 	4 MK 88 3132 (1832) 2 Aero 7A 104 104 2 Pylons 350 350 Total 3586 (2286) One Wing 1798 (1143)

DROPPING PROCEDURES

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – Wing L or R**
3. **Stores Release Sw – DEPRESS**

NOTE

For simultaneous releases from the Aero 7A-1 racks, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

JETTISONING PROCEDURES

See JETTISONING this section.

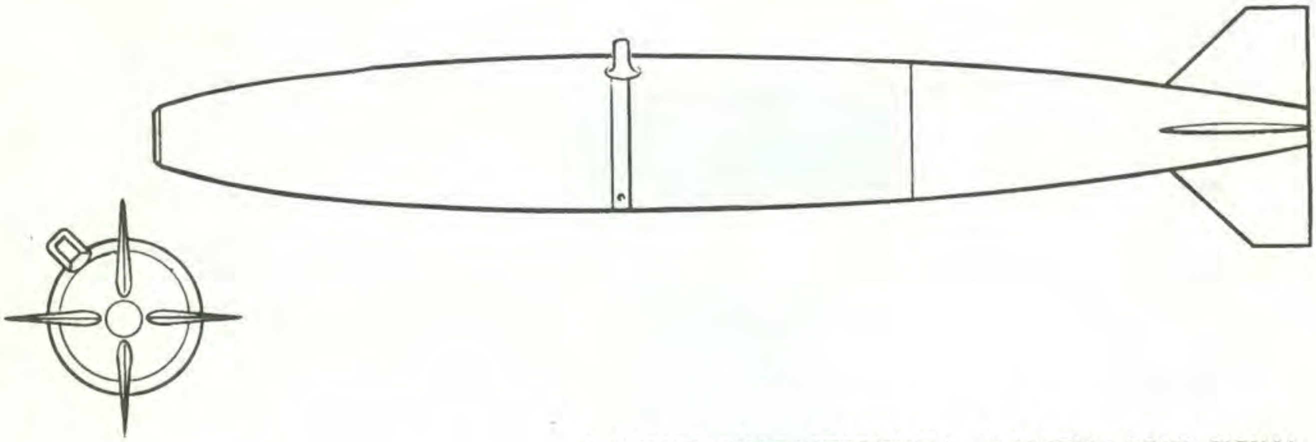
REFERENCES

1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ-106-03-69

Figure 2–89

MK 89 Practice Bomb



PHYSICAL CHARACTERISTICS

Weight – 57 pounds
Length – 31.3 inches
Diameter – 4 inches
Suspension lug – Center

PRACTICE BOMB SIGNAL

MK 4 MOD 3

DESCRIPTION

The MK 89 is a low-drag practice bomb, similar in shape to the low-drag series of general purpose bombs. The cast iron body is slender, with a long, pointed nose. The conical type fin assembly has the tail fins canted 2 degrees to impart spin to the bomb to obtain consistent trajectories.

DROPPING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
PMBR SUSPENSION Three Bombs Each Wing 	6 MK 89 2 Aero 7A-1 2 Pylons 2 PMBR Total One Wing Only	342 104 350 174 970 485

NOTE

For simultaneous releases from both wings the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

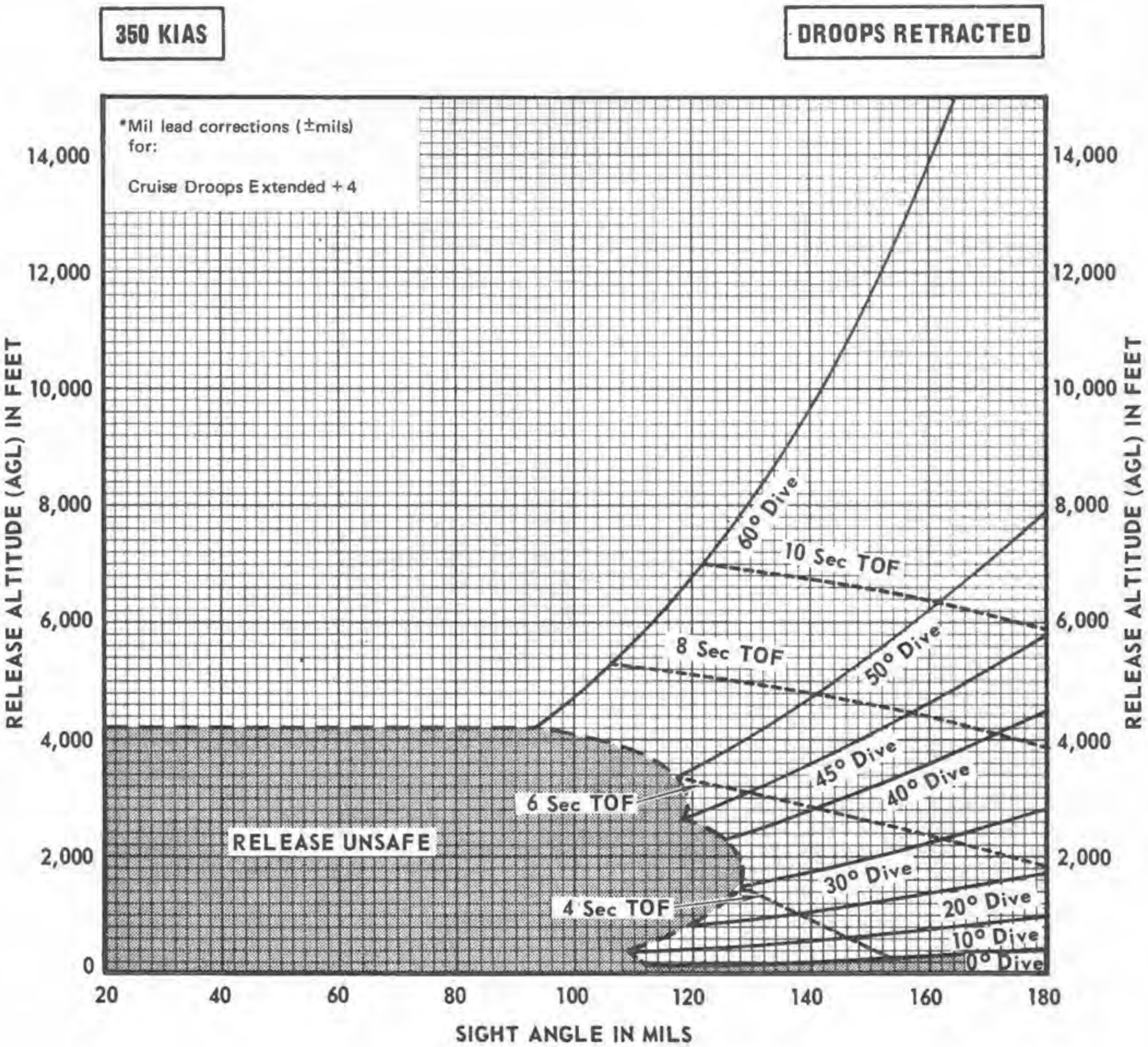
1. Restrictions – See Figure 2-2
2. Bomb Fuzing – NAVAIR 11-5A-17 (OP 2216)
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Bomb Loading Procedures – NAVAIR 01-45HH-75

AZ-107-03-69

Figure 2–90

Mil Lead for Single Delivery

MK 89 MOD 0 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

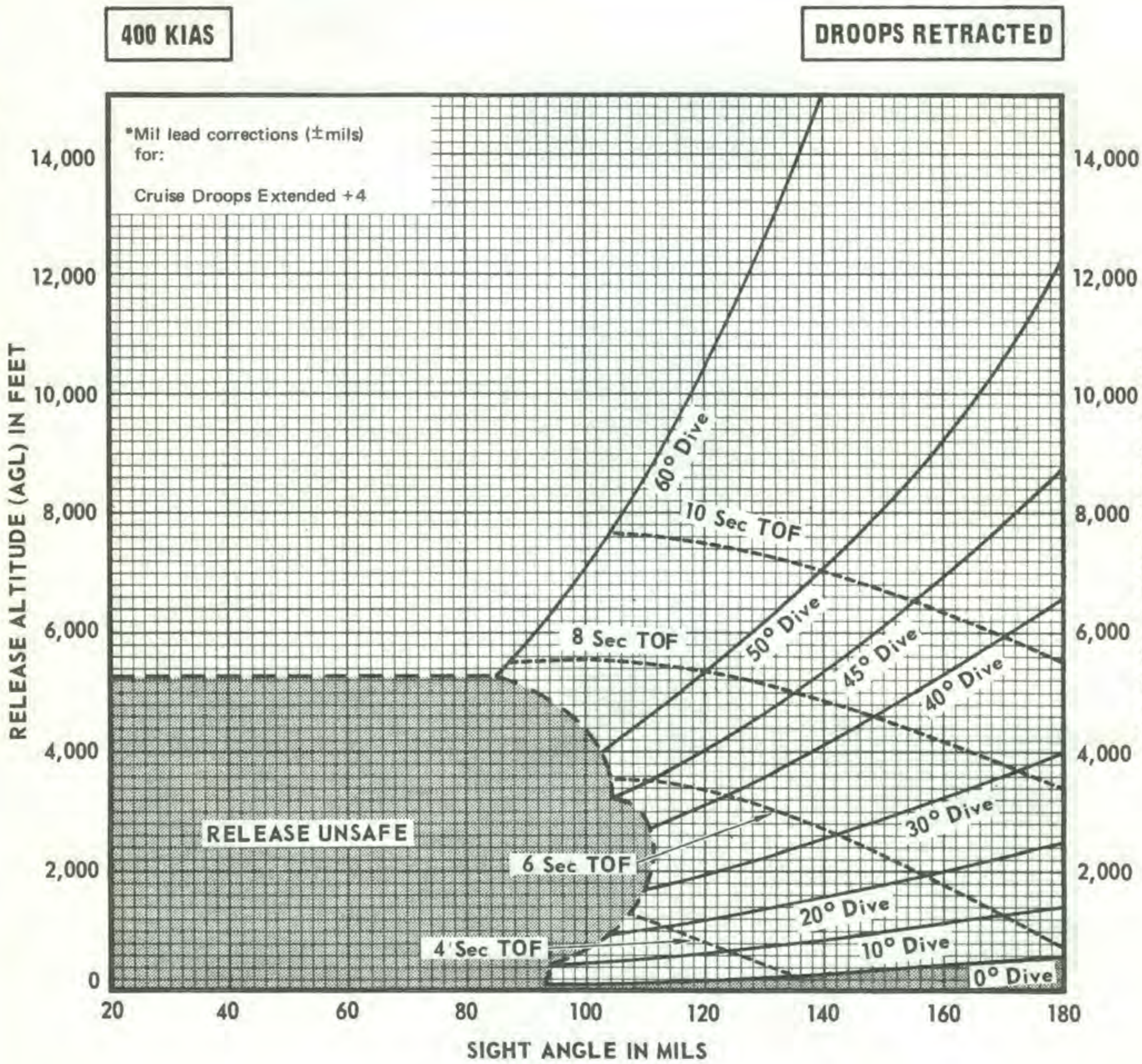
***For each 10° C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-200(1)-3-69

Figure 2-91 (Sheet 1)

Mil Lead for Single Delivery

MK 89 MOD 0 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

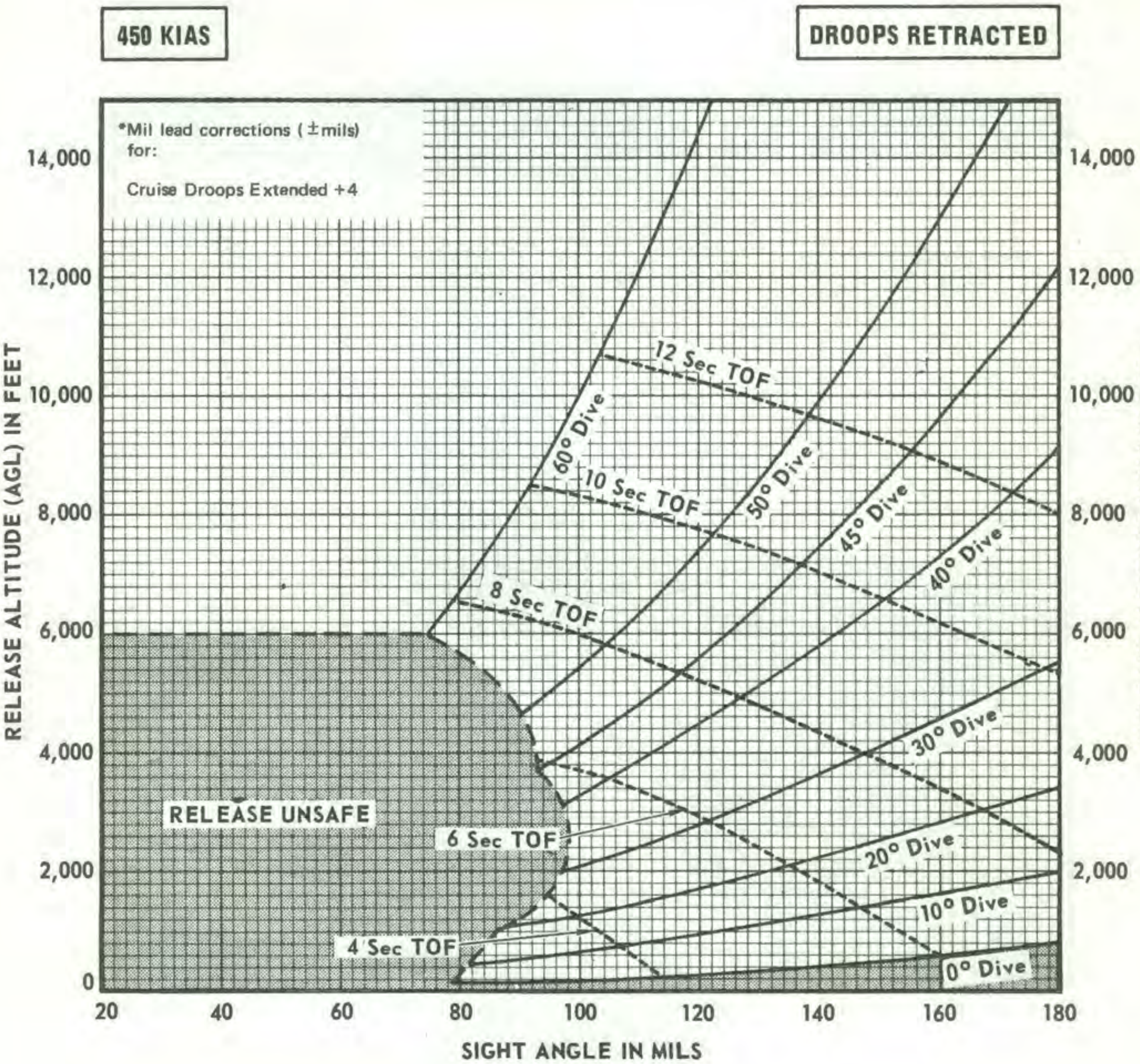
***For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-200(2)-3-69

Figure 2-91 (Sheet 2)

Mil Lead for Single Delivery

MK 89 MOD 0 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

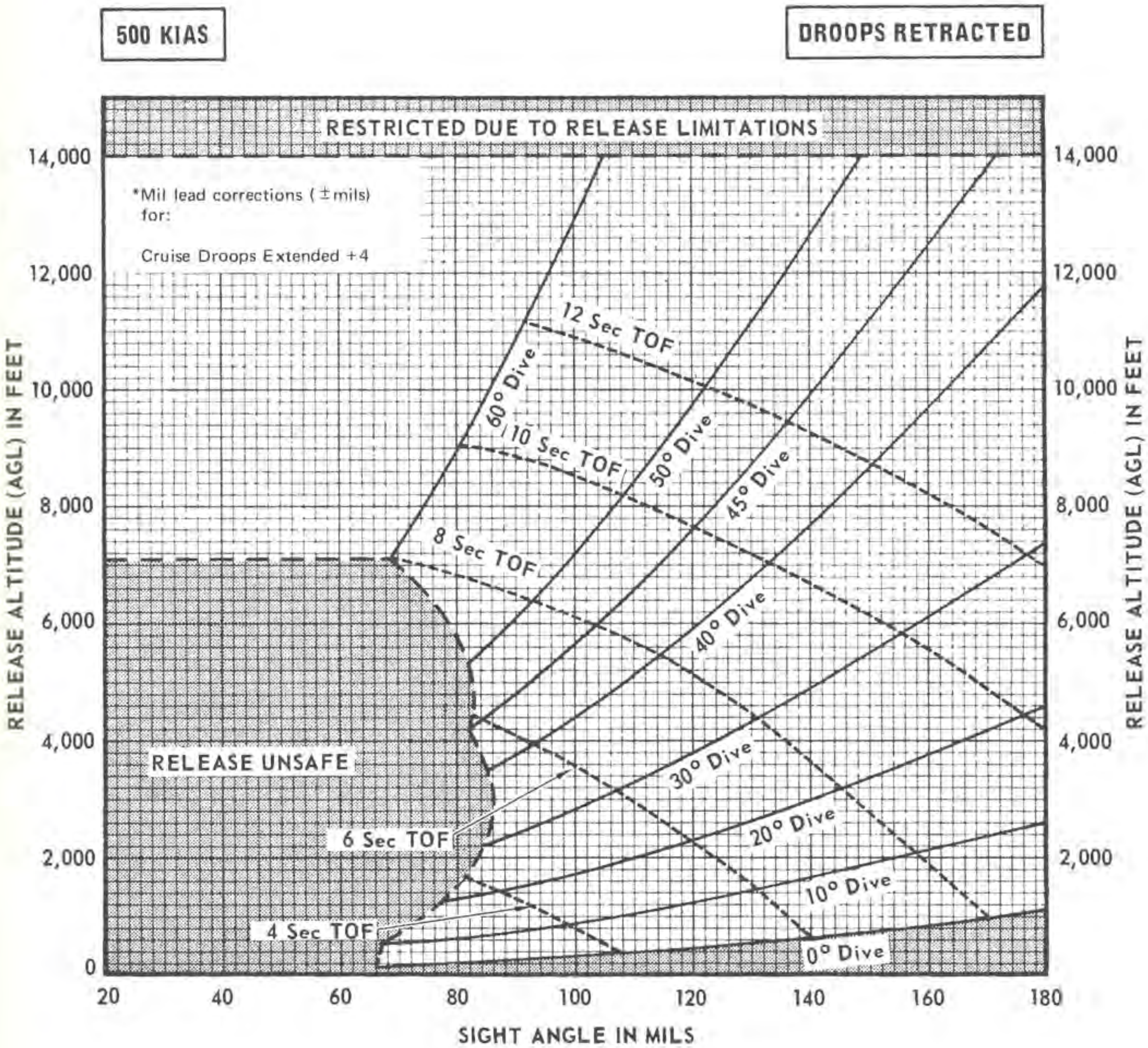
***For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-200(3)-3-69

Figure 2-91 (Sheet 3)

Mil Lead for Single Delivery

MK 89 MOD 0 PRACTICE BOMB



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

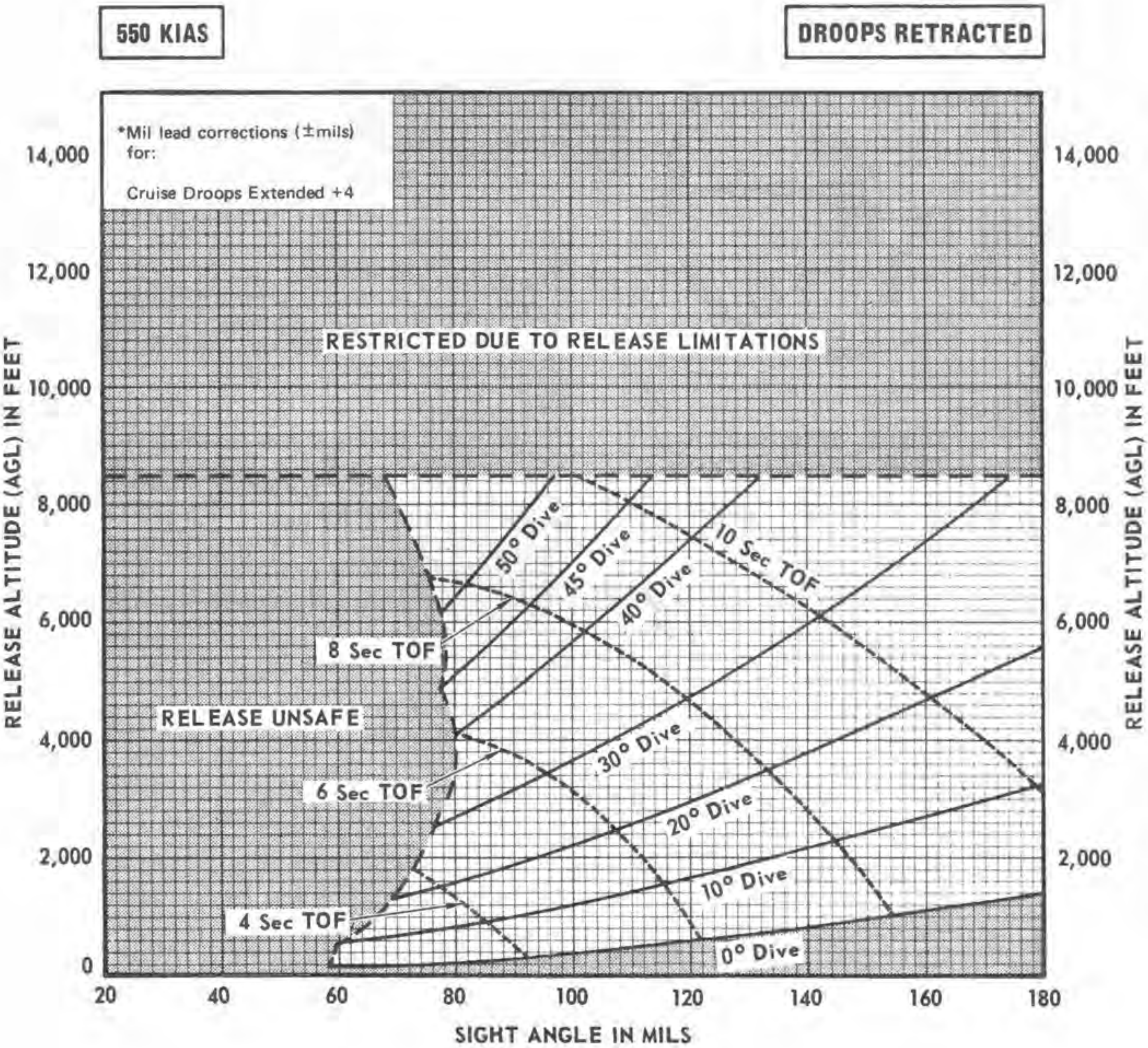
***For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.**

AZ-200(4)-3-69

Figure 2-91 (Sheet 4)

Mil Lead for Single Delivery

MK 89 MOD 0 PRACTICE BOMB



NOTE

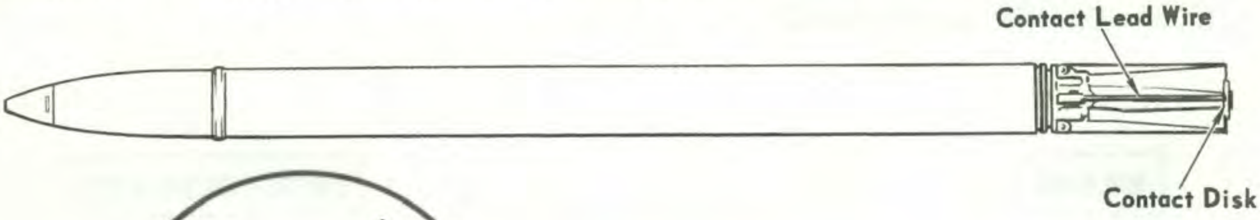
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, 0 ft target elevation, and 0.0 ft/sec ejection velocity. Released from PMBR A/A 37B-3.

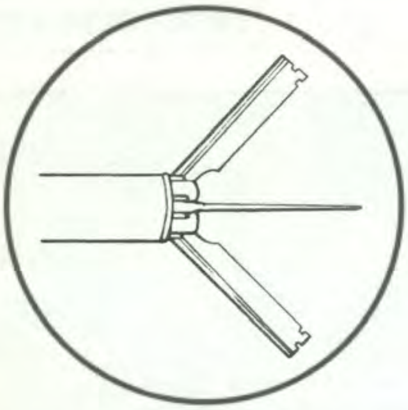
*For each 10°C increase (decrease) in temperature at release altitude, increase (decrease) the mil lead by 3 mils.

AZ-200(5)-3-89

Figure 2-91 (Sheet 5)

2.75-Inch Folding Fin Aircraft Rocket





PHYSICAL CHARACTERISTICS
Weight – 18.5 pounds
Length – 48 inches
Diameter – 2.75 inches

LAUNCHERS
LAU-3/A, LAU-32A/A, LAU-32B/A, LAU-56/A, LAU-60/A
Aero 6A; 6A-1; 6A-2, Aero 7D, LAU-61/A
LAU-68/A, LAU-69/A

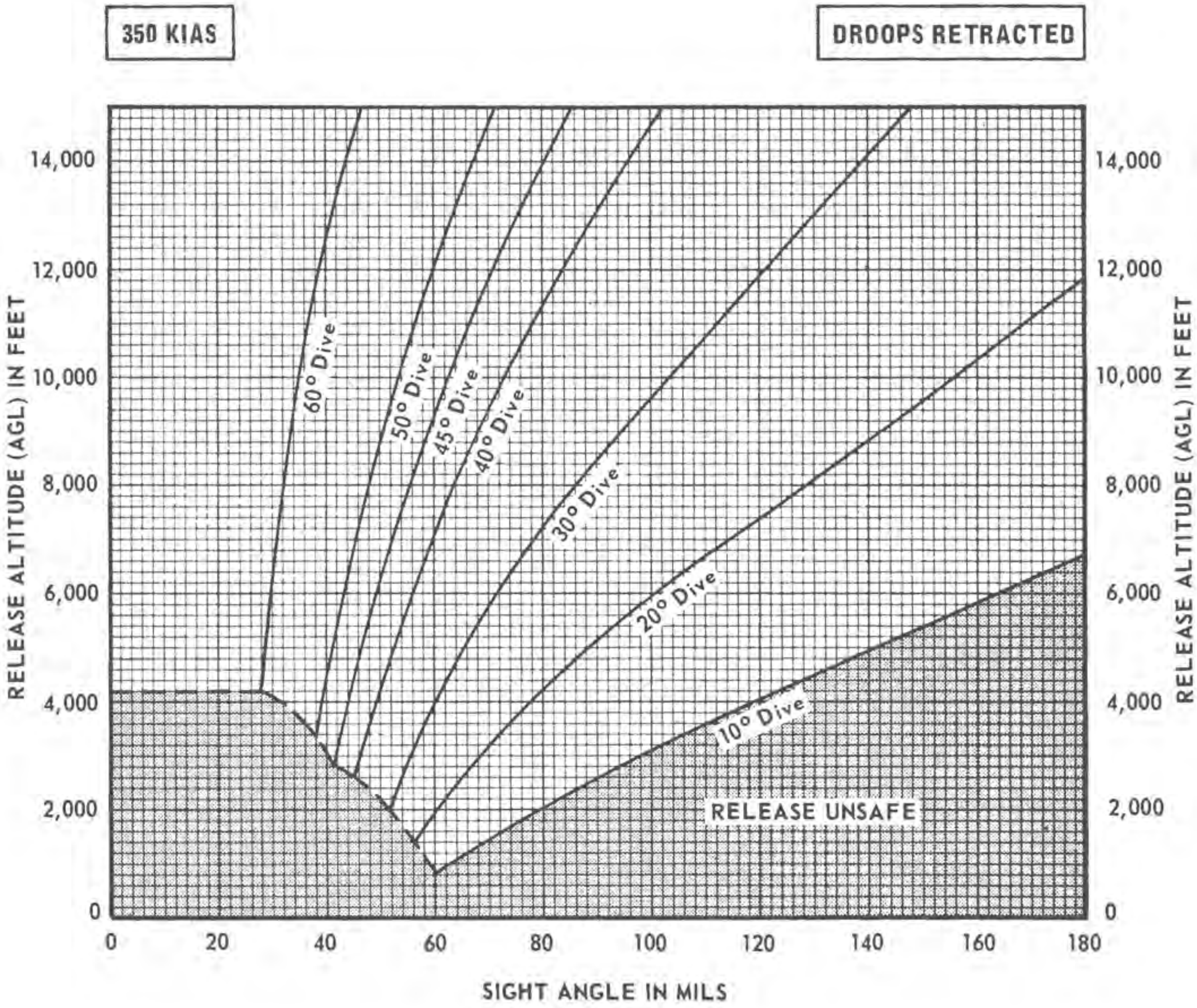
DESCRIPTION
The 2.75-inch folding fin aircraft rocket is designed as air-to-ground armament for tactical aircraft. The rocket is adapted to use a high explosive head, a high explosive anti-tank head, or an inert head for practice. The rocket is ignited by electrical power transmitted when the stores release switch is depressed. The folded fins are opened by gas pressure as the rocket leaves the launcher.

AZ-108-3-69

Figure 2-92

Mil Lead for Single Delivery

2.75 INCH FFAR



NOTE

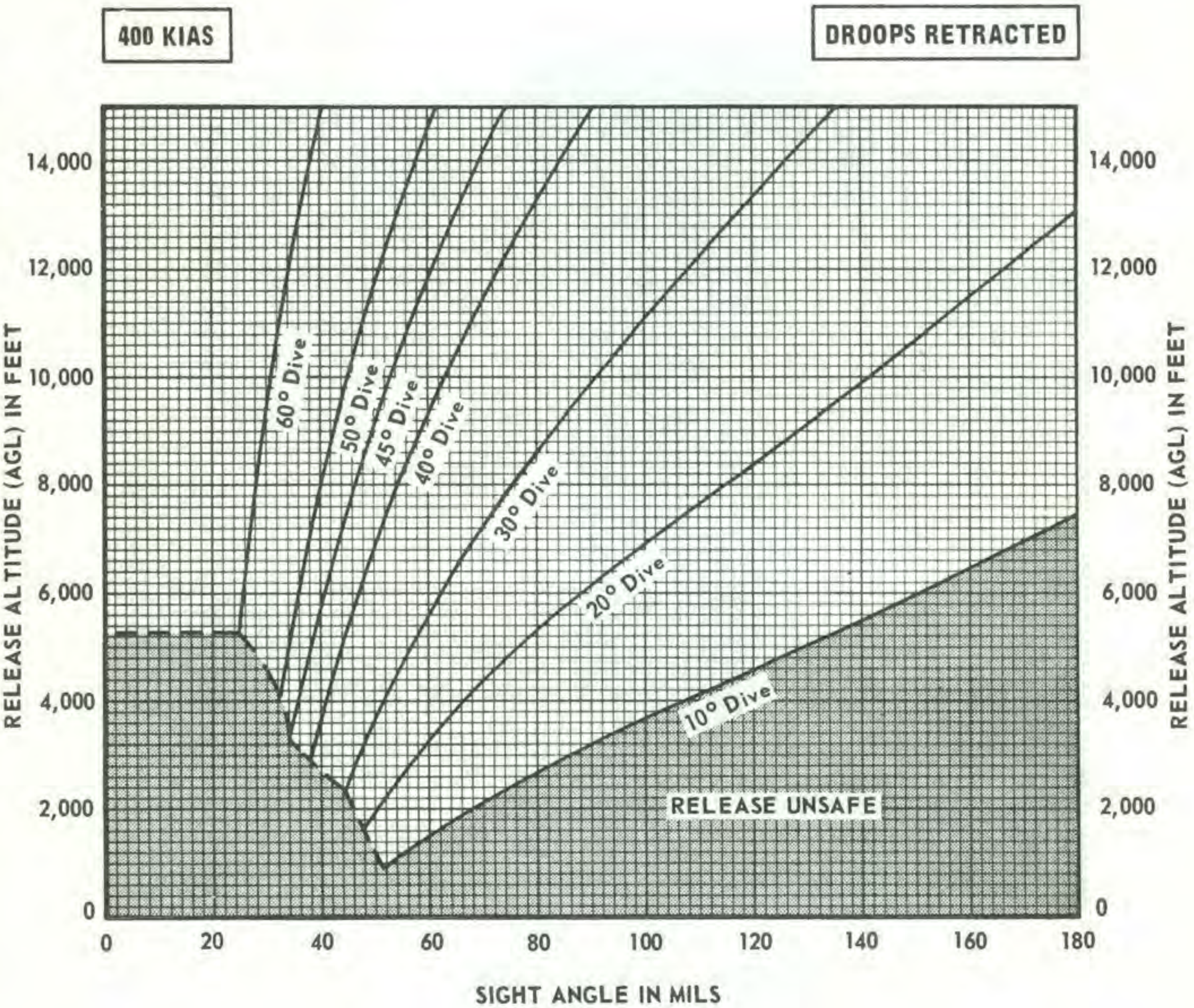
Sight angles are based on 27,000-lb aircraft gross weight, 0-ft burst altitude, and 0-ft target elevation.

AZ-236(1)-2-67

Figure 2-93 (Sheet 1)

Mil Lead for Single Delivery

2.75 INCH FFAR



NOTE

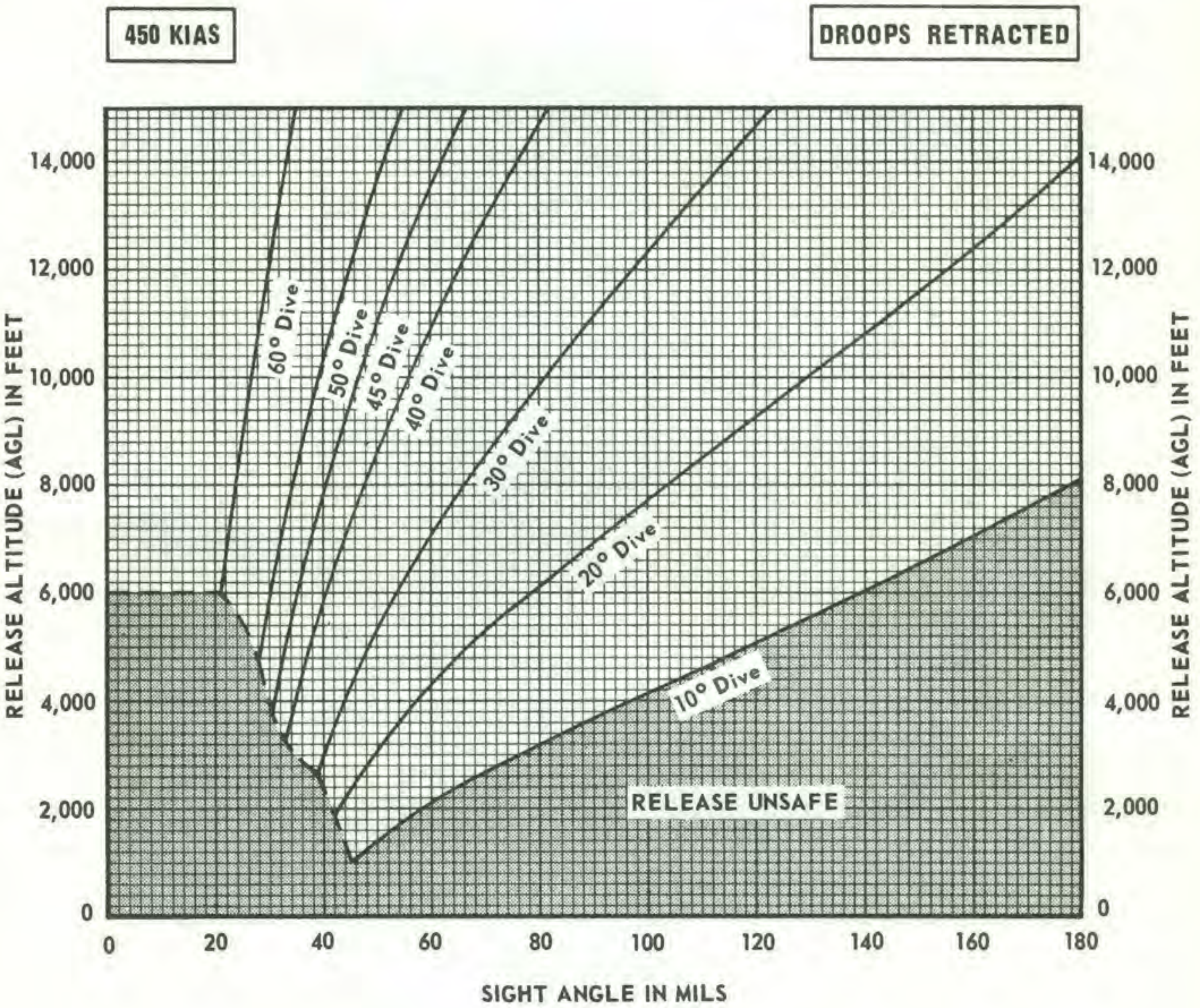
Sight angles are based on 27,000-lb aircraft gross weight, 0-ft burst altitude, and 0-ft target elevation.

AZ-236(2)-2-67

Figure 2-93 (Sheet 2)

Mil Lead for Single Delivery

2.75 INCH FFAR



NOTE

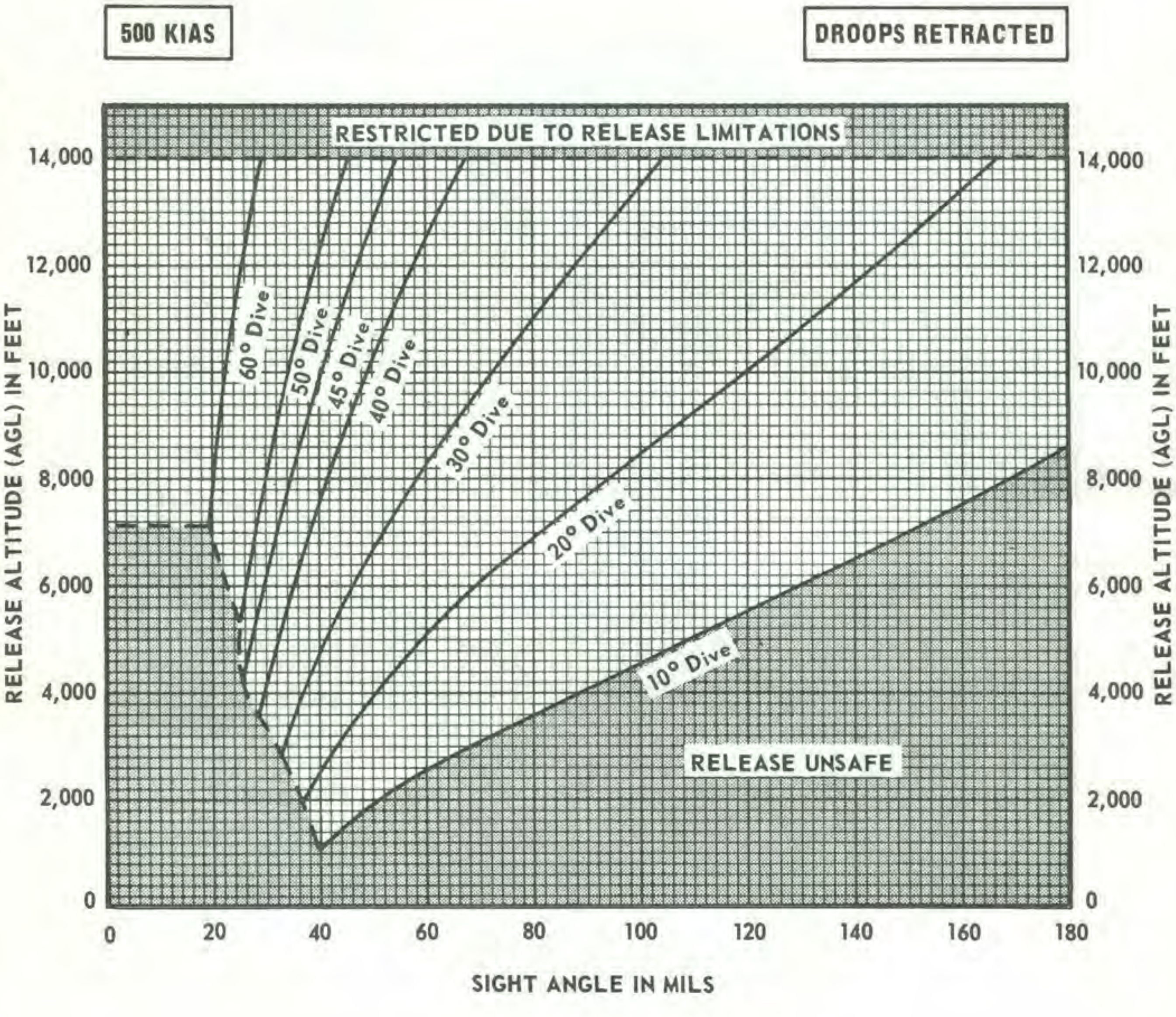
Sight angles are based on 27,000-lb aircraft gross weight, 0-ft burst altitude, and 0-ft target elevation.

AZ-236(3)-2-67

Figure 2-93 (Sheet 3)

Mil Lead for Single Delivery

2.75 INCH FFAR



NOTE

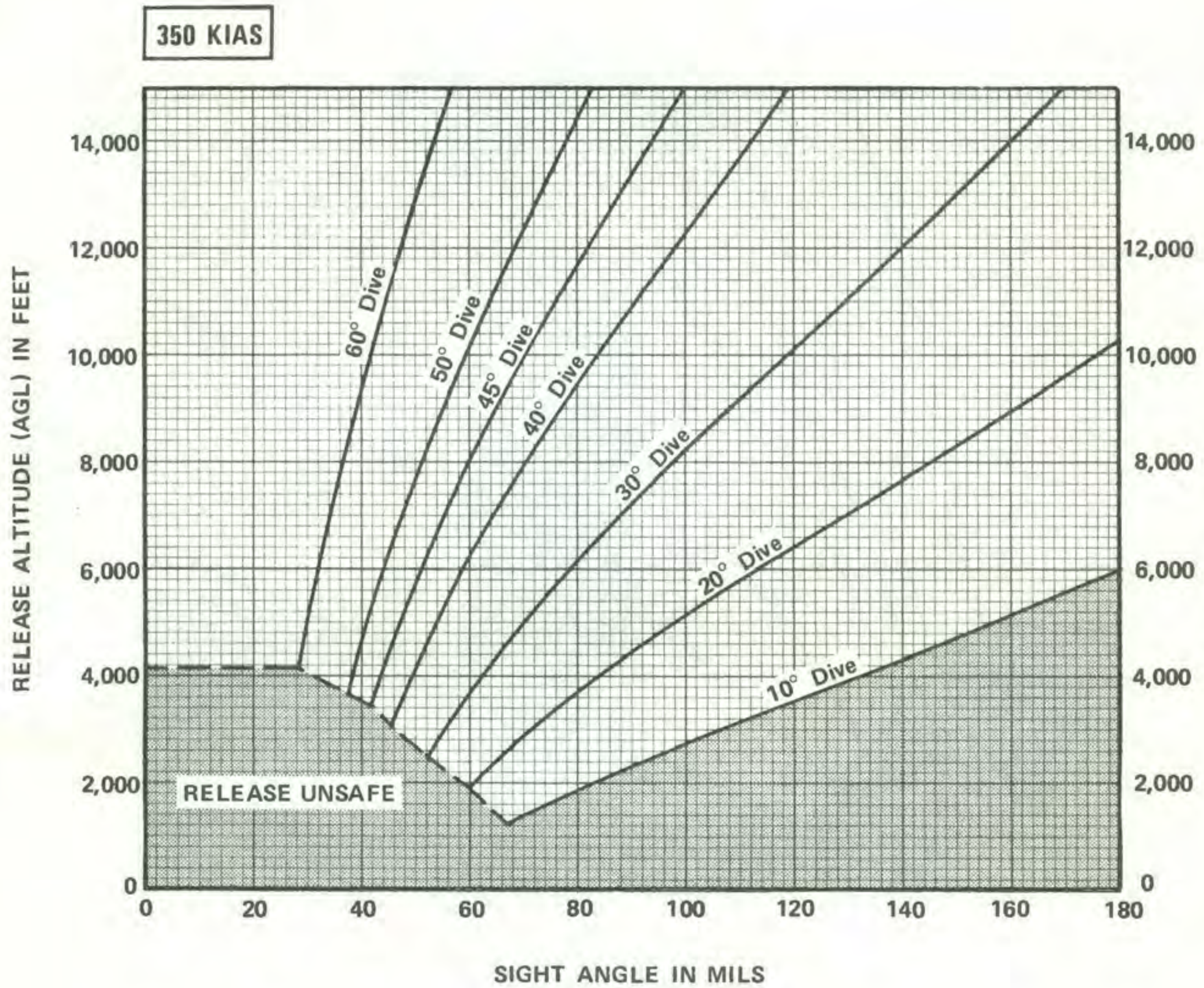
Sight angles are based on 27,000-lb aircraft gross weight, 0-ft burst altitude, and 0-ft target elevation.

AZ-236(4)-2-67

Figure 2-93 (Sheet 4)

Mil Lead for Single Delivery

2.75 INCH FFAR – M151 WARHEAD, MK 4 AND MODS MOTOR



NOTE

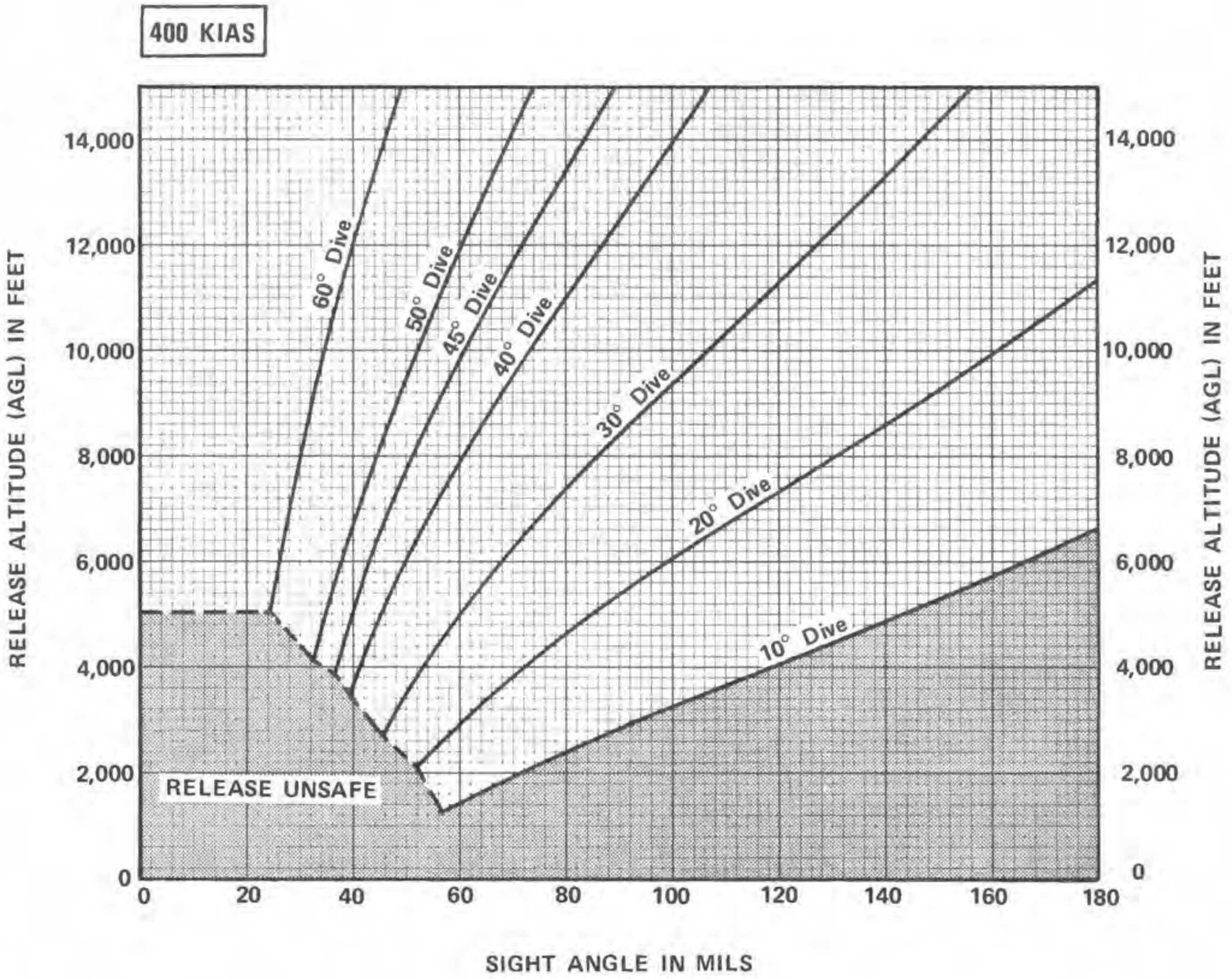
1. Sight angles are based on 27,000-pound aircraft gross weight, 0-foot burst altitude, and 0-foot target elevation.
2. Propellent temperature 70°F.

AZ-354(1)-03-70

Figure 2–93A (U) (Sheet 1)

Mil Lead for Single Delivery

2.75 INCH FFAR – M151 WARHEAD, MK 4 AND MODS MOTOR



NOTE

1. Sight angles are based on 27,000-pound aircraft gross weight, 0-foot burst altitude, and 0-foot target elevation.

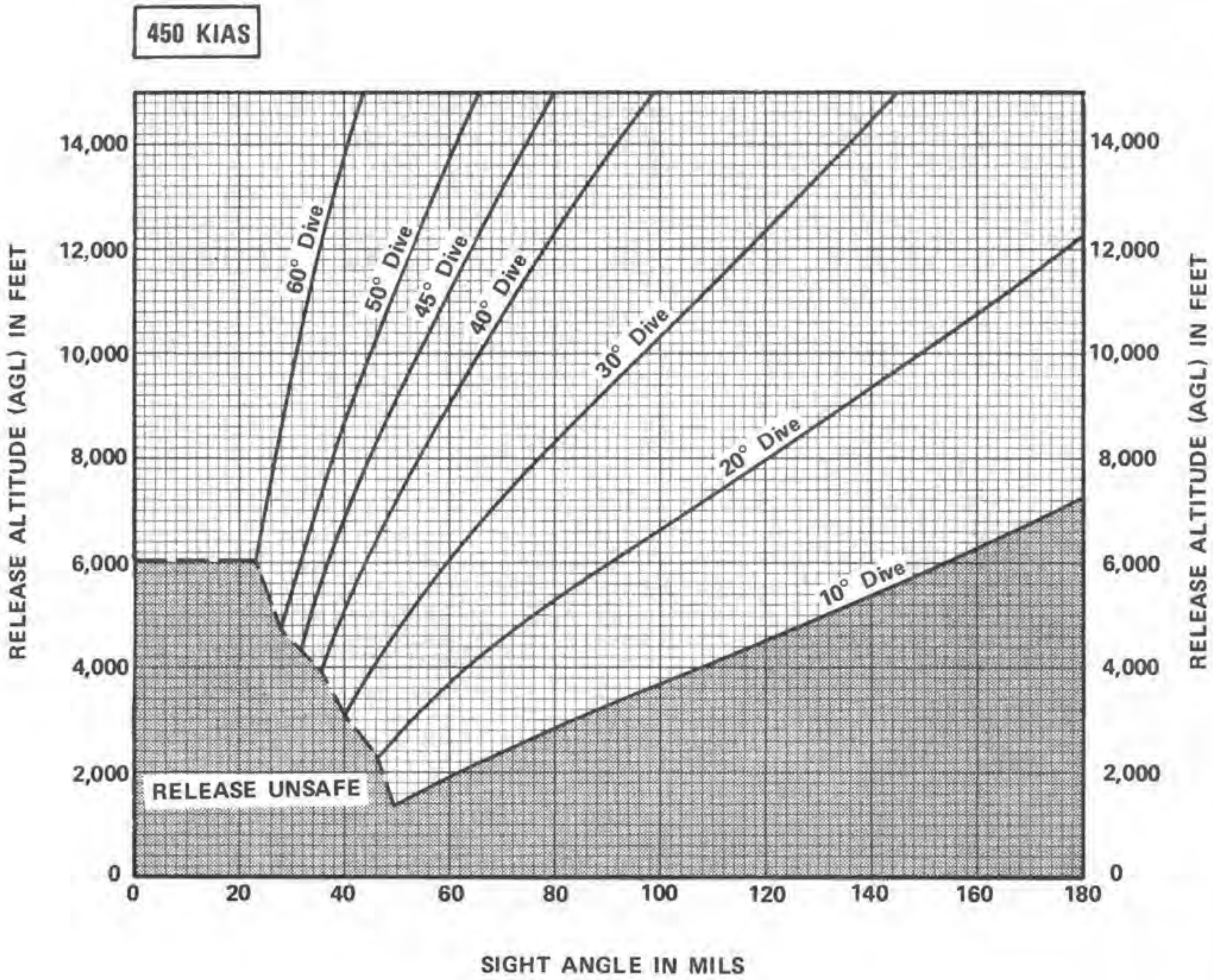
2. Propellent temperature 70° F.

AZ–354(2)–03–70

Figure 2–93A (U) (Sheet 2)

Mil Lead for Single Delivery

2.75 INCH FFAR – M151 WARHEAD, MK 4 AND MODS MOTOR



NOTE

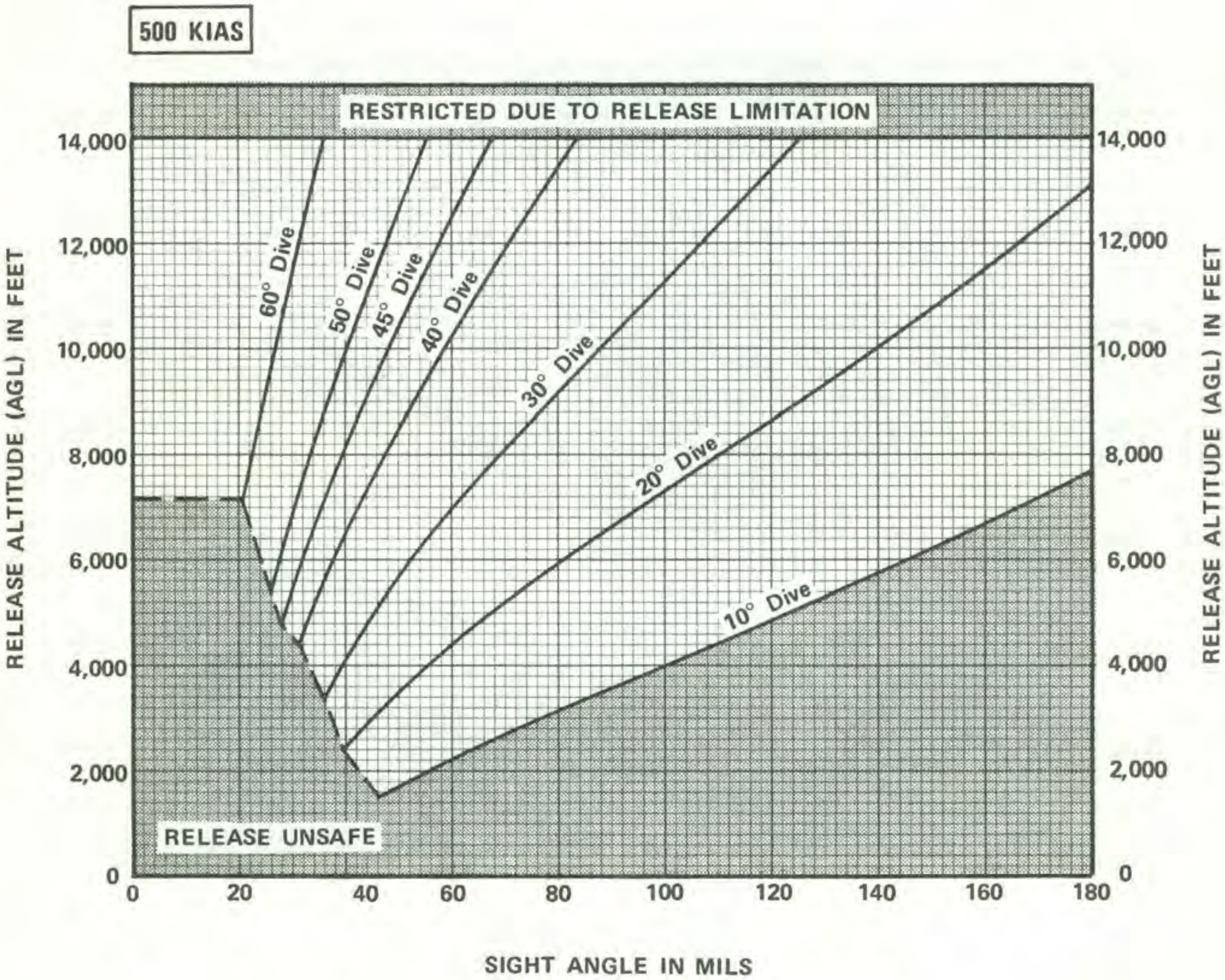
1. Sight angles are based on 27,000-pound aircraft gross weight, 0-foot burst altitude, and 0-foot target elevation.
2. Propellent temperature 70°F.

AZ–354(3)–03–70

Figure 2–93A (U) (Sheet 3)

Mil Lead for Single Delivery

2.75 INCH FFAR – M151 WARHEAD, MK 4 AND MODS MOTOR



NOTE

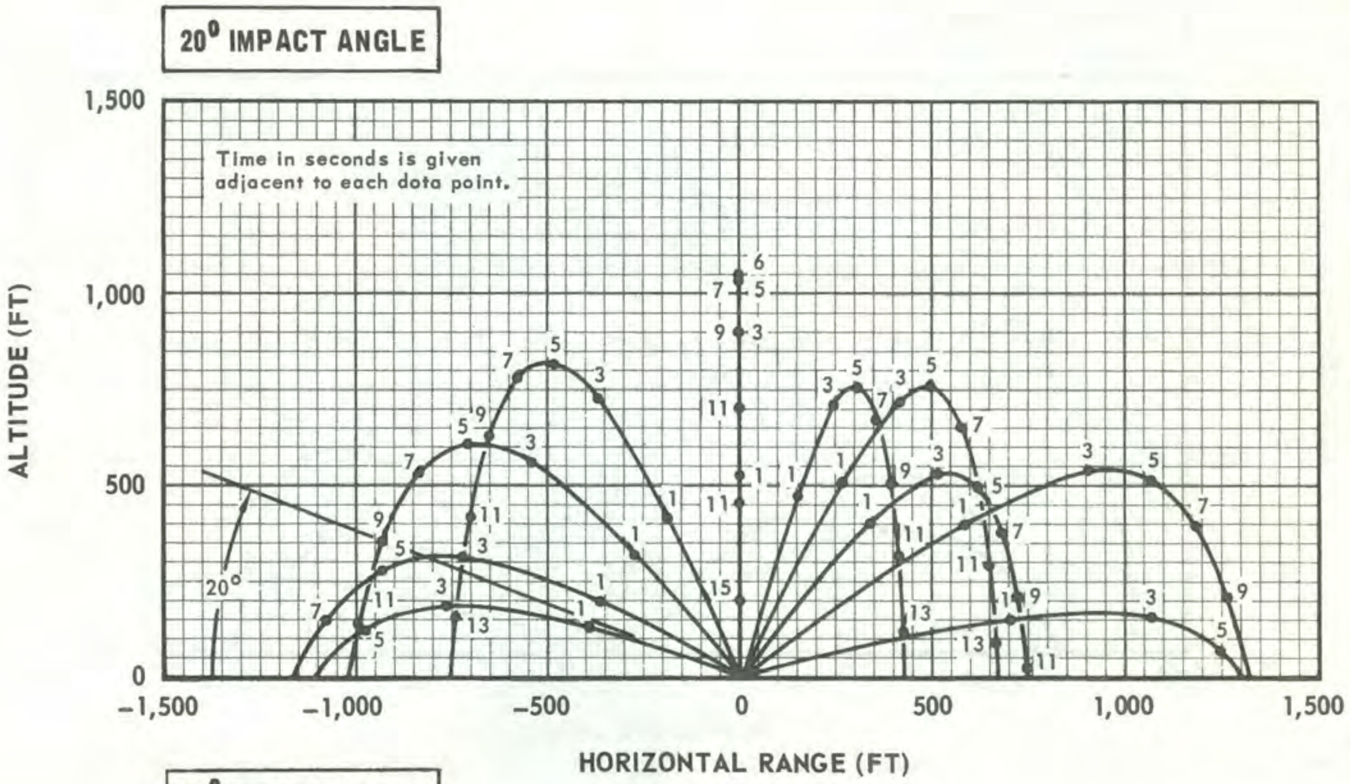
1. Sight angles are based on 27,000-pound aircraft gross weight, 0-foot burst altitude, and 0-foot target elevation.
2. Propellent temperature 70°F.

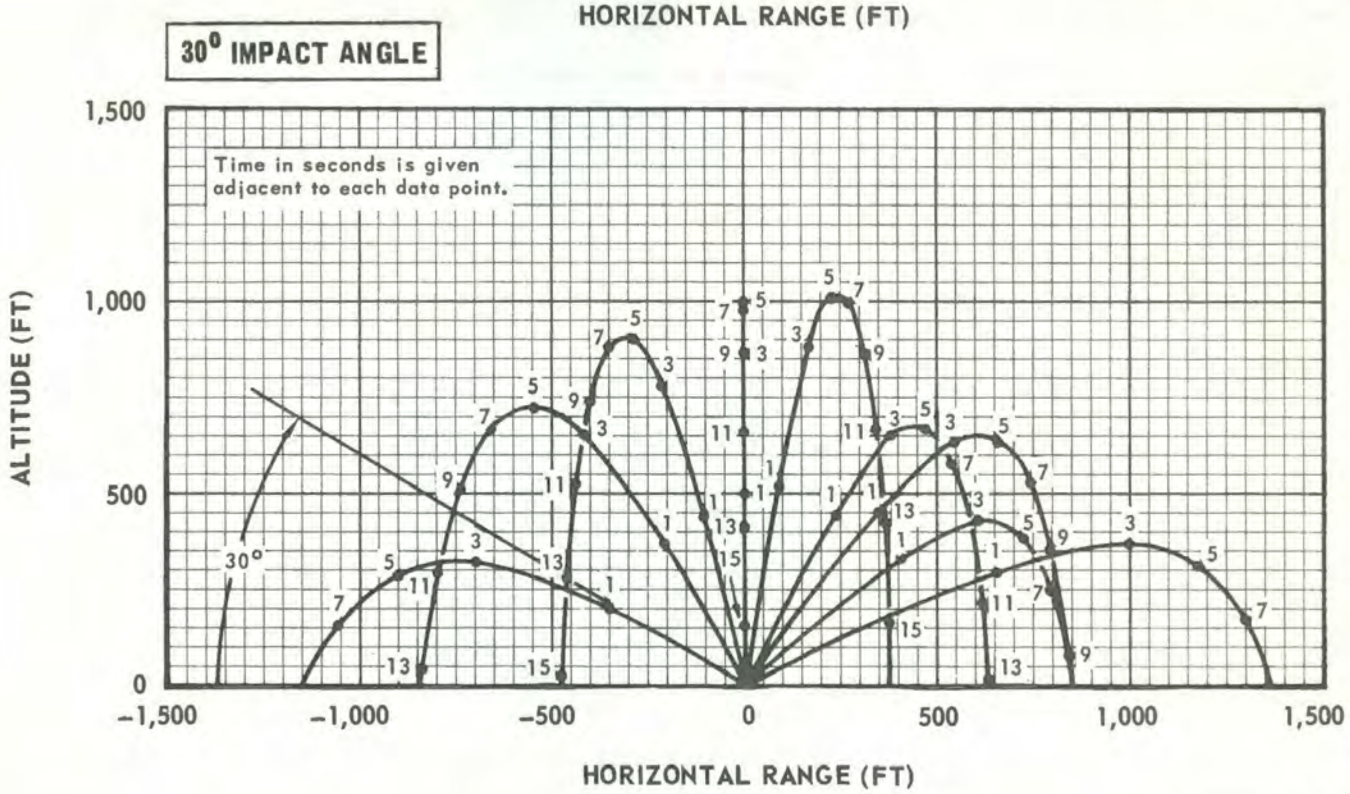
AZ–354(4)–03–70

Figure 2–93A (U) (Sheet 4)

Maximum Fragment Envelope

2.75-INCH FFAR – MK 1 MOD 1 WARHEAD





AZ-296(1)-5-68

Figure 2-94 (Sheet 1)

Maximum Fragment Envelope

2.75-INCH FFAR – MK 1 MOD 1 WARHEAD

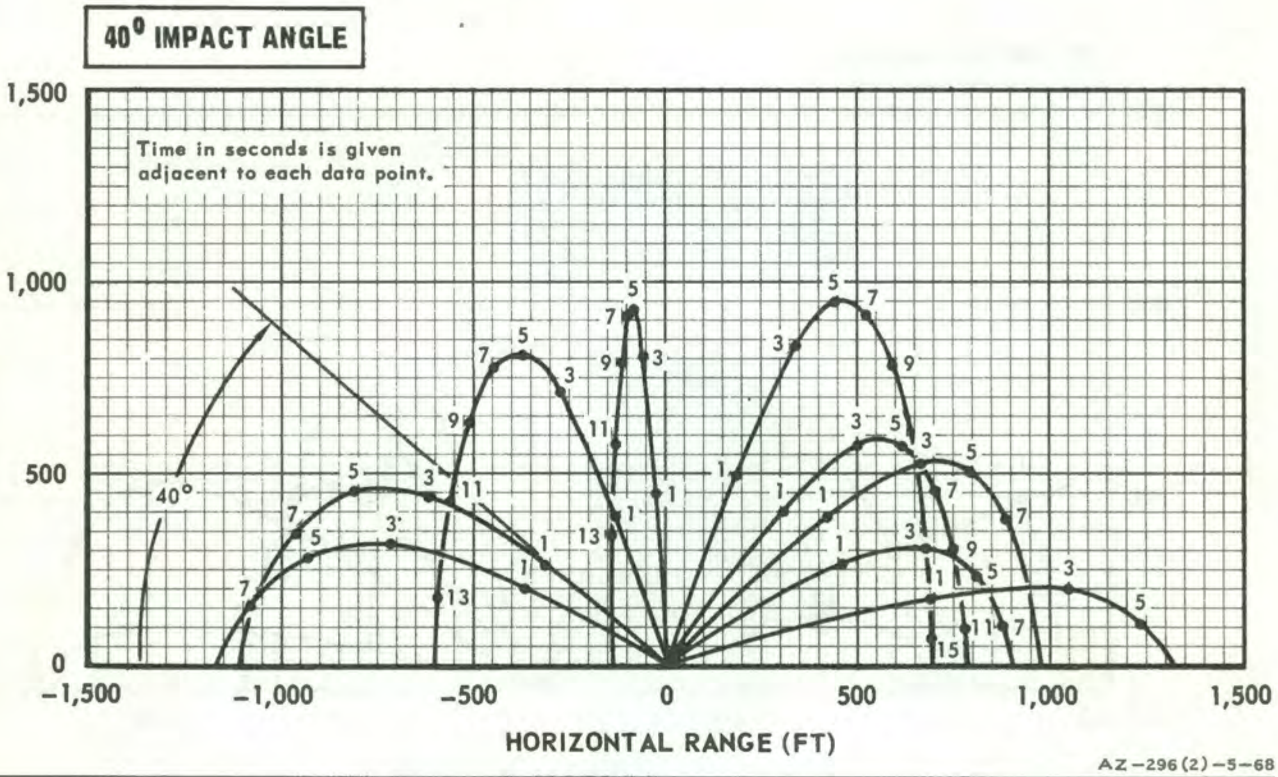


Figure 2–94 (Sheet 2)

Tested Delivery Data

2.75 INCH FFAR

DIVE ANGLE	MIL LEAD	ENTRY			RELEASE			CORRECTION PER 10 KT OF WIND -MILS		RELEASE ERROR SENSITIVITIES				
		KIAS	ALTITUDE FT AGL	APPROX RPM%	KTAS	ALTITUDE FT AGL	ALTIMETER LAG-FT	Range	Cross	FT/10KT KIAS	FT/100FT ALTITUDE	FT/DEG DIVE ANGLE	FT/MIL RANGE	FT/MIL DEFLECTION
10°	60	375–400	2,500	92–93	450	800	100	2	7	3	20	8	12	4
20°	52	400	5,000	94–96	500	2,000	200	3	8	5	10	11	15	6
30°	48	350	7,000	94–96	500	2,500	250	4	8	3	10	5	9.5	5
45°	60	250	12,000	86–88	450	4,500	0	6	8	2	9	4	8	6

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
   Slow impacts short

   Altitude – High impacts short
   Low impacts long

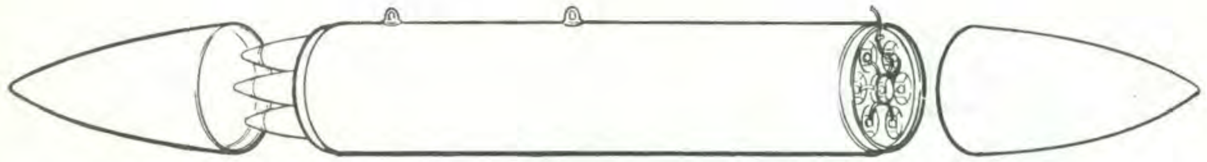
   Dive Angle – Steep impacts long
   Shallow impacts short

2. Mil leads are computed for the cruise droop extended.
3. 45° dive profile flown with speed brakes OUT.

AZ-247-2-67

Figure 2–94A

Aero 6A, 6A-1, 6A-2 Rocket Launchers



DESCRIPTION

The Aero 6A, 6A-1 and 6A-2 rocket launchers are expendable stores to ship, stow and fire seven 2.75 inch FFAR motors. The warheads are added during loading operation. Frangible fairings are used to reduce drag prior to firing the rockets. The rockets are ripple fired by intervalometer at a rate of 100 per second. A KMU-52A/A rocket launcher training aid can be installed to provide a single-fire capability

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 Aero 6A 2 Aero 7A-1 2 Pylons Total One Wing Only	296 104 350 750 375
TER SUSPENSION Two Launchers Each Wing 	4 Aero 6A 2 Aero 7A-1 2 Pylons Total One Wing Only	592 104 350 1046 523

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

JETTISONING PROCEDURES

See JETTISONING this section.

PHYSICAL CHARACTERISTICS

Weight (Loaded)	– 148 pounds
Length	– 75.1 inches
Diameter	– 9.75 inches
Suspension lugs	– 14 inches apart

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

NOTE

When the rocket launcher is carried on the TER the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position. To fire two launchers on the same wing, the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

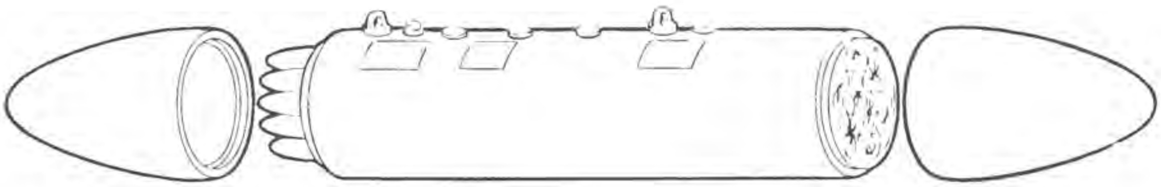
REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Launcher Loading, Arming and Preflight Inspection – NAVAIR 01-45HH-75

AZ-110-03-69

Figure 2-95

Aero 7D Rocket Launcher



DESCRIPTION

The AERO 7D is an expendable launcher used for shipment, storage and launching nineteen 2.75 FFAR motors. Warheads are added during loading operations. Two frangible fairings are used to reduce drag prior to firing the rockets. The rockets are ripple fired at a rate of 100 per second. A SWU-7/A37 rocket launcher training aid can be installed to provide a mode for firing eighteen rockets in nine launchings of two rockets each.

PHYSICAL CHARACTERISTICS

Weight (Loaded)	431 pounds
Length	98.6 inches
Diameter	15.7 inches
Suspension lugs	14 or 30 inches

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 Aero 7D	862
	2 Aero 7A-1	104
	2 Pylons	350
	Total	1316
	One Wing Only	658
TER SUSPENSION Two Launchers Each Wing 	4 Aero 7D	1724
	2 Aero 7A-1	104
	2 Pylons	350
	Total	2178
	One Wing Only	1089

NOTE

When the rocket launcher is carried on the TER the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position. To fire two launchers on the same wing, the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

JETTISONING PROCEDURES

See JETTISONING this section

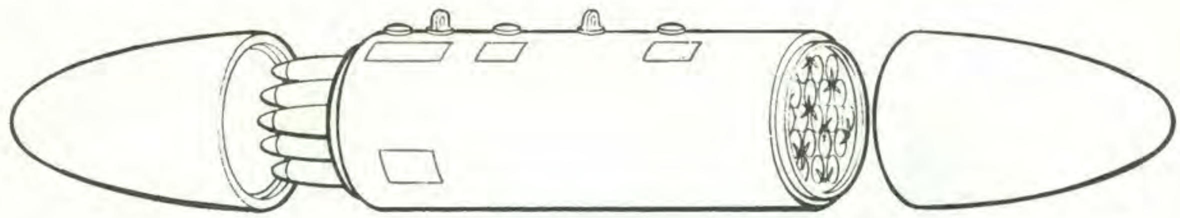
REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Launcher Loading Arming and Preflight Inspections – NAVAIR 01-45HH-75

AZ-111-01-69

Figure 2-96

LAU-3A/A Rocket Launcher



PHYSICAL CHARACTERISTICS

Weight (Empty) – 81 pounds
(Loaded) – 417 pounds
Length – 94.5 inches
Diameter – 15.75 inches
Suspension lugs – 14 inches

DESCRIPTION

The LAU 3A/A rocket launcher contains 19 paper tubes clustered and bonded together then wrapped with aluminum outer skin. Detent devices within the tubes retain the 2.75-inch FFAR. Fairings cover the ends to streamline the launcher prior to firing the rockets. These fairings are shattered by the rockets which are ripple fired at a rate of 100 rounds per second. When a SWU-31/A switch is used, a selectable option exists for single or ripple fire.

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

NOTE

When the rocket launcher is carried on the TER the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position. To fire two launchers on the same wing the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 LAU 3A/A	834
	2 Aero 7A-1	104
	2 Pylons	350
	Total	1288
	One Wing Only	644
TER SUSPENSION Two Launchers Each Wing 	4 LAU 3A/A	1668
	2 Aero 7A-1	104
	2 Pylons	350
	2 TER	210
	Total	2332
	One Wing Only	1166

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Launcher Arming – NAVAIR 01-45HH-75
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Rocket Launcher Loading – NAVAIR 01-45HH-75

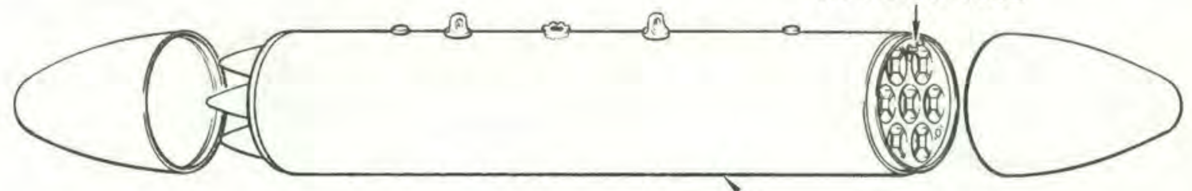
JETTISONING PROCEDURES

See JETTISONING this section.

AZ-112-03-69

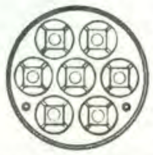
Figure 2–97

LAU-32 Rocket Launcher



DESCRIPTION

The LAU 32A/A and the LAU 32B/A rocket launchers carry seven 2.75-inch folding fin aircraft rockets. They are equipped with frangible fairings at both ends. The fairings shatter when the rockets are launched. The LAU 32A/A launcher has paper launching tubes, and is intended to be jettisoned after use. Rockets are ripple fired unless a SWU-31/A switch is used with the LAU-32A/A. When the SWU-31/A switch is used, a selectable option exists for single or ripple fire. The LAU 32B/A launcher has aluminum launching tubes, an intervalometer which is adjustable and reusable and a selectable option of single or ripple fire. Selection of single or ripple must be made prior to installing the aft fairing.



PHYSICAL CHARACTERISTICS

Weight (Empty)	– 47 pounds
(Loaded)	– 168 pounds
Length	– 67.1 inches
Diameter	– 9.8 inches
Suspension lugs	– 14 inches apart

WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 LAU 32A/A 2 Aero 7A-1 2 Pylons Total One Wing Only	336 104 350 790 395
TER SUSPENSION Two Launchers Each Wing 	4 LAU 32A/A 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	672 104 350 210 1336 668

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

NOTE

When the rocket launcher is carried on the TER, the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

To fire two launchers on the same wing the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

REFERENCES

1. Restrictions – See Figure 2–2.
2. Rocket Launcher Loading, Arming and Preflight Inspection – NAVAIR 01-45HH-75.

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

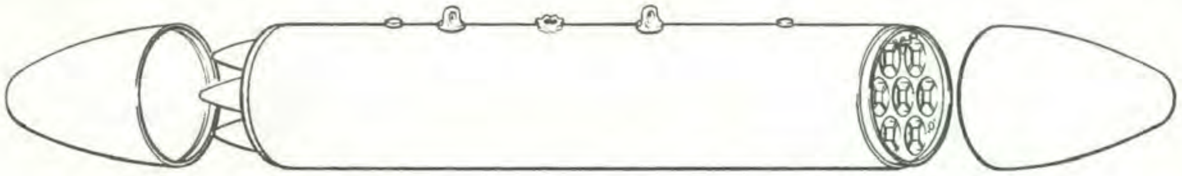
JETTISONING PROCEDURES

See JETTISONING , this section.

AZ-114-03-69

Figure 2–98

LAU-56/A Rocket Launcher



PHYSICAL CHARACTERISTICS

Weight	– 168 pounds
Length	– 67.1 inches
Diameter	– 9.8 inches
Suspension lugs	– 14 and 30 inches apart, single lug centered

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

DESCRIPTION

The LAU 56/A carries and fires seven 2.75-inch FFAR. The launcher is similar in size and shape to the LAU-32 launcher. The launcher has a selectable SINGLE or RIPPLE fire option.

NOTE

When the rocket launcher is carried on the TER the pylon MER/TER switch must be set to the RKT position to prevent jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

To fire two launchers on the same wing the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station it is necessary to have the hooks at that station open, or the stores release switch must be depressed and released once for each empty station between launchers.

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A SUSPENSION One Launcher Each Wing 	2 LAU 56/A 2 Aero 7A-1 2 Pylons Total One Wing Only	336 104 350 790 395
TER SUSPENSION Two Launchers Each Wing 	4 LAU 56/A 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	672 104 350 210 1336 668

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticiputed.

JETTISONING PROCEDURES

See JETTISONING, this section.

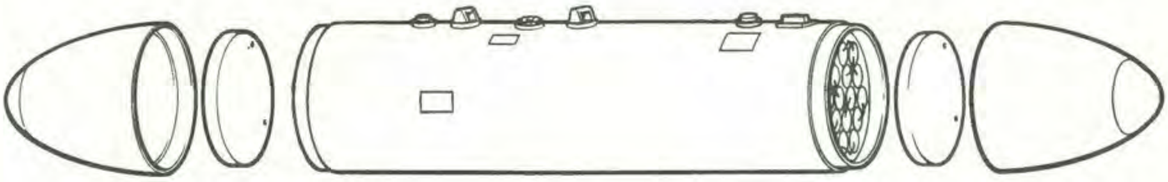
REFERENCES

1. Restrictions – See Figure 2-1
2. Rocket Launcher Arming – NAVAIR 01-45HH-75
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Rocket Launcher Loading – NAVAIR 01-45HH-75

AZ–131–03–69

Figure 2–99

LAU-60/A Rocket Launcher



DESCRIPTION

The center section of the LAU-60/A rocket launcher contains the suspension, electrical system, fire control system and a cluster of 19 fiber rocket tubes. A detent on each tube retains and ignites the 2.75-inch folding fin aircraft rockets which are fired in pairs. Forward and aft fairings are attached to the center section by a locking band and are shattered by the rockets which are ripple fired at a rate of 100 per second.

PHYSICAL CHARACTERISTICS

Weight	(Empty)	– 79.0 pounds
	(Loaded)	– 473.2 pounds
Length		– 86.5 inches
Diameter		– 15.5 inches
Suspension lugs		– 14.0 inches and center

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 LAU-60/A 2 Aero 7A-1 2 Pylons Total One Wing Only	946 104 350 1400 700
TER SUSPENSION Two Launchers Each Wing 	4 LAU-60/A 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	1893 104 350 210 2557 1278

NOTE

When the rocket launcher is carried on the TER, the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position. To fire two launchers on the same wing the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Launcher Arming – NAVAIR 01-45HH-75
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Rocket Launcher Loading – NAVAIR 01-45HH-75

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

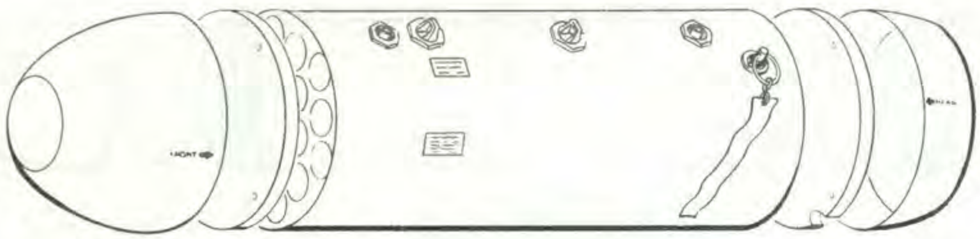
JETTISONING PROCEDURES

See JETTISONING this section.

AZ-265-03-69

Figure 2–100

LAU-61/A and LAU 69/A Rocket Launchers



PHYSICAL CHARACTERISTICS

Weight	(Empty)	– 98.0 pounds
	(Loaded)	– 506.5 pounds
Length		– 83.6 inches
Diameter		– 15.7 inches
Suspension lugs		– 14 inches

DESCRIPTION

The LAU-61/A and LAU-60/A are dual-purpose weapons designed for either air-to-air or air-to-surface use. These launchers carry and fire nineteen (19) 2.75 folding fin aircraft rockets. Each has a selective single or ripple fire grounded-type intervalometer, rf barriers and safety shorting pins. In the ripple mode two rockets are fired simultaneously with an elapsed time of 17–23 milliseconds between firings. A single rocket is discharged on the last firing. The nineteen rocket tubes of the LAU-61/A are aluminum. LAU-69/A tubes are fiber. LAU-61/A is reusable and the LAU-69/A is expendable. Initial rocket firing shatters the forward frangible fairing. The aft aluminum fairing is designed to remain intact and direct debris away from the aircraft.

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 LAU 69/A 2 Aero 7A-1 2 Pylons Total One Wing Only	1013 104 350 1467 734
TER SUSPENSION Two Launchers Each Wing 	4 LAU 69/A 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	2026 104 350 210 2690 1345

FIRING PROCEDURES

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – Wing L or R**
3. **Stores Release Sw – DEPRESS**

NOTE

When the rocket launcher is carried on the TER, the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing rockets.

To fire rockets from both wings simultaneously, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position. To fire two launchers on the same wing, the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

Forward RF barrier not required on LAU-61/A.

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

JETTISONING PROCEDURES

See JETTISONING this section.

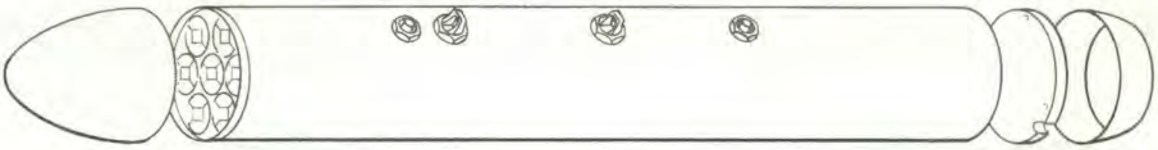
REFERENCES

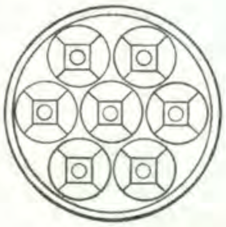
1. Restrictions – See Figure 2-2.
2. Rocket Launcher Arming – NAVAIR 01-45HH-75
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Rocket Launcher Loading – NAVAIR 01-45HH-75

AZ-271-03-69

Figure 2–101

LAU-68/A Rocket Launcher





FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

NOTE

When the rocket launcher is carried on the TER, the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously, the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

To fire two launchers on the same wing, the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between launchers.

CAUTION

Jettison this launcher when carrying live or inert warheads whether or not a firing attempt has been made when a carrier or field arrestment is anticipated.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Launcher Loading, Arming and Preflight Inspection – NAVAIR 01-45HH-75

PHYSICAL CHARACTERISTICS

Weight (Empty)	– 67.0 pounds
(Loaded)	– 217.5 pounds
Length	– 70.9 inches
Diameter	– 9.8 inches
Suspension lugs	– 14 inches apart

DESCRIPTION

The LAU-68/A is a reusable launcher designed as a dual-purpose weapon for either air-to-air or air-to-surface use. It carries and fires seven (7) 2.75 folding fin aircraft rockets and incorporates a selective single or ripple fire grounded-type intervalometer, aft rf barrier and a safety shorting pin. Initial rocket firing shatters the forward frangible fairing. The aft aluminum fairing is designed to remain intact and direct debris away from the aircraft.

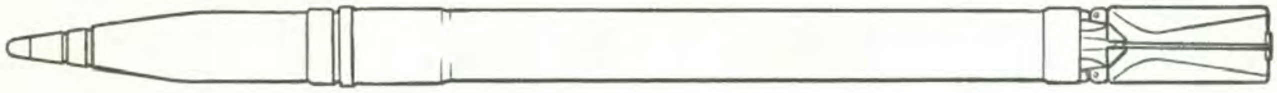
WING STATION LOADING CONFIGURATIONS

WING LOADING	EQUIPMENT-WEIGHT	
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 LAU 68/A 2 Aero 7A-1 2 Pylons Total One Wing Only	435 104 350 889 445
TER SUSPENSION Two Launchers Each Wing 	4 LAU 68/A 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	870 104 350 210 1534 767

AZ-272-03-69

Figure 2–102

5.0-Inch Folding Fin Aircraft Rocket (Zuni)



PHYSICAL CHARACTERISTICS
Weight – 107 pounds
Length – 95 to 110 inches
Diameter – 5.0 inches

LAUNCHERS
LAU-10/A, -10A/A, LAU-33A/A
LAU-35A/A

DESCRIPTION

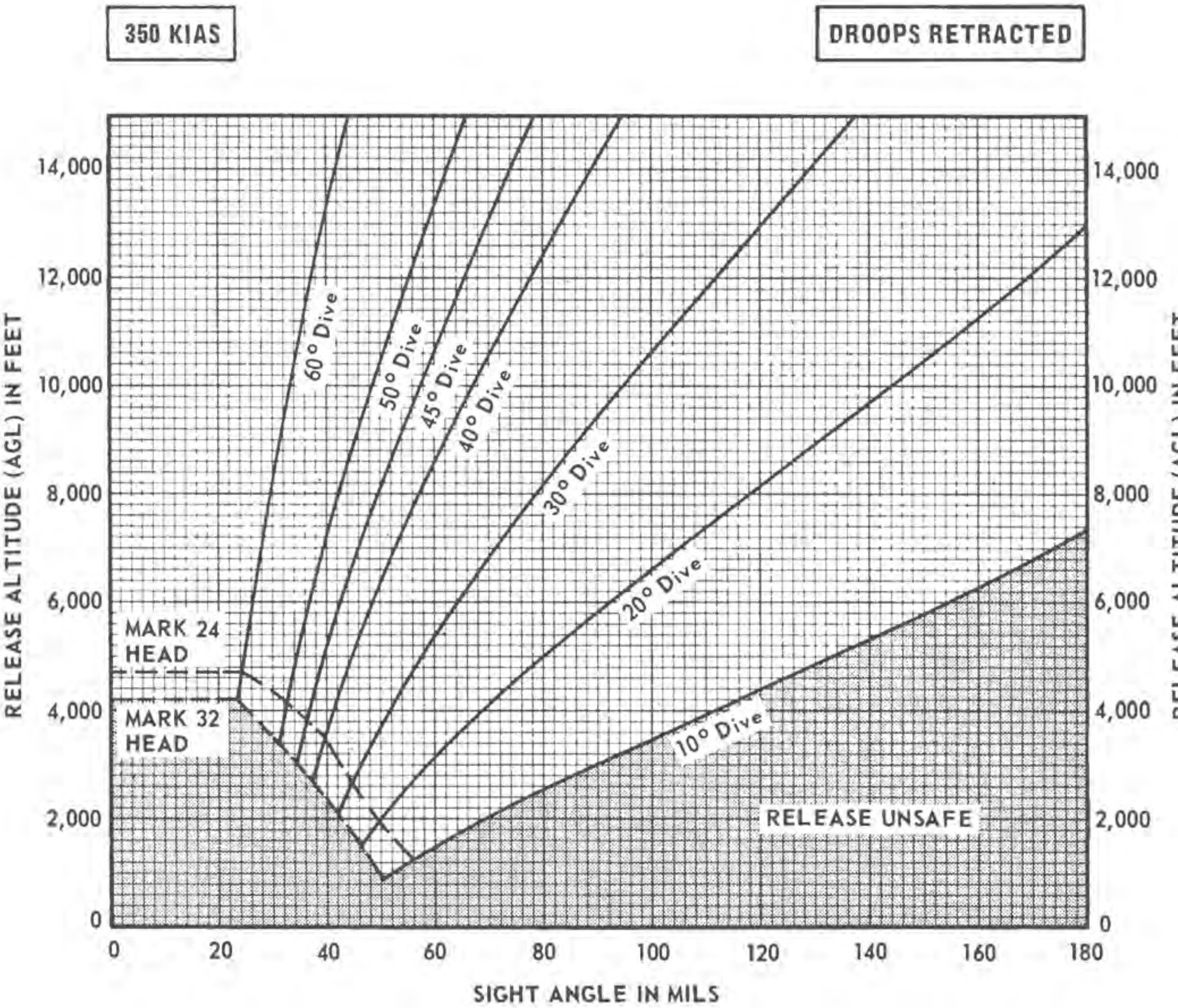
The 5-inch Zuni rocket is a Navy-developed high explosive munition which offers several advantages over other air-to-ground rockets. The peak velocity of the Zuni rocket is very fast, exceeding the velocity of a 50-caliber machine gun round. This high velocity results in an extremely short time of flight. Gravity and wind effects are thus very small resulting in a high degree of accuracy. The high velocity also produces considerable target damage due to shock effect. The rocket consists of a motor, a warhead and a fuze. At the aft end of the motor are four blast-actuated fins which extend when the rocket leaves the launcher.

AZ-109-5-68

Figure 2–103

Mil Lead for Single Delivery

5.0 INCH FFAR (ZUNI)



NOTE

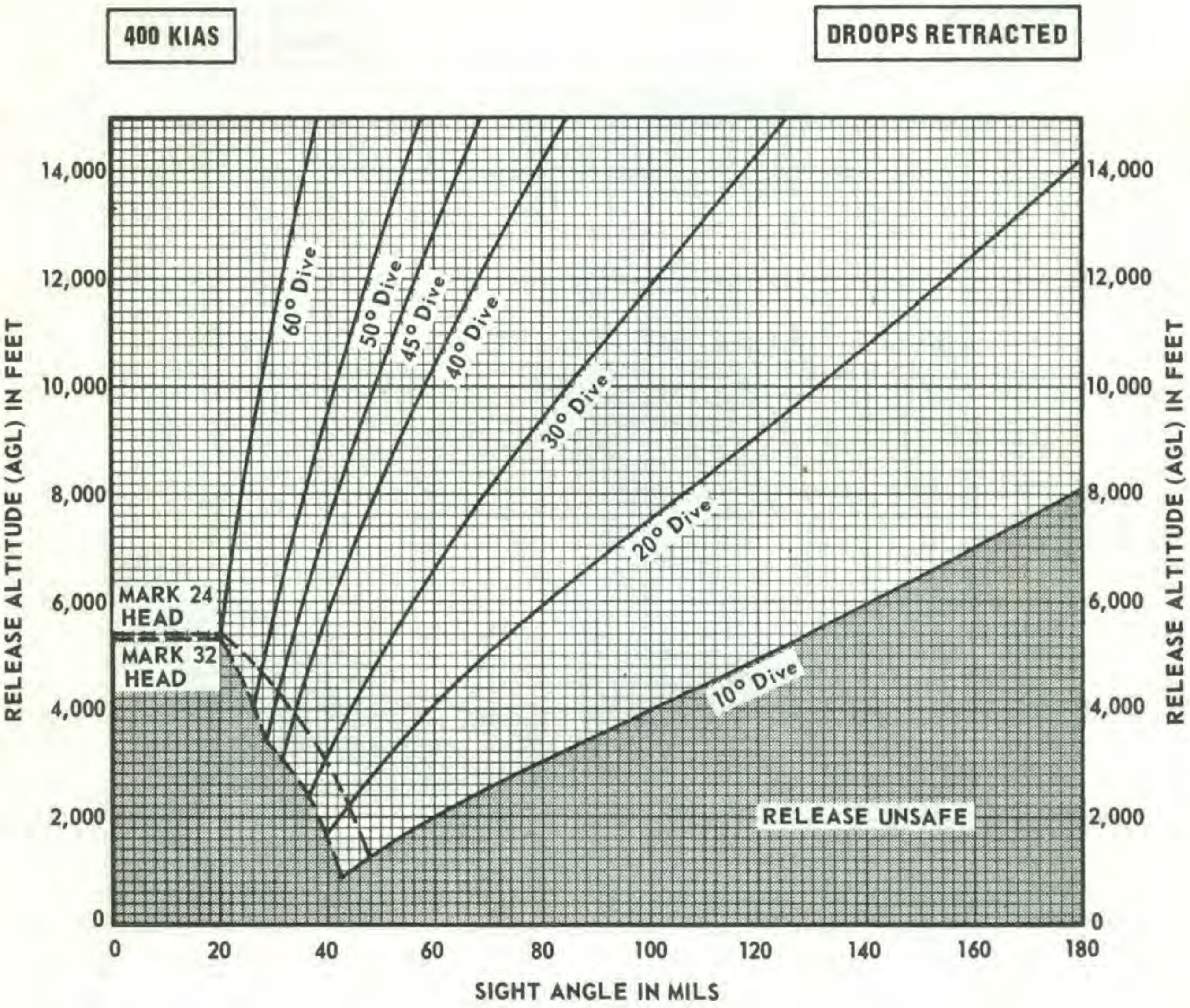
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation. Rockets launched from LAU-10A/A, LAU-33A/A or LAU-35A/A.

AZ-237(1)-03-69

Figure 2–104 (Sheet 1)

Mil Lead for Single Delivery

5.0 INCH FFAR (ZUNI)



NOTE

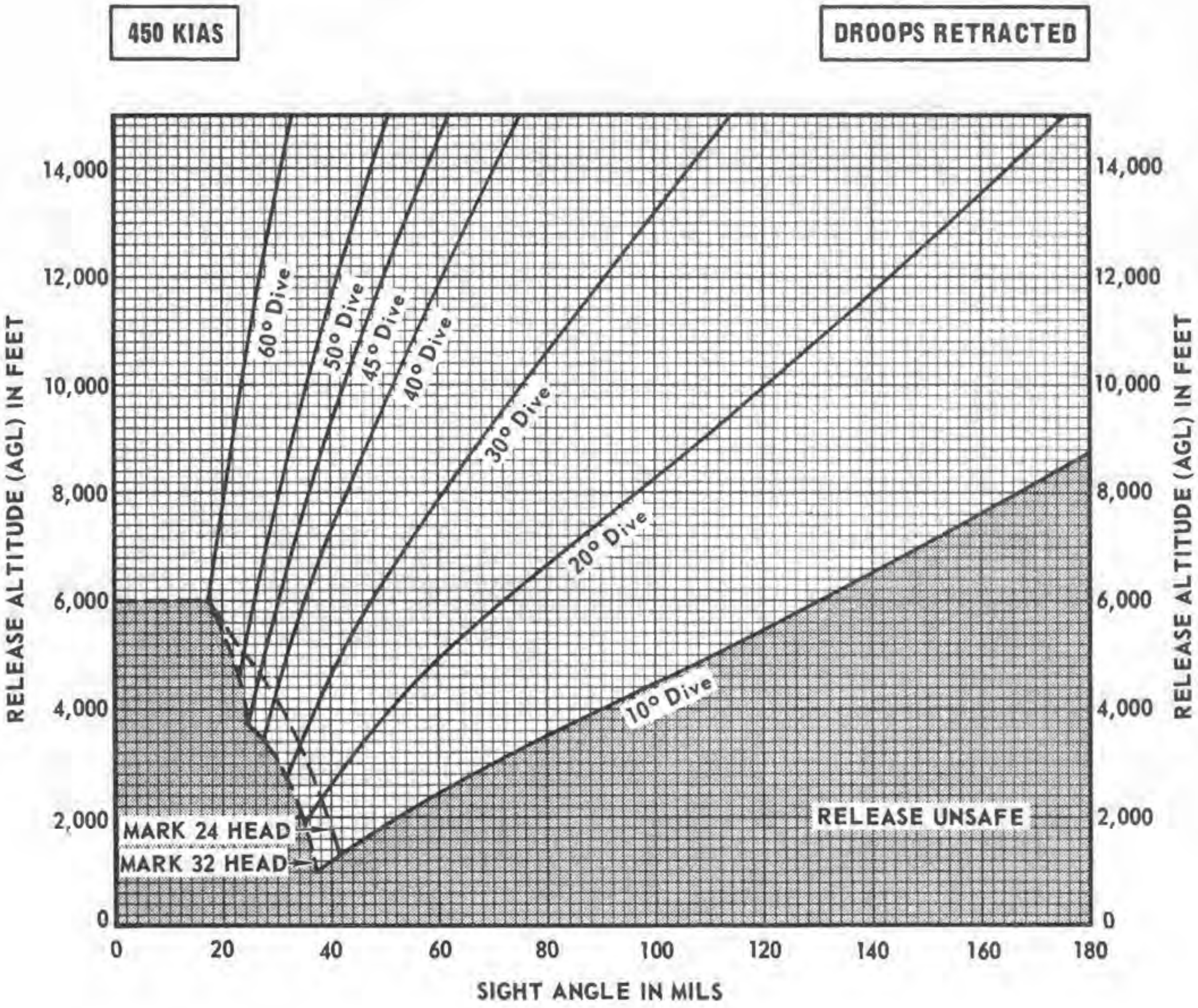
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation. Rockets launched from LAU-10A/A, LAU-33A/A or LAU-35A/A.

AZ-237(2)-03-69

Figure 2-104 (Sheet 2)

Mil Lead for Single Delivery

5.0 INCH FFAR (ZUNI)



NOTE

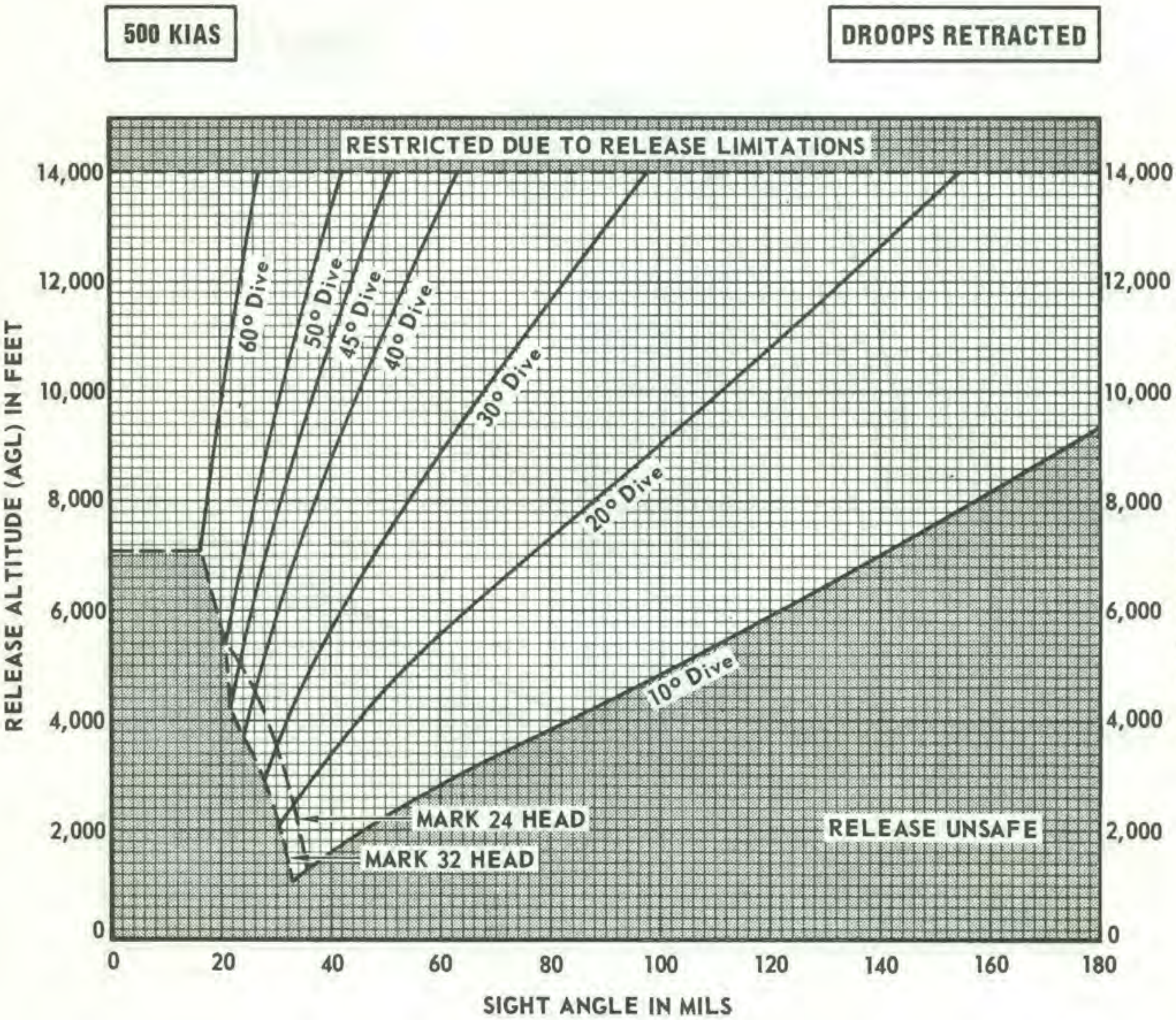
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation. Rockets launched from LAU-10A/A, LAU-33A/A or LAU-35A/A.

AZ-237(3)-03-69

Figure 2–104 (Sheet 3)

Mil Lead for Single Delivery

5.0 INCH FFAR (ZUNI)



NOTE

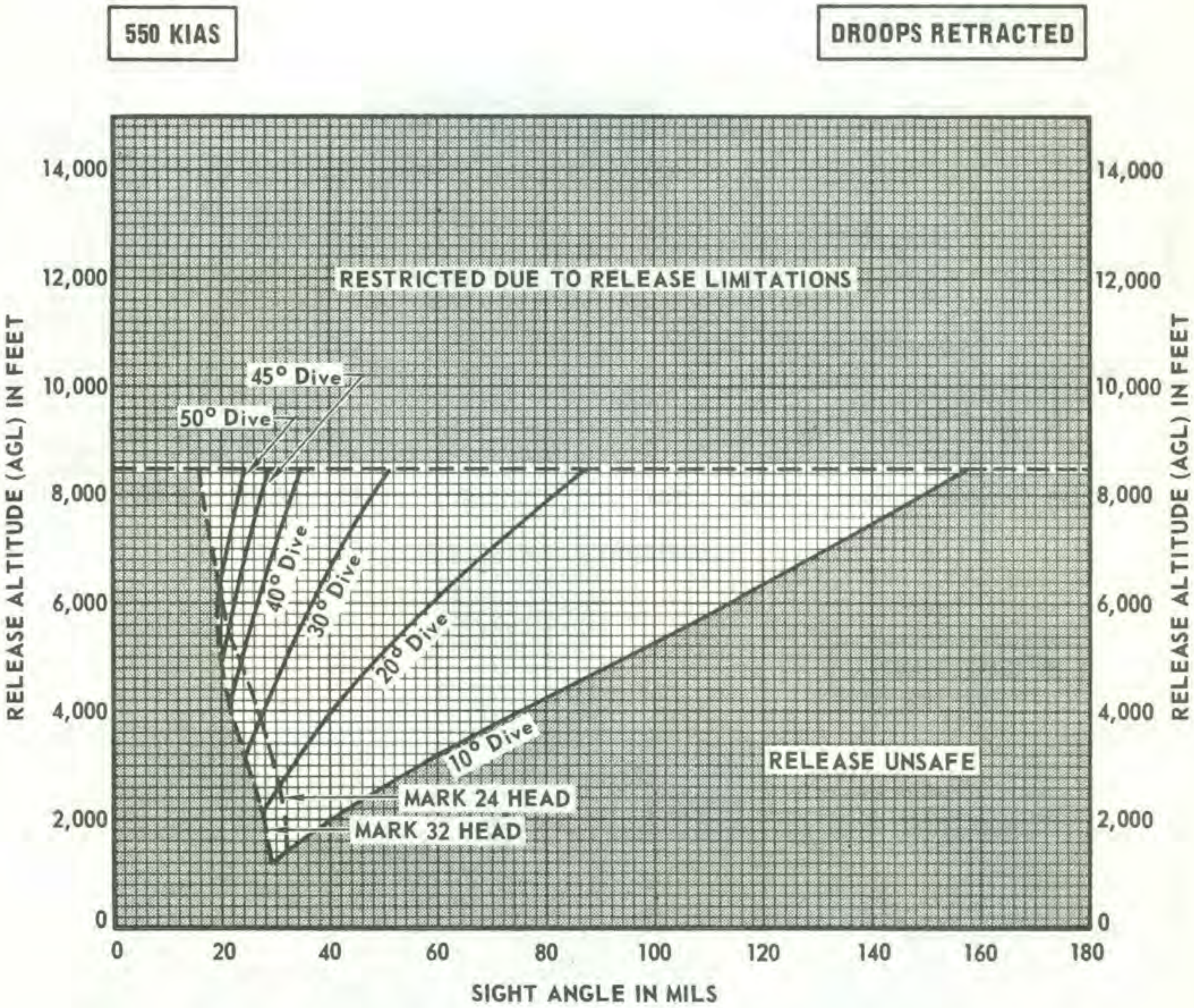
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation. Rockets launched from LAU-10A/A, LAU-33A/A or LAU-35A/A.

AZ-237(4)-03-69

Figure 2-104 (Sheet 4)

Mil Lead for Single Delivery

5.0 INCH FFAR (ZUNI)



NOTE

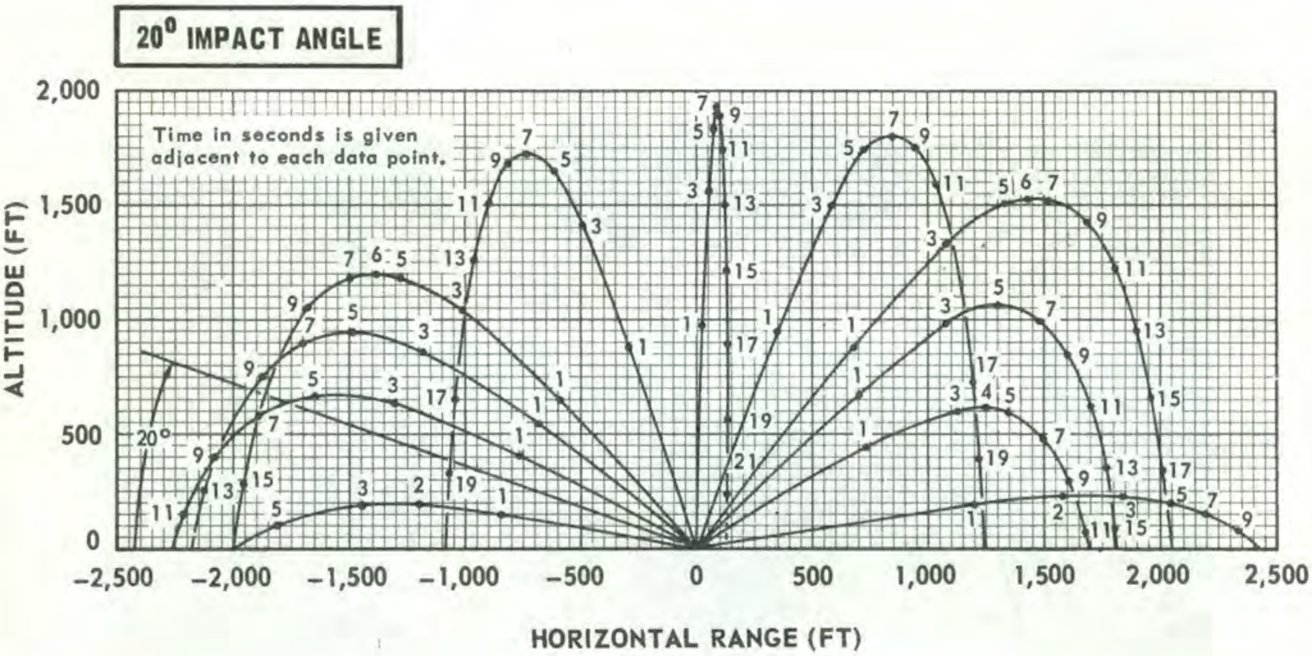
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation. Rockets launched from LAU-10A/A, LAU-33A/A or LAU-35A/A.

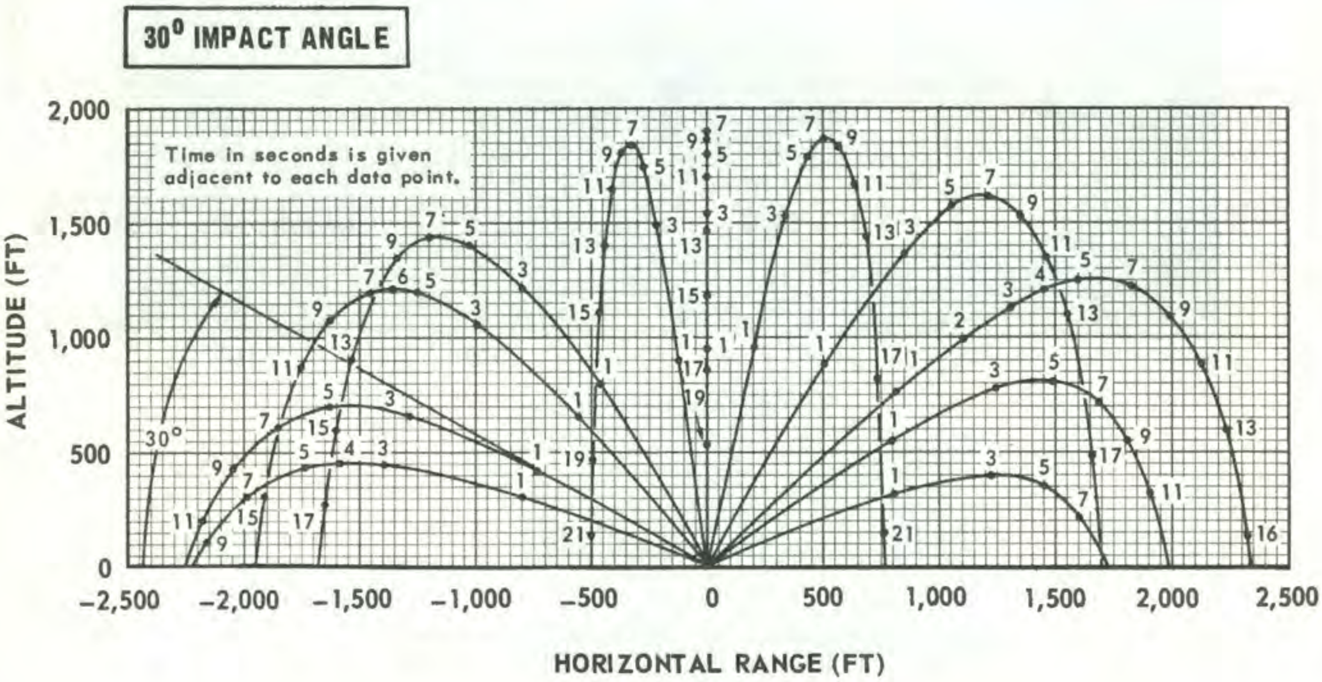
AZ-237(5)-03-69

Figure 2-104 (Sheet 5)

Maximum Fragment Envelope

5.0-INCH FFAR (ZUNI) – MK 24 MOD 0 WARHEAD



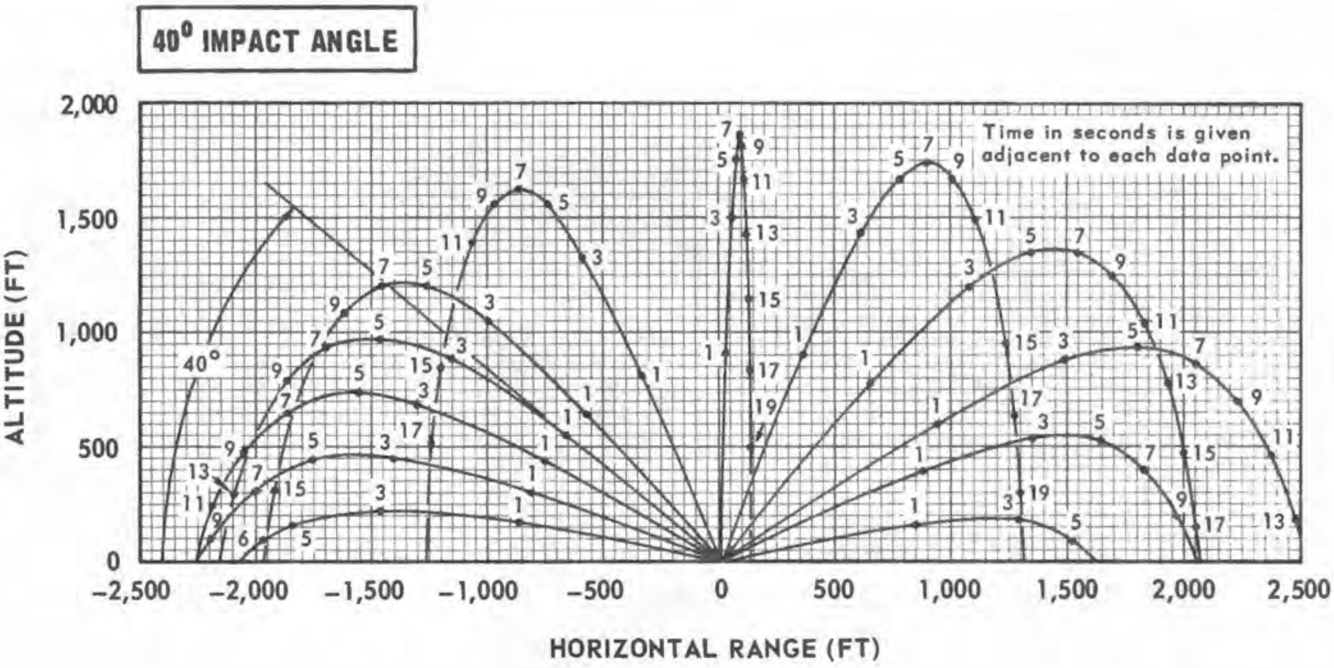


AZ-294(1)-5-68

Figure 2–105 (Sheet 1)

Maximum Fragment Envelope

5.0-INCH FFAR (ZUNI) – MK 24 MOD 0 WARHEAD

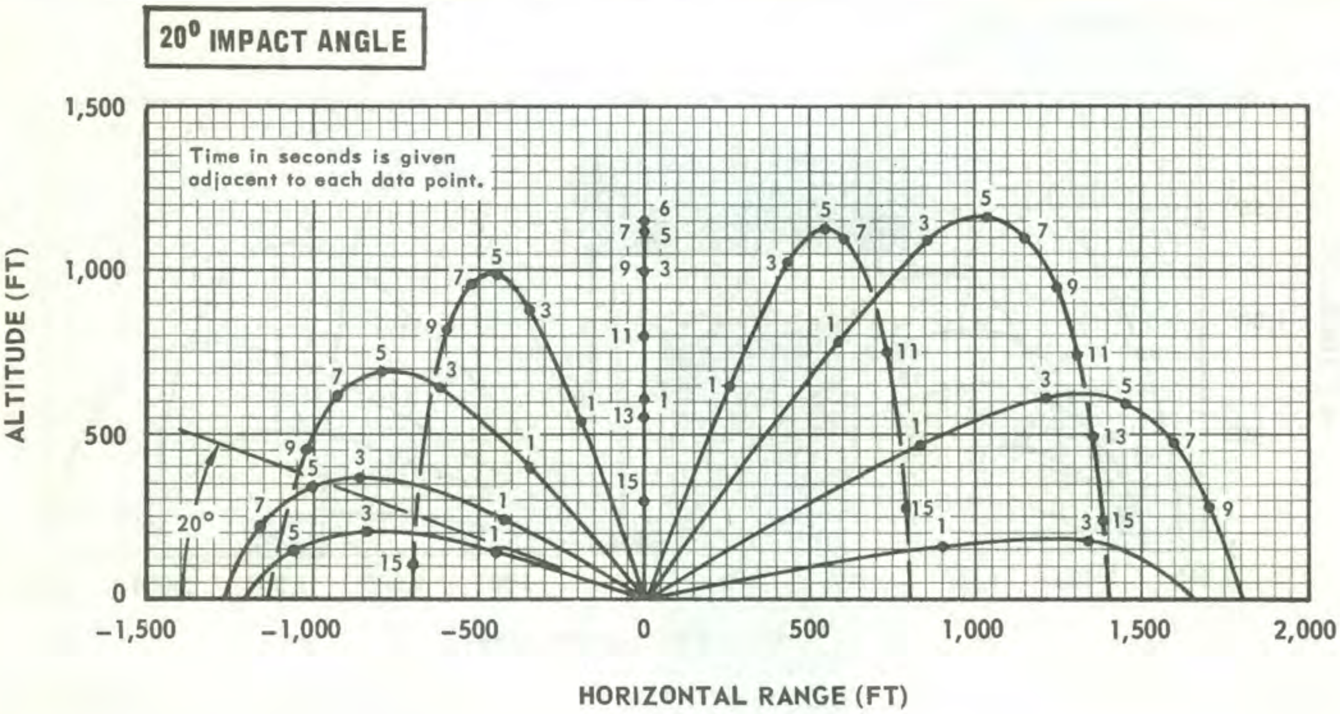


AZ-294(2)-5-68

Figure 2–105 (Sheet 2)

Maximum Fragment Envelope

5.0-INCH FFAR (ZUNI) – MK 32 MOD 0 WARHEAD



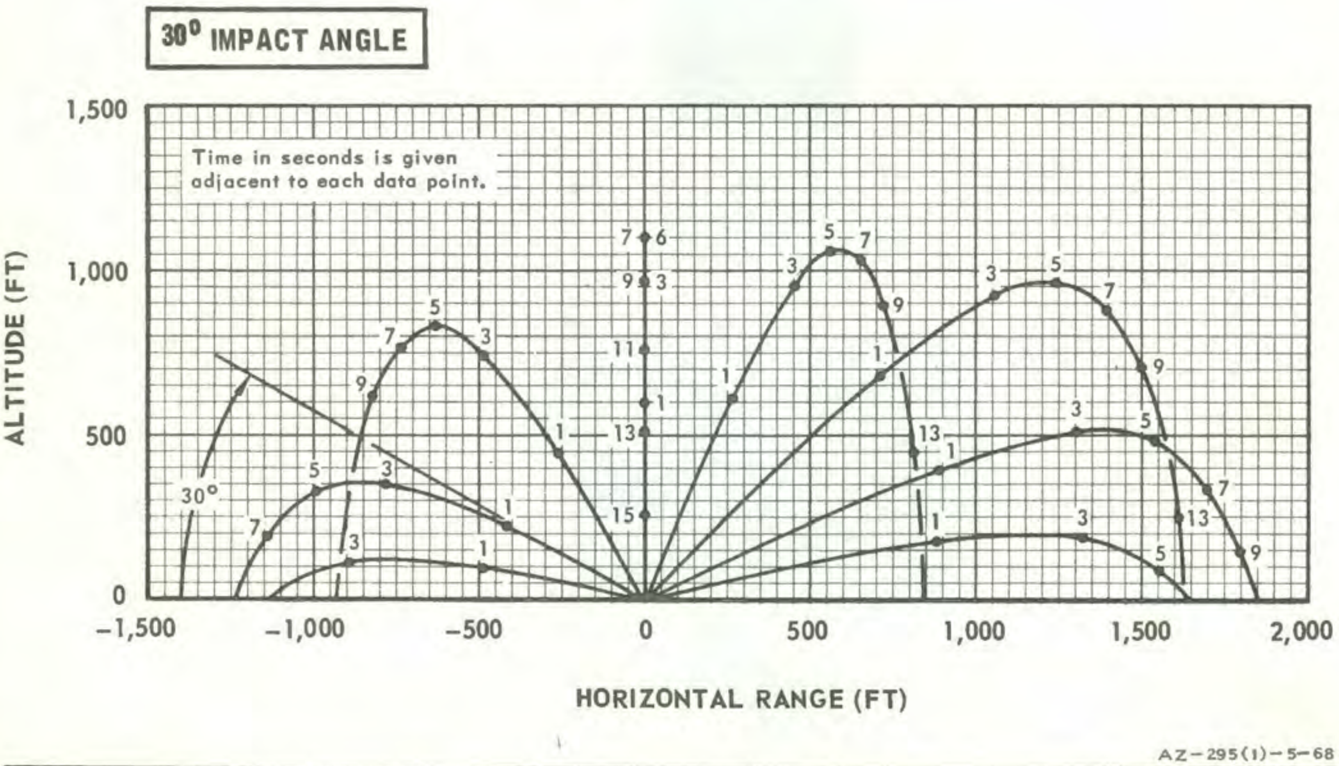


Figure 2-106 (Sheet 1)

Maximum Fragment Envelope

5.0-INCH FFAR (ZUNI) – MK 32 MOD 0 WARHEAD

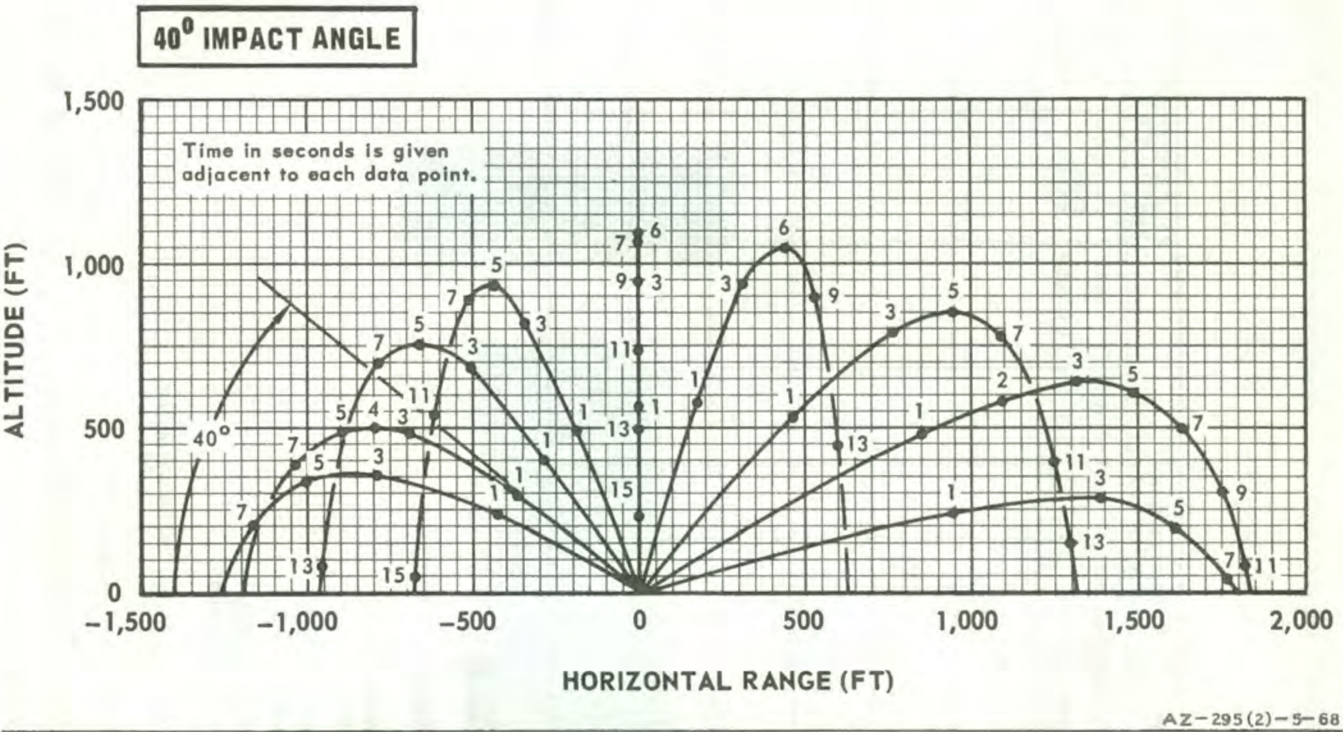


Figure 2–106 (Sheet 2)

5.0 INCH FFAR (ZUNI)

DIVE ANGLE	WARHEAD	MIL LEAD	ENTRY			RELEASE			CORRECTION PER 10KT OF WIND -MILS		RELEASE ERROR SENSITIVITIES				
			KIAS	ALTITUDE FT AGL	APPROX RPM%	KTAS	ALTITUDE FT AGL	ALTIMETER LAG-FT	Range	Cross	FT/10KT KIAS	FT/100FT ALTITUDE	FT/DEG DIVE ANGLE	FT/MIL RANGE	FT/MIL DEFLECTION
10°	MK 32	48	375-400	2,500	92-93	450	800	100	2	6	3	20	10	14	4
20°	MK 32	40	400	5,000	94-96	500	2,000	200	3	7	4.5	10	15	17	6
20°	MK 24	45	400	6,000	94-96	500	2,600	200	3	7	4.5	10	15	17	6
30°	MK 32	35	350	7,000	94-96	500	2,700	250	4	7	2	10	7	12	6
30°	MK 24	40	350	8,000	94-96	500	3,500	250	4	7	2	10	7	12	6
45°	MK 24 and MK 32	45	250	12,000	86-88	450	4,500	0	5	7	2	9	4	8	6

NOTES

1. Error sensitivities are applied as follows:

   Airspeed – Fast impacts long
Slow impacts short

   Altitude – High impacts short
Low impacts long

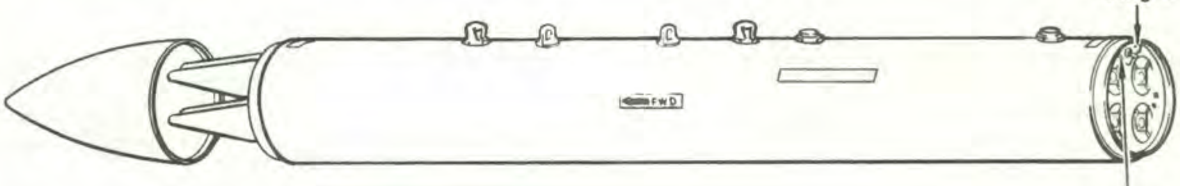
   Dive Angle – Steep impacts long
Shallow impacts short

2. Mil leads are computed for the cruise droop extended.
3. 45° dive profile flown with speed brakes OUT.

AZ-246-2-67

Figure 2-107

LAU-10 Rocket Launcher



PHYSICAL CHARACTERISTICS

Weight (Empty) – 105 pounds
(Loaded) – 533 pounds
Length – 139.57 inches
Diameter – 13.9 inches
Suspension lugs – 14 and 30 inches apart

DESCRIPTION

The LAU 10/A and the LAU-10A/A are reusable launcher units for shipping, stowing and firing four 5.0-inch FFAR ZUNI rockets. A frangible fairing over each end shatters when the rockets are fired. There is a selectable SINGLE or RIPPLE firing option, however this must be Pre-Set prior to takeoff.

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT	WEIGHT
AERO 7A-1 SUSPENSION One Launcher Each Wing 	2 LAU 10/A 2 Aero 7A-1 2 Pylons Total One Wing Only	1066 104 350 1520 760
TER SUSPENSION Two Launchers Each Wing 	4 LAU 10/A 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	2132 104 350 210 2796 1398

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

NOTE

When the rocket launcher is carried on the TER the pylon MER/TER switch must be placed in the RKT position to avoid jettisoning the launcher instead of firing the rockets.

To fire rockets from both wings simultaneously the Triple-Multiple Rack Fire Mode switch in each pylon must be set to the DUAL position.

To fire two launchers on the same wing the stores release switch must be depressed twice.

To step the TER stepping switch past an empty station it is necessary to have the hooks at that station open, or the stores release switch must be depressed and released once for each empty station between launchers.

JETTISONING PROCEDURES

See JETTISONING, this section

REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Launcher Loading, Arming and Pre-flight Inspections – NAVAIR 01-45HH-75

AZ-113-03-69

Figure 2–108

LAU-33A/A and LAU-35A/A Rocket Launchers

PHYSICAL CHARACTERISTICS

Weight (Empty)	– 72 pounds
(Loaded)	– 286 pounds
Length	– 93.5 inches
Suspension lugs	– LAU-7/A or Aero 3A Missile Launcher

DESCRIPTION

The LAU-33A/A or -35A/A rocket launchers are dual tube, single or ripple firing launchers. They carry two 5.0-inch FFAR ZUNI rockets.

FIRING PROCEDURES

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – As Desired**
3. **Stores Release Sw – DEPRESS**

NOTE

The LAU-35A/A was designed for the lower left fuselage station only. The LAU-33A/A can be used in any position except the lower left fuselage station.

Selection of SINGLE or RIPPLE must be made prior to takeoff

FUSELAGE LOADING CONFIGURATIONS

FUSELAGE LOADING	EQUIPMENT-WEIGHT	
DUAL PYLONS 	3 LAU 33A/A	786
	1 LAU 35A/A	262
	4 LAU-7/A	348
	2 Pylons	140
	Total	1536
	One Side Only	768
SINGLE PYLONS 	2 LAU 33A/A	524
	2 LAU-7/A	174
	2 Pylons	108
	Total	806
	One Side Only	403

JETTISONING PROCEDURES

See JETTISON ING this section.

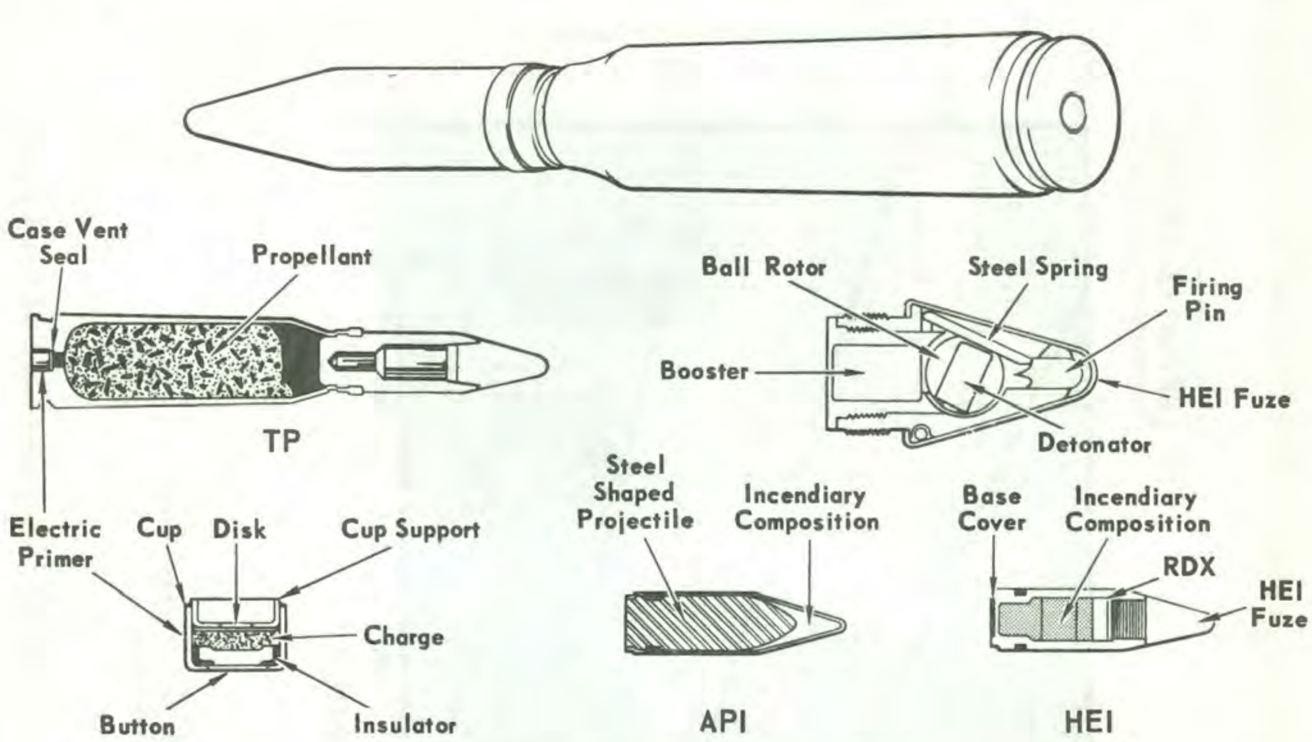
REFERENCES

1. Restrictions – See Figure 2-2
2. Rocket Loading, Arming and Preflight – NAVAIR 01-45HH-75

AZ-115-03-69

Figure 2–109

20mm Ammunition



DESCRIPTION

A 20 MM round consists of a steel cartridge case, an electric primer, propellant powder and the projectile. The primer is ignited by 28 volt DC electrical power from the aircraft armament system. The primer ignites the propellant power which forms a gas as it burns. This gas pressure forces the projectile through the gun barrel. Three types of ammunition are discussed, the only significant difference being the projectile.

The 20 MM ball projectile (TP) is a hollow steel body which does not contain a filler. The use for this projectile is for target practice.

The 20 MM Armor Piercing Incendiary (API) projectile is composed of solid steel. The nose is made of aluminum and charged with an incendiary compound. The projectile requires no fuze.

The 20 MM High Explosive Incendiary (HEI) projectile is composed of an incendiary compound, explosive compound and a fuze. This type projectile is used against aircraft and light material targets.

PHYSICAL CHARACTERISTICS

Weight (Round and Link) – 0.71 pounds
Length – 6.625 inches
Empty (Round and Link) – 0.38 pounds

FIRING PROCEDURES

1. Master Arm Sw – ON
2. Gun Set Sw – ON
3. Guns Arming Sw – READY
4. Trigger Sw – SQUEEZE

REFERENCES

1. Gun Arming – NAVAIR 01-45HH-75
2. Preflight Inspection – NAVAIR 01-45HH-75
3. Gun Loading Procedures – NAVAIR 01-45HH-75

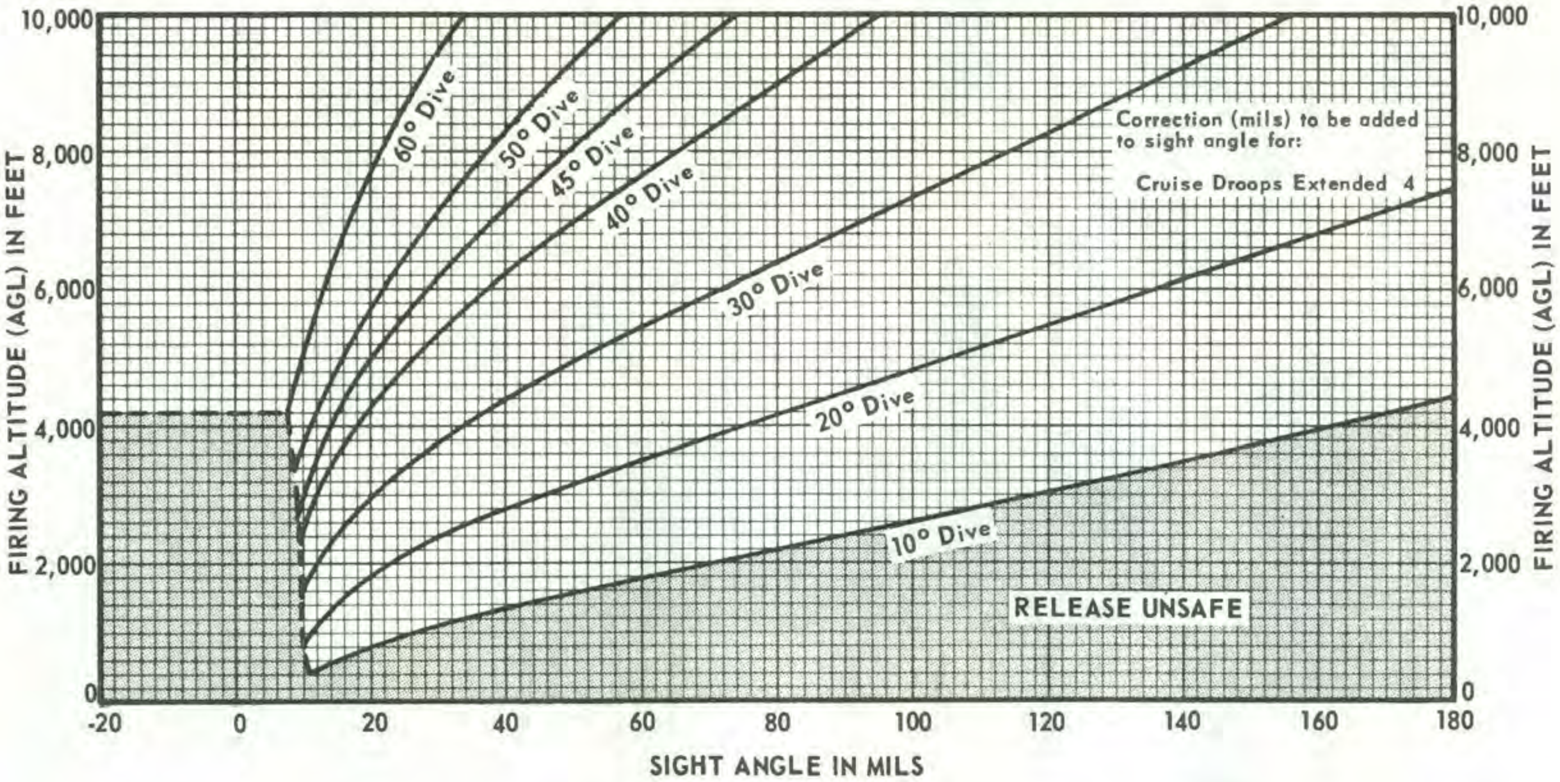
AZ-117-03-69

Figure 2–110

Mil Lead for Strafing

20MM GUNS

350 KIAS **DROOPS RETRACTED**



NOTE

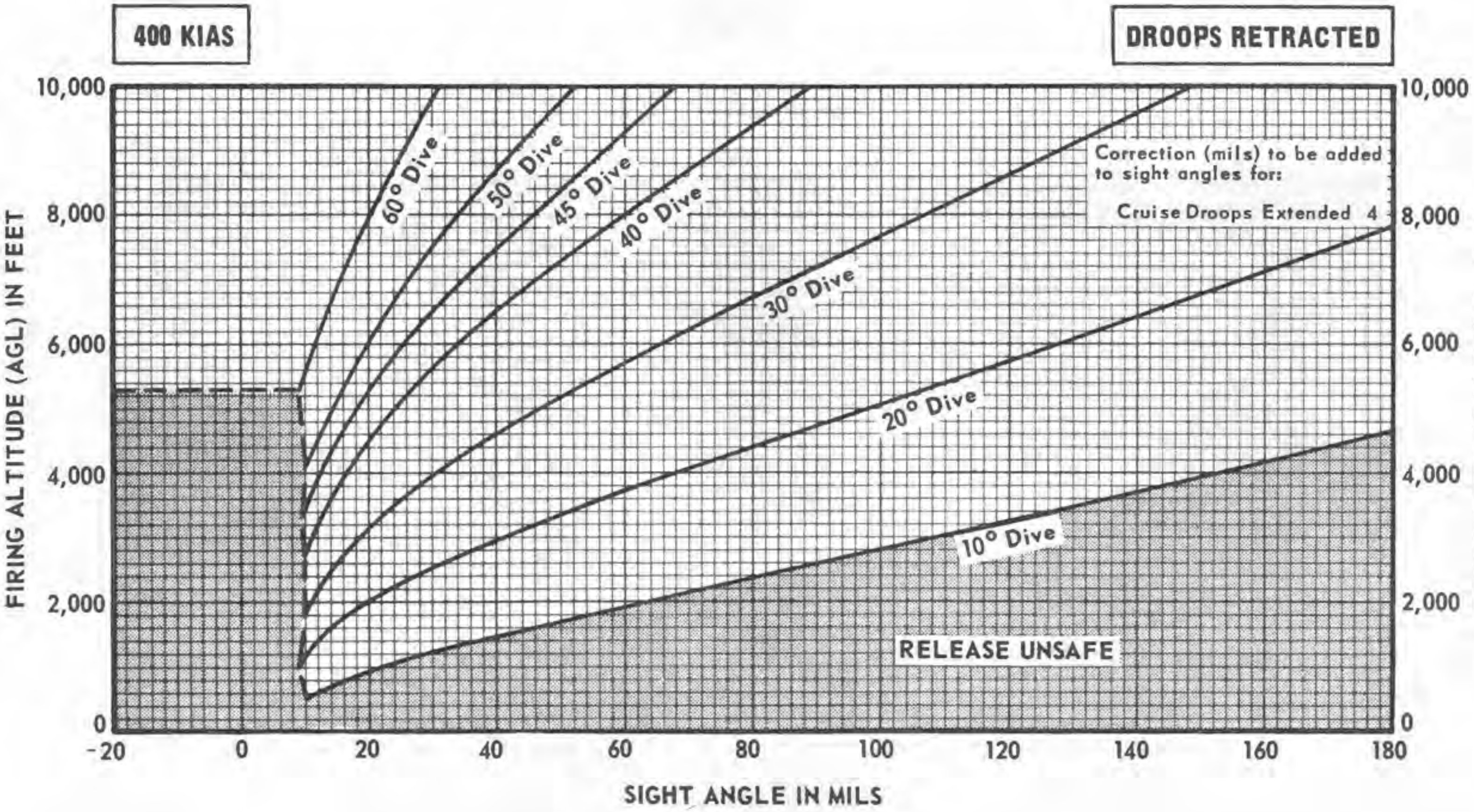
Sight angles are based on 27,000 lb aircraft gross weight
0 ft burst altitude and 0 ft target elevation.

AZ-253(1)-3-67

Figure 2-111 (Sheet 1)

Mil Lead for Strafing

20MM GUNS



NOTE

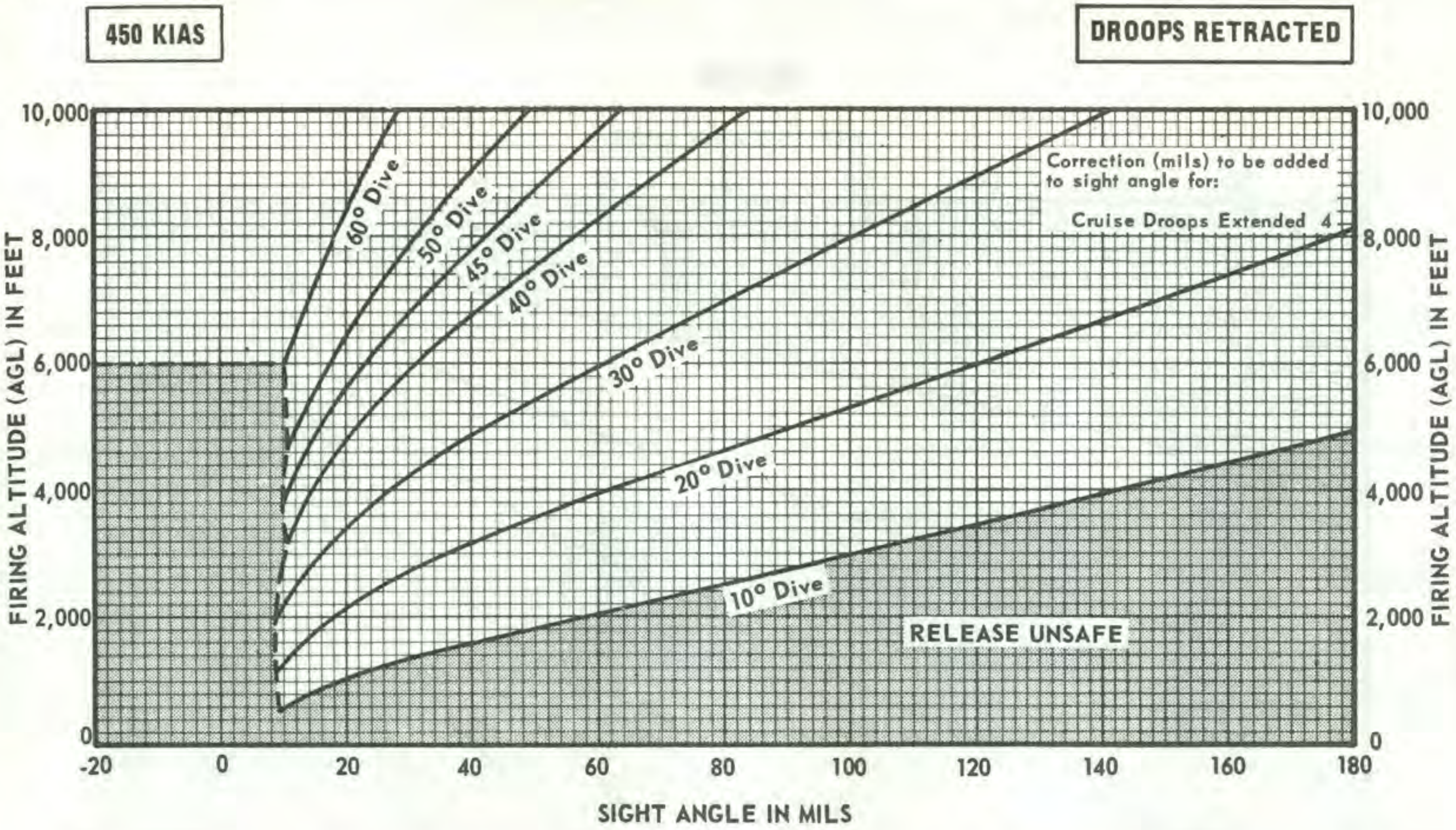
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude and 0 ft target elevation.

AZ-253(2)-3-67

Figure 2-111 (Sheet 2)

Mil Lead for Strafing

20MM GUNS



NOTE

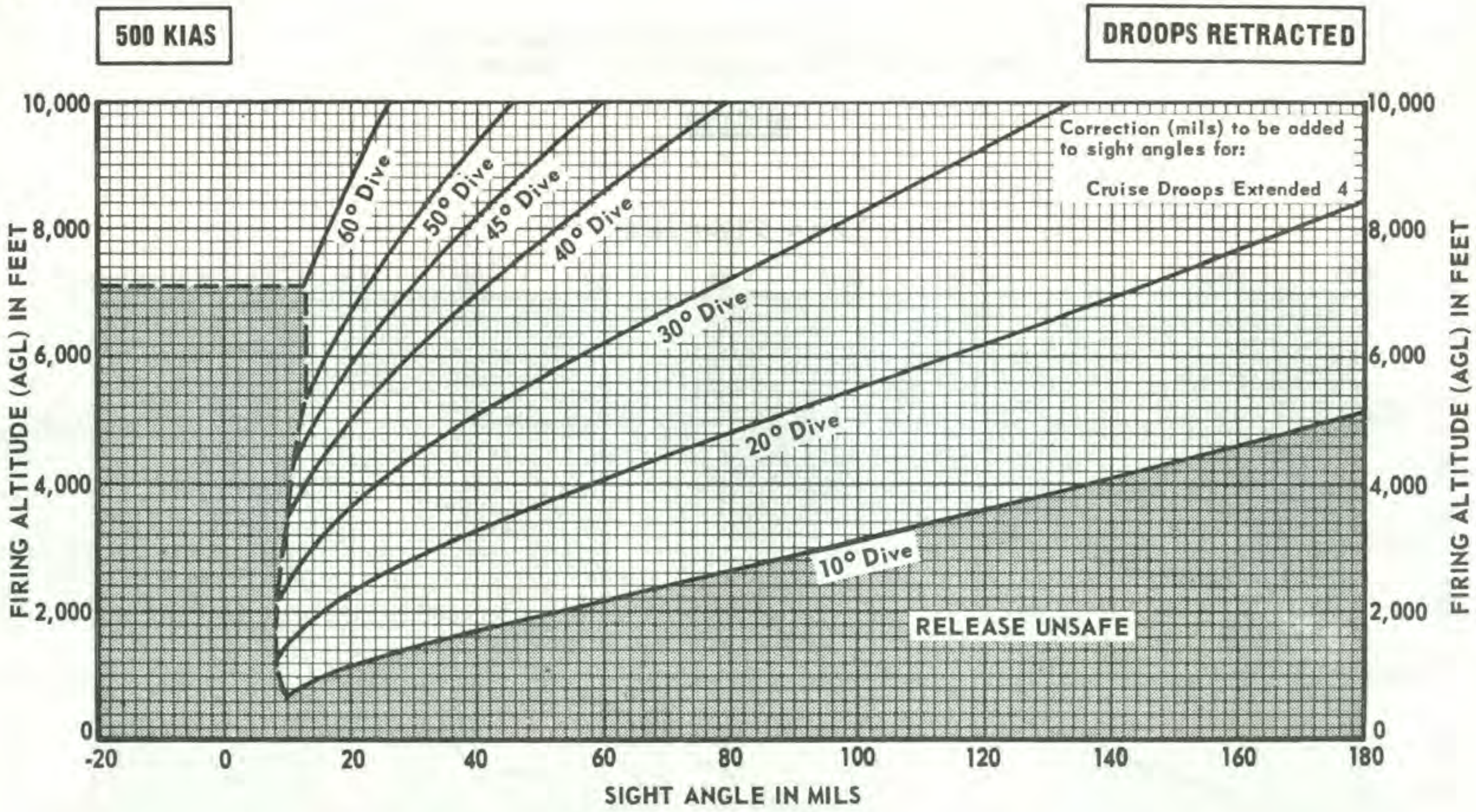
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation.

AZ-253(3)-3-67

Figure 2-111 (Sheet 3)

Mil Lead for Strafing

20 MM GUNS



NOTE

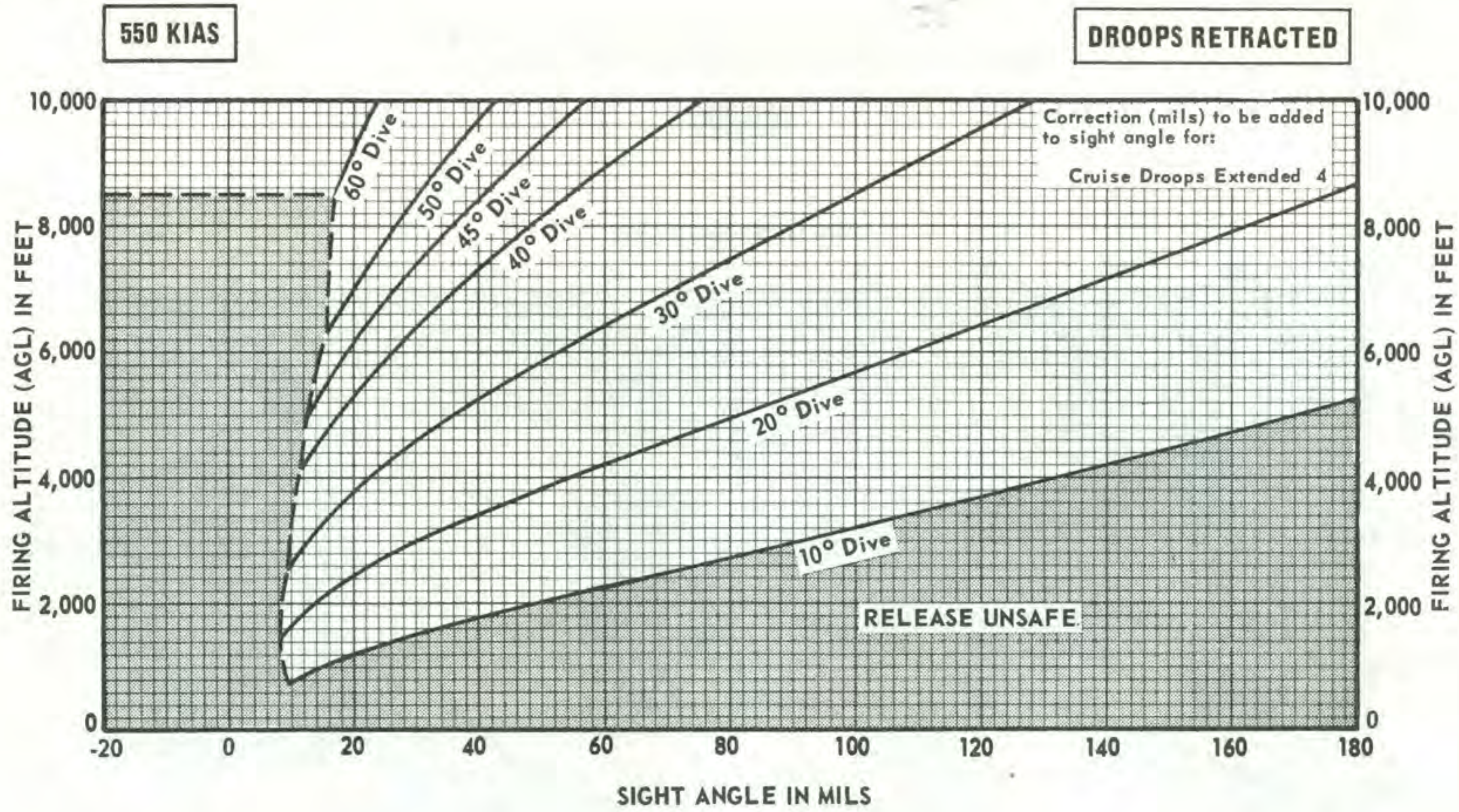
Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation.

AZ-253(4)-3-67

Figure 2-111 (Sheet 4)

Mil Lead for Strafing

20MM GUNS



NOTE

Sight angles are based on 27,000 lb aircraft gross weight, 0 ft burst altitude, and 0 ft target elevation.

AZ-253 (5)-3-67

Figure 2-111 (Sheet 5)

Tested Delivery Data

20MM GUNS

DIVE ANGLE	FIRING SIGHT PICTURE 3,000 FEET SLANT RANGE	ENTRY KIAS	ENTRY ALTITUDE FT AGL	ENTRY APPROX RPM %	ENTRY INITIAL SIGHT PICTURE MILS	RELEASE KIAS	RELEASE ALTITUDE COMMENCE FIRING FT AGL	RELEASE ALTITUDE CEASE FIRING FT AGL	RELEASE ALTIMETER LAG – FT	AVERAGE RECOVERY ALTITUDE FT AGL	CORRECTION PER 10 KT DEFLECTION WIND MILS	CORRECTION PER 10 KT DEFLECTION WIND FEET
10°	Pipper 3 mils above top of target	350–400	2,000–2,500	94	5–10 Mils Above Target	450	500	350	100	150–250	5	10
20°	Pipper 3 mils above top of target	350–400	3,500–4,000	92	5–10 Mils Above Target	450	1,000	700	200	200–300	5	10

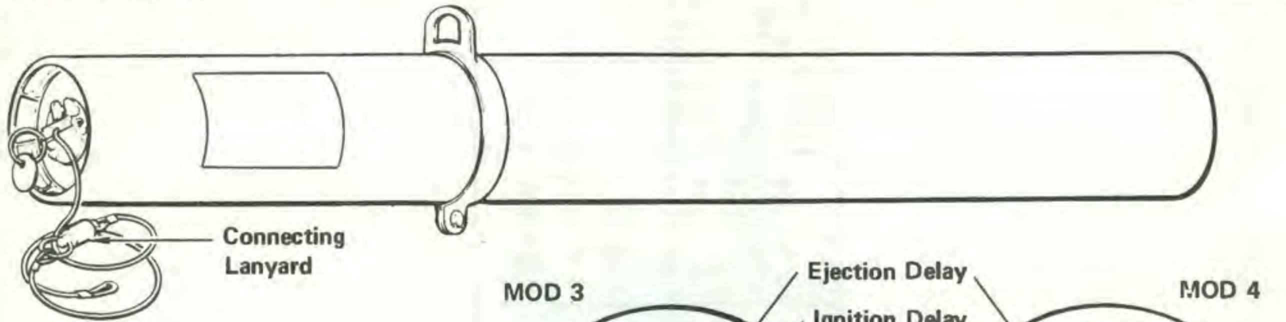
NOTE

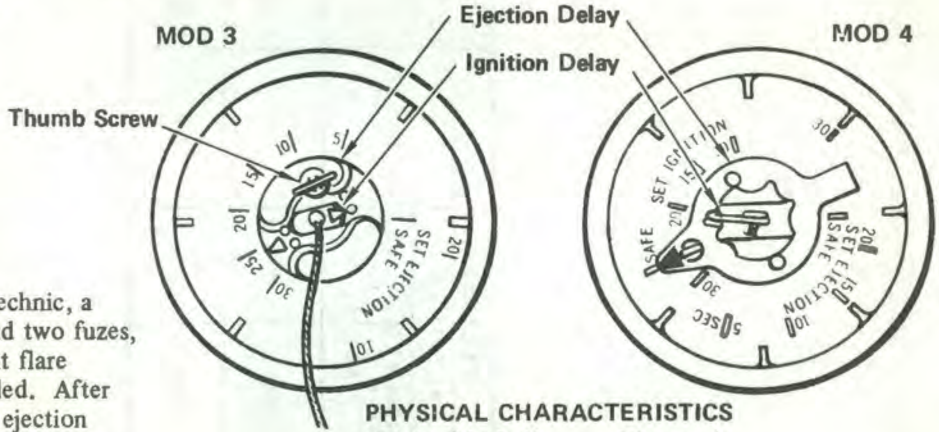
1. Test flown with cruise droop extended.

AZ–248–2–67

Figure 2–112

MK 24 Flare





DESCRIPTION (MOD 3 AND 4)

The Mk 24 Flare consists of a pyrotechnic, a parachute, an ejection mechanism and two fuzes, all enclosed in an aluminum case. At flare release the connecting lanyard is pulled. After a preset delay (0 to 30 seconds) the ejection fuze causes the flare, parachute and ignition fuze to be ejected from the case. When the ignition fuze's preset delay expires, the flare is ignited. Flare burning time is 180 seconds. The MOD 4 flare is contained in and attached to a drogue tray to facilitate installation and ejection from SUU-40/A dispensers.

PHYSICAL CHARACTERISTICS

Weight (MOD 3)	– 27 pounds
Length	– 36.0 inches
Diameter	– 4.8 inches

Suspension – Single Banded Lug

WING STATION LOADING CONFIGURATION

WING LOADING	EQUIPMENT–WEIGHT	
PMBR SUSPENSION Four Flares Each Wing 	8 MK 24 2 Aero 7A-1 2 Pylons 2 PMBR Total One Wing Only	216 104 350 174 844 422
TER SUSPENSION Two Flares Each Wing 	4 MK 24 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	108 104 350 210 772 386
MER SUSPENSION Three Flares Each Wing 	6 MK 24 2 Aero 7A-1 2 Pylons 2 MER Total One Wing Only	162 104 350 446 1,062 531

DROPPING PROCEDURES

1. Master Arm Sw – ON
2. Armament Sel Sw – Wing L or R
3. Stores Release Sw – DEPRESS

NOTE

For simultaneous release from both wings both Triple-Multiple Rack Fire Mode switches must be in the DUAL position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at that station open or the stores release switch must be depressed and released once for each empty station between flares. With the –501 or –521 TER or MER, the mechanical fuzing switch must also be placed in the nose position to obtain automatic stepping past the empty stations.

JETTISONING PROCEDURES

See JETTISONING this section.

REFERENCES

1. Restrictions – See Figure 2-2
2. Flare Arming – NAVAIR 01-45HH-75
3. Preflight Inspection – NAVAIR 01-45HH-75
4. Flare Loading Procedures – NAVAIR 01-45HH-75

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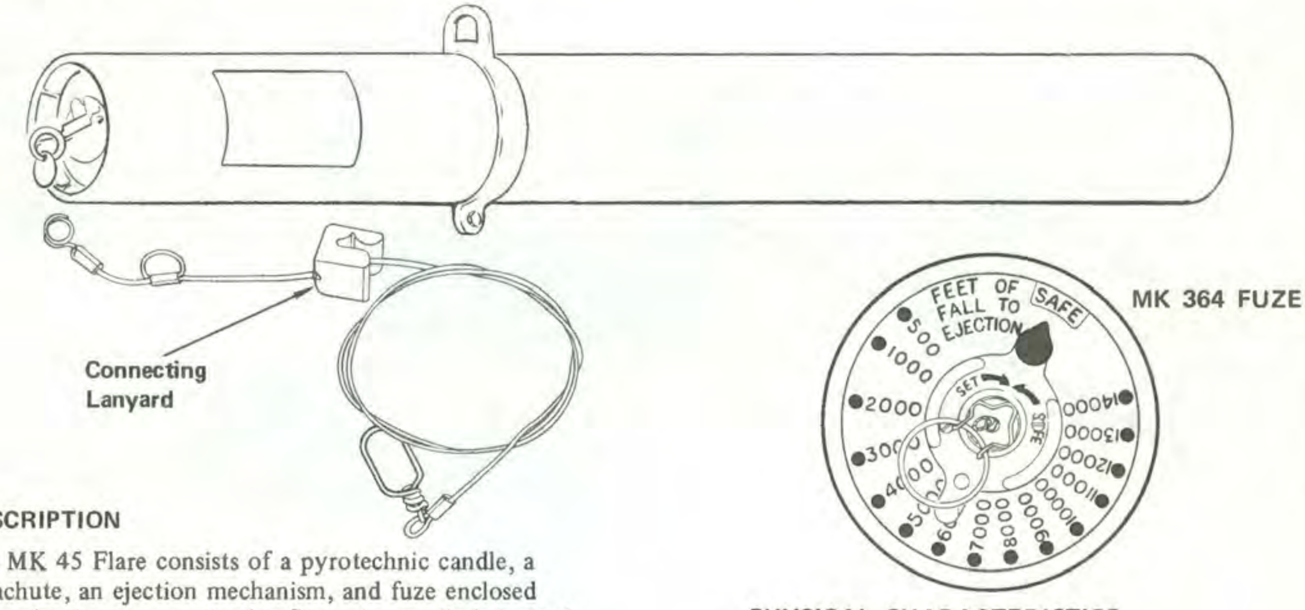
Figure 2–113

MK 45 Flare



MK 364 FUZE

DESCRIPTION

The MK 45 Flare consists of a pyrotechnic candle, a parachute, an ejection mechanism, and fuze enclosed in an aluminum case. In this flare, the candle is ignited by force exerted by the parachute as it opens. The fuze has 15 functional settings and one safe setting. These settings control the approximate feet of fall between launch and ejection of the candle and parachute assembly from the outer case. Some MK 45 Flares are manufactured and shipped partially assembled in drogue trays for launching from the SUU-40A dispenser.

PHYSICAL CHARACTERISTICS

Weight – 28 pounds
Length – 36.0 inches
Diameter – 4.8 inches
Suspension – Single Banded Lug, 14 inches

WING STATION LOADING CONFIGURATION		
WING LOADING	**EQUIPMENT-WEIGHT**	
PMBR SUSPENSION Four Flares Each Wing 	8 MK 24 2 Aero 7A-1 2 Pylons 2 PMBR Total One Wing Only	224 104 350 174 852 426
TER SUSPENSION Two Flares Each Wing 	4 MK 24 2 Aero 7A-1 2 Pylons 2 TER Total One Wing Only	112 104 350 210 776 388
MER SUSPENSION Four Flares Each Wing 	6 MK 24 2 Aero 7A-1 2 Pylons 2 MER Total One Wing Only	168 104 350 446 1,068 534

DROPPING PROCEDURES

1. **Master Arm Sw – ON**
2. **Armament Sel Sw – Wing L or R**
3. **Stores Release Sw – DEPRESS**

NOTE

For simultaneous release from both wings both Triple-Multiple Rack Fire Mode switches must be in the DUAL position.

To step the MER or TER stepping switch past an empty station, it is necessary to have the hooks at the station open or the stores release switch must be depressed and released once for each empty station between flares. With the –501 or –521 TER or MER, the mechanical fuzing switch must also be placed in the nose position to obtain automatic stepping past the empty stations.

JETTISONING PROCEDURES

See JETTISONING, this section.

REFERENCES

1. Restrictions – See Figure 2-2.
2. Flare ARming – NAVAIR 01-45HH-75
3. Preflight Inpsection – NAVAIR 01-45HH-75
4. Flare Loading Procedures – NAVAIR 01-45HH-75

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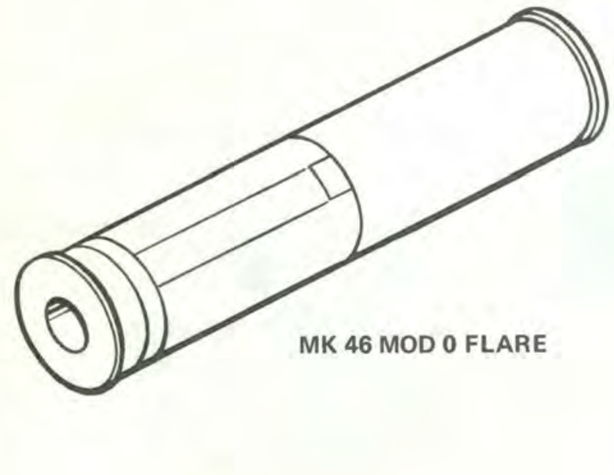
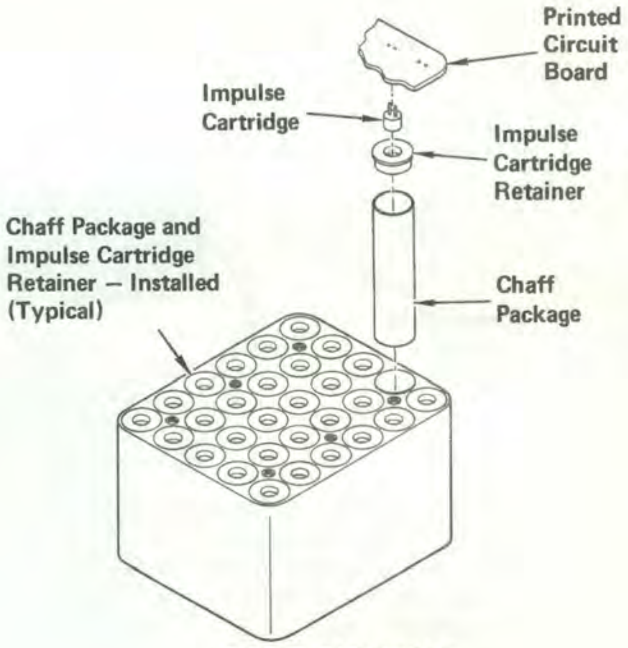
Figure 1–114 (U)

ALE-29A Chaff Dispenser





PHYSICAL CHARACTERISTICS

CHAFF DISPENSER		FLARE	
Weight (payload)	– 11.5 pounds	Length	– 5.8 inches
Length	– 9.7 inches	Diameter	– 1.4 inches
Width	– 8.2 inches		
Height	– 6.3 inches		

DESCRIPTION

The AN/ALE-29A dispenser consists of two major subassemblies: a glass fiber plastic block with 30 holes for insertion of the payload packages and a printed circuit board. The circuit board has jacks for installing 30 electrically initiated impulse cartridges and circuitry for distributing the firing signal to the correct cartridge. When the dispenser is loaded, a payload package is loaded in each of the 30 holes. An impulse cartridge is installed in each of the 30 jacks on the printed circuit board. The printed circuit board is then attached to the dispenser. The payload is ejected by gas pressure generated when the impulse cartridge fires.

The Mk 46 Mod 0 flare is launched from the AN/ALE-29A dispenser and is designed to create an infrared source. When the initiation pulse is applied to the impulse cartridge, the expanding gases act against the piston which ejects the firing device and pellet assembly from the dispenser tube at approximately 70-140 fps. The acceleration imparted to this assembly actuates an acceleration sleeve in the firing device, releasing a safety pin on the firing device. When clear of the plastic case and acceleration has been maintained, the safety pin is removed. This allows the firing pin to strike the primer, igniting the flare pellet.

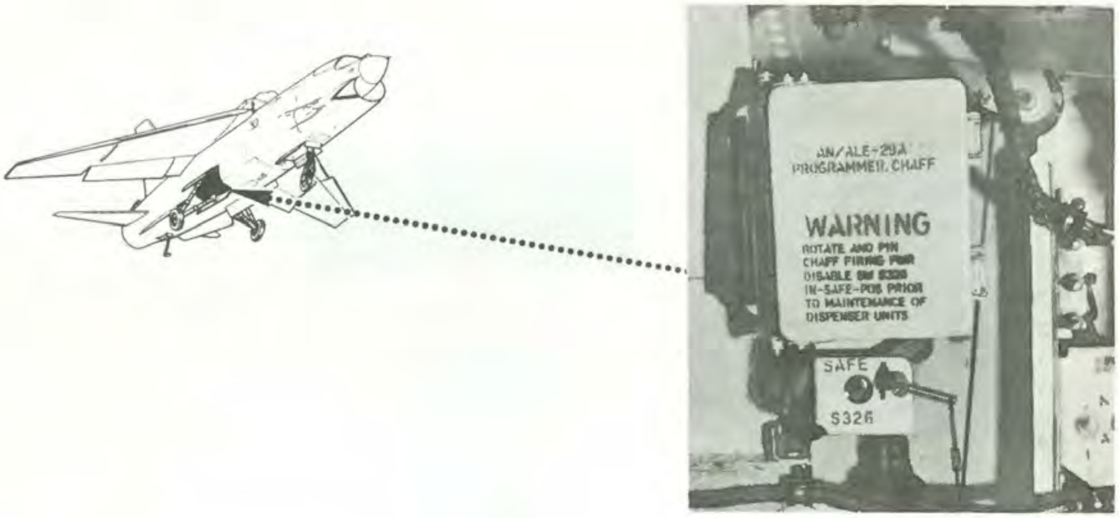
REFERENCES:

1. Dispenser .... NAVAIR 16-30ALE29-3
2. Flare .... NAVAIR 11-15-4
3. Loading .... NAVAIR 01-45HH-75

AZ-355(1)-03-70

Figure 2-115 (U) (Sheet 1)

ALE-29A Chaff Dispenser



PROGRAMMER HOUSING AND DISABLE PIN
(See Detail A for Programmer Panel)

DETAIL A

DISPENSER LOADING
Chaff, RR-129 – 30 ea Dispenser Total – 60 IR Flare, Mk-46 – 30 ea Dispenser Total – 60

DISPENSING PROCEDURE

PREFLIGHT

1. BURSTS, BURST INTERVAL, SALVO and SALVO interval switches on programmer set.
2. RESET switch on programmer – with power on aircraft system, press and hold for 6 seconds after each dispenser loading. (The control panel selector switch must be in FWD, AFT, or BOTH.) The cockpit CHAFF RESET switch may be held in the RESET for 6 seconds regardless of chaff selector switch position.
3. Chaff counters on control panel – press and set to "30".
4. Safety pin removed from firing power disable switch after sequence switches are reset.

AUTOMATIC OPERATION

1. Control panel selector switch – FWD, AFT, or BOTH as desired.
2. AUTO FIRE switch – press to initiate dispensing of chaff or decoys as selected on programmer.

MANUAL OPERATION

1. Control panel selector switch – FWD, AFT, or BOTH as desired.
2. Chaff Manual fire switch – depress once to dispense one salvo of bursts as selected on programmer. Press during automatic operation to dispense one extra burst.

AZ–355(2)–08–70

Figure 2–115 (U) (Sheet 2)

section IV
enemy ground defenses and friendly countermeasures

[refer to (Secret) NAVAIR 01-45HHA-IT(A) (U)]

section V
aircraft employment

CONTENTS

PART 1 – AIR-TO-AIR COMBAT

PART 2 – AIR-TO-GROUND WEAPONS DELIVERY

PART 1 — AIR-TO-AIR COMBAT

INTRODUCTION

The F-8 is normally employed in two major roles: air-to-air combat and air-to-ground weapons delivery. In the air-to-air role, the F-8 is used as a fighter for target CAP, barrier CAP, force CAP, escort, and weather reconnaissance. Use of the F-8 in a combined role (air-to-air and air-to-ground) during the same flight is not recommended. Wing racks and pylons which are installed for the air-to-ground mission (and cannot be jettisoned) will significantly degrade the aircraft's air-to-air capability. The F-8 will not turn, climb or accelerate as well with wing stores or racks. In addition, wing stores reduce the acceleration (g) limits of the aircraft.

EMPLOYMENT

When used as a fighter, standard armament loading should be two Sidewinder missiles and a full load of 20mm ammunition. AIM-9Ds should be installed on single pylons. The basic fighting element is the two-aircraft section using loose deuce tactics.

TARGET CAP

The F-8 is ideal for providing close-in protection for friendly attack aircraft. Should enemy air opposition develop, the resulting mix of friendly and enemy aircraft may preclude the use of air-to-air missiles. In such a case guns should be relied on as the primary weapon. TARCAP is flown with either one or two F-8 sections, in a ratio of about one fighter for every four attack aircraft. TARCAP aircraft should be tanked enroute to provide maximum fighting fuel in the target area.

BARRIER CAP

The F-8 can be used as BARCAP, stationed between friendly aircraft and the expected threat. In particular instances, it is useful to establish selected and number-designated geographic holding points. This information is passed to the SAR destroyers so that flights may be positioned at any specific point they request without compromising their intentions. If more than one section is available, the sections can be stationed in mutually supporting positions, although not necessarily in visual contact. At night the section is separated by altitude levels and maintains either a radar trail formation or an individual tactical pattern relative to a preselected TACAN position. BARCAP flown at night or in IFR conditions without visual reference to land or sea must be under positive control.

ESCORT

In an escort role, the F-8 can provide protection for attack, photo, and ELINT mission aircraft. The standard fighter armament of a full load of 20mm and 2 AIM-9D missiles is recommended.

Attack escort is essentially a TARCAP mission that provides the attack formation air cover to and from the target, as well as in the target area. TARCAP considerations discussed above apply.

Photo escort can be conducted by a single F-8 unless the probability of air opposition dictates the use of a section. Cycle times in excess of 1 hour and 45 minutes may require F-8 tanking.

ELINT escort can be flown by the F-8 but certain sacrifices in aircraft performance will be necessary in some situations. Escorting EA-3B and RA-3B aircraft presents little problem to the F-8. Standard loose deuce tactics will provide adequate cover. Escorting EC-121 and C-130 aircraft visually will necessitate slow fighter speeds and distances of from 2 to 5 miles between the fighter and the ELINT aircraft. If enemy air attack is encountered under such conditions, it would be difficult for the F-8's to get in position for protection soon enough. If AEW or destroyer control is available, it should be utilized to keep the fighters in the vicinity of the ELINT aircraft. The fighters can then keep up their airspeed and be in a better position to intercept incoming raids. When escorting ELINT aircraft, F-8 radar use must be limited.

FORCE CAP

When the F-8 is employed as a fighter interceptor, basic armament loading can be four Sidewinder missiles and a full load of 20mm.

The F-8 weapon system can be employed in anti-air warfare defense of the force by two basic methods. It can be flown on sustained CAP or maintained on short notice as a DLI. The most important advantages of the CAP are that it accelerates the task force reaction time and extends the anti-air defensive envelope. However, a sustained CAP may exhaust the reserve aircraft within a few hours and thus reduce the total task force armament. The use of DLI generally shortens the defensive envelope but maintains a higher sustained total readiness. In actual practice it may be advantageous to mix or vary the methods as befits the tactical situation. This section presents the important considerations that affect the employment of the F-8 in a task force environment. However, the principles are also valid and applicable to the problems associated with land-based defense.

The mission of the task force usually generates the requirement for air-to-air defense. The mission is determined by higher command and is beyond the scope of this manual. However, the mission may place several restraints on the selection of CAP or DLI defenses. For example, the nature of the mission will dictate the type of action, the required movement of the Position of Intended Movement (PIM), and the extent of deck preparations for launching attack airplanes.

The greatest asset the carrier has over the land base is mobility. However, the ability to move as far as 600 NM per day is frequently not compatible with sustained air operations unless movement of the PIM is into the wind. The interference with PIM movement has a direct bearing on the decision to maintain a CAP. Figure 5–1 illustrates how the PIM is adversely affected by the duration of the land/launch time into the wind, the CAP cycle time, and the angle between the PIM direction and the land/launch heading.

If the conditions imposed by the requirement for mobility cannot be met by the carrier, then either the conditions will have to be changed or DLI will have to be employed. The task force mission may call for immediate preparations for launching a large scale attack effort. The extent of the preparations and launch are likely to either impede the land/launch operation of CAP fighters, or to tie up the ready catapults of the DLI.

Early Warning Radius

The task force early warning radius is one of the most important factors affecting the choice of CAP or DLI. Early warning provides time to evaluate before acting. Every minute required to complete the cycle of reaction is equivalent to 8 to 15 miles of early warning range (depending on raid speed). It is most important to note that the early warning radius is highly variable and difficult to measure because it is affected by atmospheric conditions; relative stationing of friendly ship, air and shore sites; electronic status of the individual sites; and the speed, position and altitude of the threat. Generally, a long early warning radius permits the use of DLI while a short radius negates their practical value.

Deck Launch Interval

The time required to launch the first DLI and the rate of launch of the succeeding DLI are important factors to consider. It is affected by the condition of readiness of pilots, aircraft, and ship, and by the turn into the wind necessary to meet the launch wind requirement. The rate of launch of the succeeding DLI determines how many fighters will engage the raids. It is primarily a question of the reserve aircraft available and the capability of the ship to launch them. Launch rate may be slowed appreciably at night and/or in poor weather conditions.

Weather and EMCON Conditions

Weather and EMCON conditions considered separately or together have a major effect on fighter employment and effectiveness. In adverse weather the carrier's into-the-wind time for CAP recovery may seriously affect its ability to make good its PIM. A combination of adverse weather and EMCON conditions can further complicate CAP employment, for with no radiating navigational aids or radars in operation, the CAP cannot maintain station. The use of DLI would be forced. A request for DLI by early warning pickets or aircraft would necessarily require breaking of the EMCON condition.

One solution is to employ a long range CAP, stationed in the expected threat quadrant, as a barrier patrol with no AI radar emission restrictions. Return navigation would require skillful AI radar techniques on the part of the CAP to effect its own approach.

CAP STATIONING

CAP is used in defense of a task force for several reasons. It will provide the most rapid method to engage enemy raids, to identify incoming unknowns, and to augment the early warning information. Basically, there are only five possible CAP station locations. They are low-near, low-far, high-near, high-far, and long range. The selection of the correct CAP stations to fit the tactical situation depends upon several important factors. They are: the nature of the threat; the area to defend; the supporting air defense weapons; the number of fighters available and their cycle time; the extent of the early warning and communications perimeters; and the EMCON condition. The following paragraphs will discuss the effect of these factors on the five CAP stations.

LOW-NEAR CAP STATION

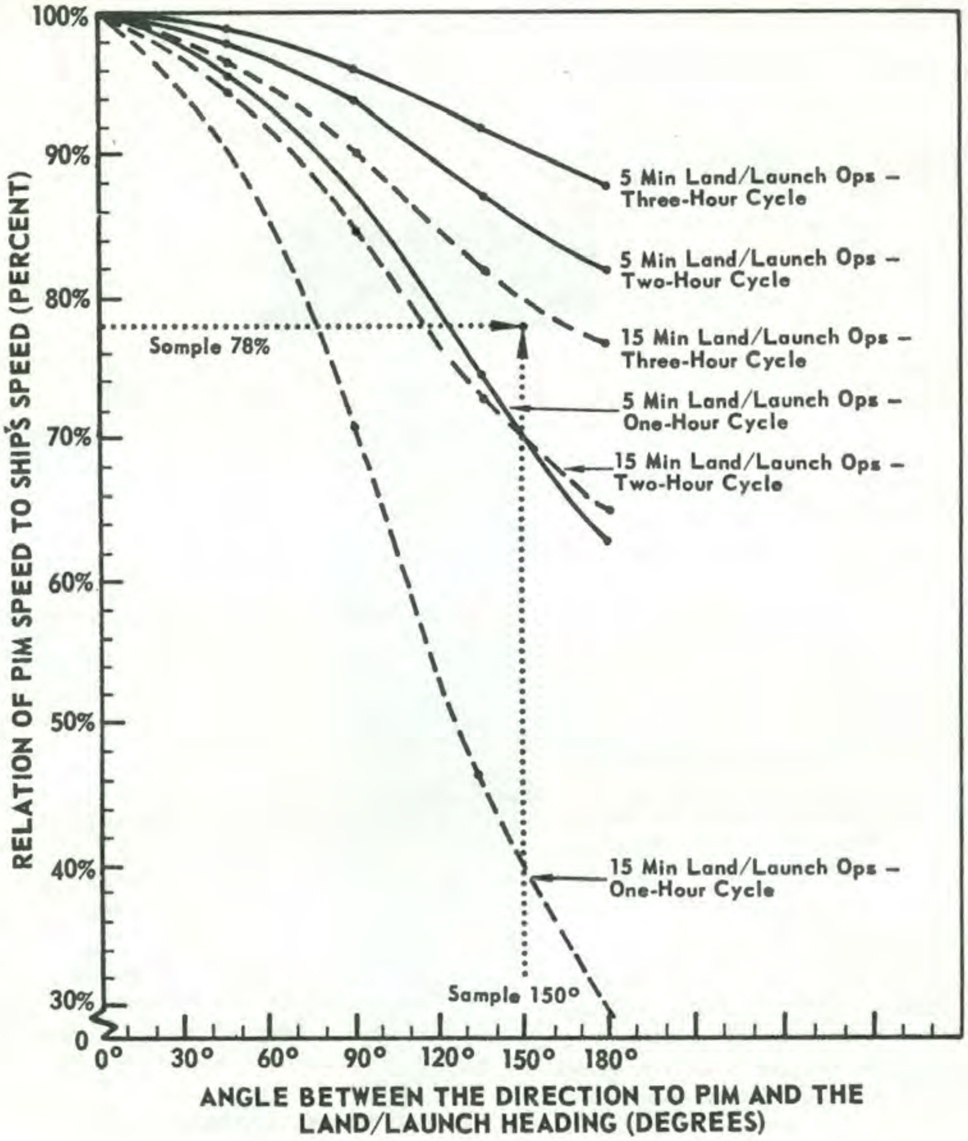
The low-near CAP station is defined as being close to or in the vital area at an altitude, commensurate with the weather, which will permit immediate arrival at co-altitude with low flying raids. If the fighter's radar is being used as an AEW gap-filler against low flyers, then the altitude of the CAP station should be determined by the ducting levels and sea state. It will frequently be at co-altitude with the low raids. The low-near CAP station has the following characteristics:

Advantages

a. Permits early detection and attack of low flyers and descending raids.

b. Provides all-quadrant protection for vital area against all types of raids.

CAP Employment Factors



Assumptions:

Ship's air-operation speed and cruise speed is the same. Ship's rate of turn 45 degrees per minute. Launch and CCA recovery of each aircraft requires 5 minutes.

Condition:

PIM – 21 Knots.

Ship Speed – 27 Knots.

Angle between the direction to PIM and Land/Launch heading – 150°.

Solution:

Divide PIM Speed by Ship's Speed. 21 divided by 27 = 78%. Draw line horizontally from 78% and vertically from 150°.

Answer:

1 CAP on a 1½ hour cycle, 2 CAP on a 2-hour cycle or 3 CAP on a 2¾ hour cycle.

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Figure 5-1

c. Permits all of the fighters to bear on raid.

d. Permits fighter maneuvering below friendly SAM zones.

e. Retains fighters within radar and communications range of ships.

f. Allows fighters to maintain visual station on ships during day-VFR weather, under EMCON conditions.

g. Reduces possibility that enemy long range surveillance radar will be able to see CAP.

h. Provides minimum susceptibility to communication jamming.

i. Provides small CAP station radius.

Disadvantages

a. CAP cannot engage raids near limits of early warning range.

b. Reduces cycle time about 10 percent from optimum.

In general, the low-near CAP station should be the best tactical CAP station for the F-8 when used in one or two carrier independent task forces. It makes maximum use of the capability of a small number of airplanes to detect and intercept low flying targets, descending raids, and mid-altitude saturation raids from all quadrants. It should permit employment of SAM missiles and CAP jointly. At the same time it should allow maximum reliability of communications, control, and navigational aids.

The low level CAP station is very adaptable to the F-8. The look-up capability of the radar is better than the look-down (detection of higher altitude targets). The primary weapon, the Sidewinder, is a most effective air-to-air weapon for the destruction of low flying jet targets. The aircraft has the ability to climb from sea level to 35,000 feet in 3 minutes, if necessary to intercept medium or high altitude raids. Its ability to descend is equal only in fair weather, daylight conditions.

LOW-FAR CAP STATION

The altitude of the low-far CAP station is determined by the same criteria as the low-near CAP station. The positioning of the low-far CAP station may vary from just beyond the effective radar/communications horizon of the task force to about one-half the early warning range. The low-far station has the following characteristics:

Advantages

a. Permits CAP to detect and intercept low flying and descending targets at extended ranges in one quadrant.

b. Provides one-quadrant extended intercepts and identification runs against higher flying raids.

c. Permits CAP operations closer to, but below enemy surveillance radar.

d. Separates the fighters from friendly SAM zones, vertically and horizontally.

e. Provides small CAP station radius.

Disadvantages

a. Requires picket ship or AEW control for high order of effectiveness.

b. Provides only one-quadrant protection unless large number of fighters are used.

c. Requires electronic aids unless station is oriented over geographic point or picket ship during day VFR.

d. Reduces cycle time about 10 to 15 percent from optimum.

e. On-station time reduced about 15 minutes for every 50 miles of distance from the carrier.

In general, the low-far CAP station is most advantageous if only one quadrant requires protection, or if enemy surveillance radar overlaps the task force or beachhead zones of influence.

An F-8, for example, is capable of launching and proceeding to a CAP station 100 miles from the force at sea level. Deducting the fuel required for landing reserve (1,500 pounds) and transit to and from station, a combat or loiter package of 4,800 pounds is available. This is enough to allow about 1 hour and 10 minutes of surveillance on station at maximum endurance, or 50 minutes of loiter and 15 minutes of sea level combat at 500 knots. Total cycle time available would be approximately 1 hour and 45 minutes.

HIGH-NEAR CAP STATION

The high-near CAP station is defined as near or over the vital area at an altitude that conflicts with friendly SAM zones, or from which a fighter, commensurate with weather, would require a substantial length of time to descend to the altitude of a low flyer. The high-near CAP station has the following characteristics:

Advantages

a. All-quadrant protection against medium and high altitude raids.

b. Maximum cycle time.

c. Concentrates fighters against raids.

Disadvantages

a. May be unable to detect or attack low flyers or descending raids.

b. Conflicts with friendly SAM zones.

c. Can be used by enemy long range surveillance radar to locate task force.

d. Large CAP station radius.

In general, the high-near CAP station utilizes the capability of the F-8 only when the task force does not have conflicting SAM zones, and all-quadrant protection against medium and high raids is desired. Additional CAP stations (low) must be provided for low level targets.

HIGH-FAR CAP STATION

The high-far CAP station is located about 50 to 150 miles from the vital area. The altitude of the high-far CAP station is the same as that of the high-near CAP station. The high-far CAP station has the following characteristics:

Advantages

a. Permits intercepts and identification runs against medium and high altitude raids at extended ranges in one quadrant.

b. Does not require picket ship or AEW for communications and control.

c. Separates the fighter from friendly SAM zones.

Disadvantages

a. Usually unable to provide protection against low flyers and descending raids unless raids remain at altitude until reaching the high-far CAP station.

b. Does not provide all-quadrant protection for vital area.

c. Cannot be used when enemy GCI zones overlap task force zones.

d. Reduces on-station time about 15 minutes per 50 miles of distance from carrier.

e. Provides large CAP station radius.

In general, the high-far CAP station utilizes the capability of the F-8 when one-quadrant protection against medium and high altitude raids only is desired, and picket and/or AEW control is not available.

Included in a decision to use any fighter on a high CAP station must be the consideration of the CAP capability to intercept or detect the low level target or descending target. An attack against a descending target is one of the most difficult to make. This is the preparatory maneuver to an ASM launch. Radar look-down performance is poor. The descending attack is difficult to execute and places the fighter employing the Sidewinder missile in its most disadvantageous position in terms of IR contrast and detection. Also, the missile aerodynamic envelope is more limited in a descending attack than in an attack from any other aspect. The time required to descend from high to low altitude to attack a low level target is at least equal to, and in most cases greater than, that required to climb for an intercept. In addition, effective radar operation is not possible in a rapid descent, as opposed to a high speed climb.

LONG RANGE CAP STATION

The long range CAP station is normally a form of barrier CAP (BARCAP). It is defined as being beyond the normal task force early warning range, at distances of 150 to 300 miles. The altitude can either be very low to remain below enemy surveillance radars, or at about 20,000 feet for optimum use of the search capability of the radar for all-altitude coverage. The long range CAP station has the following characteristics:

Advantages

a. Provides long range one-quadrant intercepts against snoopers.

b. Provides long range one-quadrant protection against potential low flyers and descending raids, by completing the intercept before the raids descend from cruise altitude.

c. Does not conflict with friendly SAM zones.

d. Provides long range identification of raids in one quadrant.

Disadvantages

a. Requires long range picket or AEW airplane for full effectiveness.

b. Provides only single-quadrant protection for task force.

c. On-station time reduced 15 minutes for every 60 miles of distance from carrier.

In general, the long range CAP station provides the task force with very long quadrant intercepts against snoopers and enemy raids. Although the search capability of the radar is severely limited when compared with the F-4 radar, the possibilities of utilizing the F-8 for this type of CAP station should not be discounted. The F-8 may be used in this kind of CAP stationing even with its limited search coverage, if the expected raid approach corridor is narrow. In some instances, an F-8 can be stationed with an F-4, the latter acting as a controlling and search agency.

A typical mission would be a climb out and descent to a CAP station at 175 miles. The combat fuel package available on station would be 4,000 pounds, sufficient for at least one subsonic intercept, or a total of 90 minutes loiter, at 20,000 feet. Total cycle time would approximate 2 hours for the loiter mission and 80 minutes if subsonic combat is required.

PART 2 — AIR-TO-GROUND WEAPONS DELIVERY

INTRODUCTION

In the air-to-ground role, the F-8 can be used in coordinated Air Wing strike missions, armed reconnaissance and close air support of ground forces. The F-8, configured with wing pylons and bomb racks, has the capability to carry and deliver a variety of bombs, rockets and 20mm ammunition.

EMPLOYMENT

Reconfiguration time (attack to fighter/fighter to attack) will be from four to six hours. This time will vary depending on aircraft spot on the ship, availability of equipment, weather conditions, etc. The time includes electrical and armament system verification checks.

If aircraft resources and tactical considerations permit, a selected number of aircraft should remain air-to-ground or attack configured while a selected number remain fighter configured. This method will improve system reliability and eliminate time lost in reconfiguring aircraft.

EXTERNAL ARMAMENT LIMITATIONS

CAUTION

With full fuel and ammunition load, the maximum gross takeoff weight of 34,000 pounds can be exceeded with some combinations of external stores. Refer to AN 01-1B-40 Handbook of Weight and Balance for specific aircraft weight and to figure 2–14 for individual store weights. If the total weight exceeds 34,000 pounds, wing fuel may be removed to reduce the gross weight. Do not remove more than 3,000 pounds of wing fuel or the center of gravity will move forward of the takeoff limit.

Only the external armament stores listed in this manual may be carried and released singly or in combination to the limits shown. When carrying stores in combination, the more restrictive limits apply. All stores are cleared for catapult and arrested landings unless otherwise noted. Operating limitations for the basic aircraft apply with fuselage pylons and stores, and wing pylons and bomb racks installed. Operating limitations for the attack configured aircraft apply when carrying wing stores. Empty rocket packs and empty multiple bomb racks are considered to be wing stores. External armament combinations appear in Section II with weights useful in planning attack missions.

CARRIER OPERATING LIMITATIONS

Carrier operations are not permitted at gross weights in excess of 30,000 pounds with asymmetrical external wing stores loadings.

Catapult launches with an asymmetrical external wing loading imbalance in excess of 2,000 pounds are not permitted.

Arrested landings with external stores should be avoided whenever possible. However, if necessary, arrested landings with nonexpendable/nonjettisonable stores may be conducted within current gross weight limitations providing external wing stores loading per station and asymmetrical wing stores loading imbalance, if any, do not exceed 2,000 pounds.

Barricade engagements are permitted. Stores will not interfere with barricade engagement but may tear loose and present a hazard to flight deck personnel.

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