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REPORT
of
THE ARMY AIR FORCES BOARD

AAFSAT, ORLANDO, FLORIDA

Project 44F 2416
Bombs, glide - survey
Missiles, guided, air-to-surface - 4201

SUBJECT

CONTROLLED MISSILES

PROJECT No. (G) 5 2416 DATE 29 October 1943

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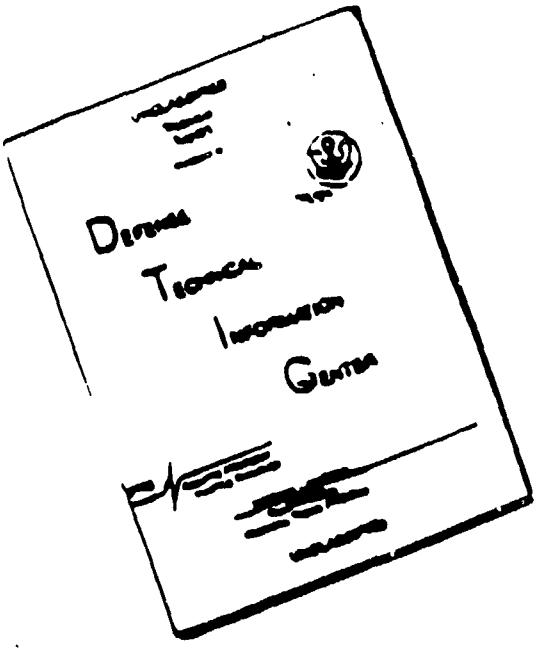

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THE ARMY AIR FORCES BOARD
Army Air Forces School of Applied Tactics
Orlando, Florida

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FINAL REPORT ON "CONTROLLED MISSILES" PROGRAM
ARMY AIR FORCES BOARD PROJECT NO.(G) 5

1. INTRODUCTION

a. Under the provisions of the Army Air Forces Project No. (G) 5, subject "Controlled Missiles", and in accordance with letter from Headquarters Army Air Forces dated 19 July 1945, subject "Controlled Missiles", the Army Air Forces Board undertook a thorough study of the controlled missiles development program.

b. In accordance with results obtained from this study and from demonstrations and conferences on controlled missiles, the inclosed report is submitted by the Army Air Forces Board for purposes of formulating a specific program for operationally introducing various controlled missiles into combat at an early date, and for recommending further development and/or elimination of other types of subject weapons.

2. NATURE OF CONTROLLED MISSILES

a. Extensive scientific and technical resources have been devoted to the research and development of controlled missiles with the object in view of attempting to discover and develop a weapon which will further our effort to destroy the enemy's installations with the greatest effectiveness and the minimum losses to our own forces. This great expenditure of effort toward producing such a weapon has culminated to date in the development of several possible items which have reached a stage which appears to warrant their introduction into an operational theater. This development has also produced several items which appear to have combat possibilities but which are not as yet ready to be introduced into combat.

b. The Special Weapons Division of the Materiel Command at Wright Field has been operating very closely with the National Defense Research Committee and with the Navy on the development of controlled missiles and the results to date seem to warrant complete exploration of their possibilities. It is, therefore, the object of this report to furnish information on the present status of this development; to segregate known missiles into those which are believed to be at present operational and into those which should either receive further development or be completely eliminated for tactical or technical reasons.

c. The operational controlled missiles available to date consist of airborne, air-lau[UNCLASSIFIED] bombs which require for their control various

accessory equipment involving small aircraft, radio, television, and gliders. From the initial study of these weapons there is one outstanding factor of employment which is immediately apparent. That being, that none of these weapons can at present be considered as a replacement or substitute for any known standard bomb now in use. These weapons must be assigned for specific tasks, by specific units, at specific times and under specific conditions and only in this way can the maximum advantage be gained from their use.

d. A thorough understanding of the powers and limitations of the controlled bomb used in air attack will be absolutely essential to its correct strategical and tactical employment. As a basis for its sound employment, appropriate Commanders must be fully familiar with the capabilities and limitations of these weapons and operating personnel must be highly trained and completely familiar with the circumstances and methods by which they may function.

e. In formulating the tactical doctrine for the employment, procurement and training of organizations equipped with controlled missiles, it is necessary to keep in mind the special nature of the weapons and above all, the fact that they will be economically inferior in usage to standard bombing procedure unless their specific advantages are utilized by virtue of their employment against the most suitable targets under most favorable conditions for their successful functioning.

3. DISCUSSION

a. The Army Air Forces Board having studied all available material on controlled missiles, finds that there are five specific types which might shortly be operational (see Annex A for detailed technical description). These specific types being the preset glide bomb, the high angle azon bomb, the television controlled glide bomb, radio controlled glide bomb and power driven bombs. In addition to these weapons, there are under development target seeking variations of the above bombs. These target seeking weapons, however, do not appear to be perfected to an operational point.

b. On 15 October 1945, a demonstration was held at Muroc Lake, California, at which time the five basic weapons above mentioned were demonstrated and tested for the benefit of interested Headquarters. Following the demonstration, a conference was held reference the development and operational program of controlled missiles and the decisions which were voiced at this congerence are outlined in this report and were generally concurred in by the Army Air Forces Board.

c. In general, a study of these controlled missiles deemed operational provides the following information:

(1) Preset Glide Bombs: The preset glide bomb is at present operational but is definitely limited to very large area targets and its sole advantage appears to be the fact that the launching aircraft can attack an area target from a distance of approximately 20 miles at an altitude of approximately 20,000 ft., thus

remaining outside of the concentrated anti-aircraft defences of said target. The reliability of this weapon is reasonably good but its accuracy is relatively poor. It is basically no more than an initial step in the development of the radio controlled television guided glide bomb. The Army Air Forces School of Applied Tactics has completed the training of two groups in the use of this weapon on or about 10 October 1943 and these groups have been sent to the Eighth Air Force for purposes of introducing the glide bomb. It is believed that with due regard to the advantages of the glide bomb it will be entirely superseded by a controlled glide bomb, with or without television guidance, as soon as same become operationally available, for the controlled glide bomb with television guidance will have the same advantages as the original glide bomb plus a certain degree of accuracy.

(2) High Altitude Azon Bombs: The high angle azon bomb appears to be the most satisfactory controlled missile developed to date for it is not only reasonably simple to place into production but it is also of conventional size and dimensions, thus permitting it to be carried in any bombardment type aircraft and permitting its launching in the orthodox manner. The azon bomb is no more than a standard bomb with a radio controlled fin which permits the bombardier to correct the deflection error while the bomb is in flight. This bomb is extremely accurate but must of necessity be limited to target areas where anti-aircraft fire is not such as to prohibit the launching airplane from maintaining a normal bombing run course until the bomb has hit the target. This procedure is necessary in order that the bombardier can observe its flight in a vertical plane and make proper corrections.

(3) Television, Controlled Glide Bombs: A great deal of thought has been given to the use of the television, controlled glide bomb for specific targets where extreme accuracy is desired and where defenses are such that the attacking aircraft must remain a given distance from the target. This type of bomb is a highly specialized weapon in that it will call for very technical maintenance personnel and highly trained controlling personnel as well as a reasonable amount of fairly complex accessory equipment in the launching aircraft. This weapon may be the answer to the destruction of targets which are invulnerable from high angle bombing or to the destruction of targets whose ground fire precludes of close enough approach for normal bombing. This weapon, when thoroughly developed, may also be utilized for accurate bombing within a given area through the overcast, especially if it is used in conjunction with H2X radar bombing equipment.

(4) Controllable Glide Bombs: The controllable glide bomb is the least impressive in its performance but is apparently one of the simplest long range bombs to put into operation. It consists of a normal glide bomb which, instead of being preset, is controllable by radio from the mother airplane. The purpose of this arrangement is to increase the accuracy and, therefore, the effectiveness of this weapon. However, in order to control it, it is necessary that the bombardier be able to see the bomb and judge its position with respect to the target throughout its entire trajectory. This is accomplished by means of a smoke canole or flare which is placed in the bomb and permits observation of its flight. Since the purpose of the glide bomb is to permit the launching airplane to remain outside of the heavily defended anti-aircraft zone around specific area targets, it is felt that this bomb has little practical application for what is gained in accuracy is lost by virtue of the fact that in order to obtain this accuracy, the launching airplane must continue close enough to the target to witness the fall of the bomb throughout its course. With the possible exception of ideal climatic conditions, its proper guidance does not appear feasible for distances in excess of 10 miles. This weapon might, however, be utilized sucessfully against coastal installations which do not permit of anti-aircraft protection on the attacking side of the target.

(5) Power Driven Bombs: The power driven bomb has very definite operational possibilities but its construction and production is just as complex as that of an airplane and takes almost as long. It requires technical personnel for its successful maintenance and operation and due to its expense and complex nature, is very definitely a weapon which should be limited to specific targets which are of the highest importance to destroy. The power driven bomb, although apparently operational, will not be available for combat use for some time since its production is slow and complex. It apparently operates best when utilizing television guidance, thus permitting the operator to control the bomb as if he were flying it personally.

(6) Target Seeking Bombs: Target seeking bombs will consist of various adaptations of the above type bombs which, rather than being controlled from a mother aircraft, will contain light seeking, heat seeking, radar seeking or other homing devices tending to direct them against the target. These weapons are still definitely in the development stage and although they will be eventually of definite operational value, especially against shipping, it is felt that little tactical study can be made of their present use. They have not as yet been tested to a sufficient extent to furnish the necessary data required to consider them for introduction into the combat th[illegible]

4. CONCLUSIONS: After due study of the entire controlled missiles program in all of its aspects, it is concluded that:

a. Controlled missiles have a definite tactical usefulness, but should be limited to specific targets where their outstanding characteristics will give them an economic advantage over normal bombardment weapons.

b. Due to the nature of controlled missiles, it is prerequisite to their successful use that special weapon groups be formed and trained for this purpose, for it is deemed inadvisable to simply issue these weapons to standard operational bombardment organizations even though they may be given a limited amount of training in their use.

c. The azon bomb is the most practicable for immediate mass production, and that maximum effort should be diverted toward the procurement and distrubution of this weapon to combat areas.

d. The controlled Glide or Power weapons, utilizing television for guidance will probably develop into the most valuable weapons for highly accurate bombing and, therefore, that maximum effort should be diverted to their procurement in limited quantities for the purposes of test and tactical development.

e. All types of controlled missiles recommended for operational development should be tested under actual combat conditions as soon as they are available.

5. RECOMMENDATIONS: It is recommended that:

a. The controlled missiles be contracted for, and placed into combat operation in the following order:

(1) Glide bombs.
(2) Azon bombs.
(3) Radio controlled glide bombs.
(4) Television, controlled glide bombs.
(5) Power driven bombs.

b. All types of controlled weapons be procured in limited quantities fordevelopment of proper tactics, and that they be initiated in various theaters on specific problems at the earliest practicable date.

c. Further tests and development be conducted on all types of controlled missiles in order of the following priority:

(1) Television, controlled glide bombs.
(2) Power driven bombs.
(3) Target seeking bombs.

[redacted]

d. Specific groups be designated as special weapon units and be trained in the use of all missiles deemed operational, that these groups be trained in the United States on the basis of one group per theater and that they be fully equipped with the necessary technicians to handle all types of controlled missiles now available.

e. Controlled missiles developed at a future date be introduced to the combat theaters through the special weapon groups as outlined above.

f. Procurement be immediately initiated for a minimum of 10,000 azon bombs, and that initial distribution of same be made to the Army Air Forces Tactical Center, the Ninth Air Force, and the Fifth Air Force. It is contemplated that initial use will be against shipping.

g. Plans be initiated for the training of special weapons groups and the procurement and training of technical personnel to be placed therein, and that these groups be equipped by squadron with sufficient types of aircraft to cope with all special controlled missiles.

h. The directive at present out to the Materiel Command to contract for the purchase of one hundred units of power driven bombs be let at the earliest practicable date, and that these units be utilized for tests, tactical development, and an initial introduction into combat theaters.

i. The General Motors project for the construction of power driven bombs, which project is not deemed satisfactory by the Materiel Command, be discontinued.

j. Immediate action be taken to obtain delivery of the five thousand television units at present under contract, and that an additional contract or letter of intent be let for an additional two thousand units. This will make the Army the largest purchaser of this equipment in the field, and therefore, will give us precedence on material and production.

[redacted]

ANNEX A

DESCRIPTION OF CONTROLLED MISSILES

CONTENTS

DESCRIPTION OF CONTROLLED MISSILES

I. HIGH ANGLE AZON TYPE BOMB

1. Description: This is a 1,000 lb. standard bomb equipped with gyro stabilized radio control and/or television or target seeking equipment built into a false tail section. A flare is attached to the tail to make the bomb visible to the bombardier. Bomb now has radio control in azimuth only and depends upon bombsight accuracy for range.

2. Carrying Airplane: This bomb may be carried on any bombardment type airplane capable of carrying 1,000 lb. bombs. It is carried in the bomb bay similar to conventional bombs. Twenty-four volts D.C. must be made available in the bomb bay.

3. Special Maneuvers: The carrying airplane must continue on its course, using only mild evasive maneuvers until the bomb hits. This requires from 30 to 60 seconds depending upon altitude at release. Minimum altitude to allow time for eclipse is 15,000 feet.

4. Method of Aiming and Control: The bomb is dropped with the conventional bombsight with greatest accuracy required on range. The bombardier has control of the bomb in azimuth only with corrections as high as 2,500 feet right or left from 15,000 feet being possible. The eclipse method is used, whereby the bomb, made visible by a flare, is caused by the bombardier to eclipse the target and remain in that relative position until impact. Several of these bombs may be dropped in train and given simultaneous control by the bombardier. Radio control equipment is portable and may easily be carried in the plane.

5. Advantages: Advantage of great accuracy from high altitude. Much greater accuracy than is possible using only the conventional bombsight can be obtained in azimuth and by dropping several of these controlled bombs in train, range errors are minimized.

II. CONTROLLABLE GLIDE BOMB, PRESET DATA

1. Description: This is a 12 ft. wing span glider which carries a standard 2,000 lb. demolition bomb. It has a single gyro control unit which stabilizes the glider in yaw and roll. The elevator is fixed at the proper angle for maximum glide. This glide bomb flies approximately one mile for each 1,000 ft. of altitude at time of release.

2. Carrying Airplane: This glide bomb is carried on the external bomb racks on the B-17F. Each airplane carries two of these bombs. Preliminary tests indicate that the B-25 will be suitable for carrying one bomb.

3. Special Maneuvers: No special maneuvers are required.

4. Method of Aiming and Control: This bomb is aimed by aiming the entire airplane with the bombsight, however, since the bomb is in the air a relatively long time compared to conventional bombs, wind arrows become very large unless properly compensated for. The exact methods of doing this have not been determined, however, preliminary tests indicate that accurate corrections can be made if wind information is available or can be determined prior to release. No control is possible after release.

5. Advantages: The advantages of this type of glide bomb are:

a. Release outside of concentrated ring of enemy ack ack.

b. Flat trajectory insures collision with the target; no bombs exploding in vacant areas.

c. Greater explosive force as flat glide path does not cause bomb to bury itself in the earth.

III. TORPEDO CARRYING GLIDE BOMB

1. Description: This glide bomb employs the 12 ft. wing span glider used for the preset gate glide bomb. Preset glide bomb as is now on hand plus a modification kit is all that is needed. A modification kit contains the necessary parts to adapt the glider to carrying the type of torpedo used by the Air Corps, plus a simple mechanism to eject the torpedo out of the wings at the proper time. The gliding angle remains at over 5 to 1; that is more than 5,000 ft. range for each 1,000 ft. of altitude. A torpedo may be of the type which after a given time begins to travel in circles searching over a large area at a reduced speed so as to run longer.

2. Carrying Airplane: Two torpedo glide bombs may be carried under the B-17F. Tests are now being conducted to determine the suitability of the B-25 for carrying one glide bomb.

3. Special Maneuvers: No special maneuvers are required.

4. Method of Aiming and Control: The glide bomb is aimed by aiming the entire airplane by use of the bombsight. Wind corrections are entered into the bombsight making the drop as accurate as possible. A preset angle, determined by ballistic test, is set in the bombsight to determine the release point. No control is possible after release.

5. Type of Targets: This bomb is usable only against marine targets.

6. Advantages: Chief advantage is that common to all glide bombs, the carrying airplane may release the torpedo well outside the concentrated ring of enemy anti-aircraft fire. This torpedo carrying glide bomb was initiated for use with the circling "searching" type torpedo to be dropped into harbor installations and ships at anchor there. It should be extremely effective on such a mission.

IV. RADAR CONTROLLED GLIDE BOMB

1. Description: This glide bomb is a 12 ft. wing span glider carrying the standard 2,000 lb. demolition bomb. A plastic nose is added in front of the bomb to carry the radar equipment. Gyroscope stabilized servo motors are connected to the rudder and elevators and necessary relays to transform the electrical impulses from the radar equipment into the appropriate right, left, up or down movements of the controls are included. Two types of radar equipment are now under development designated as RHB and SRB:

a. RHB Type: This type of radar control requires that the target be illuminated by radar emanations from the carrying airplane. This requires special illuminating equipment to be installed in place of the lower ball turret of the B-17F. After release of the bomb, certain maneuvers must be flown as position of the illuminating airplane with respect to the target and the glide bomb must be maintained. Limited evasive maneuvers may be flown during this time. It is expected that the illuminating airplane will not have to approach closer than 10 miles to the target and possibly as high as 20 miles.

b. SRB Type: The SRB radar equipment carries its own illuminating equipment, sending out its own impulses and picking up the reflections from them. This type of bomb can be dropped from any altitude using radar detection equipment or the bombsight to aim it as accurately as possible. It then flies preset until within a range of its radar equipment. The dropping airplane is free to leave immediately after dropping.

2. Carrying Airplane: The carrying airplane for this type glide bomb is the B-17F equipped with special radar illuminating equipment for the RHB and with radar detecting equipment for locating the targets through the overcast for both types. The B-17F will carry two of this type bomb and the B-25 will carry one of this type.

3. Type of Targets: The radar type bomb will work only on marine targets which are reflectors of the radar waves.

4. Advantages: The outstanding advantage of the radar type glide bomb is that the target need not be visible. The bombs will work equally as well through fog, clouds, rain or snow, day or night. The bombs may be dropped outside the range of enemy ack ack, gliding about one mile per 1,000 ft. altitude.

V. TELEVISION RADIO CONTROLLED GLIDE BOMBS

1. Description: This is a 12 ft. wing span glider which carries a standard 2,000 lb. demolition bomb. It has an inclosed fuselage attached to the rear of the bomb in which the television equipment can be mounted. A television camera is mounted underneath the bomb in a housing so that it can "see" forward. Gyro stabilized servo motors control the rudder and elevators. A radio receiver connected to the servo motors enables remote control to be maintained throughout the flight.

2. Carrying Airplanes: Two bombs are carried on the external wing racks of the B-17F airplane. Preliminary reports indicate that the B-25 is satisfactory to carry one bomb.

3. Special Maneuvers: No special maneuvers are required except that at present the range of the television is limited to about 10 miles. This means that the releasing and controlling airplane must remain within 10 miles of the bomb until impact. It may make any evasive maneuvers required, however. Greater range may be expected in the future with improvement of the television equipment.

4. Method of Aiming and Control: This bomb is aimed as accurately as possible by aiming the carrying airplane with the bombsight. Release point is determined by preset angle set into the bombsight.

The glide bomb pilot has before him a television receiver in which he sees just what the television camera on the bomb "sees". He has a small stick with which he can signal up, down, right or left to the bomb. He then centers the target in his television picture so that the bomb is flying directly toward the target and maintains this heading by corrections as needed.

5. Type of Targets: This bomb is accurate against a point target, however, it is necessary that the target be contrasting or have some distinguishing features such as roads, railroads, rivers or lakes to enable it to be located in the television image. It is suitable for either land or marine targets. Direct hits can be expected on such targets.

6. Advantages: This glide bomb is extremely accurate against a variety of targets. It may be released outside the concentrated ring of enemy ack ack but must remain within 10 miles of the target. It may make any evasive maneuver necessary during this time.

VI. RADIO SMOKE OR RADIO FLARE GLIDE BOMB

1. Description: This is a 12 ft. wing span glider which carries a standard 2,000 lb. demolition bomb. It has gyro controls on point and roll and direct control on pitch. A radio receiver enables control to be maintained throughout the flight. This bomb has either a smoke tank or one or more flares mounted on the rear to enable it to be observed by the bombadier.

2. Carrying Airplane: Two glide bombs may be carried on the external bomb racks of the B-17F. The B-25 may be used to carry one.

3. Special Maneuvers: It is required that the carrying airplane make an approximate one minute turn starting immediately after release of the bomb. This is to enable the airplane to be in the proper position for control, and to then continue on toward the target until the bomb strikes. Mild evasive maneuvers are possible during this time.

4. Method of Aiming and Control: The bomb is aimed and dropped with the bombsight as accurately as possible toward the target. Dropping angle to determine release point is found by ballistic test. The glide bomb flies preset during the first minute during which time the carrying airplane executes a turn designed to bring it back to the release point and on the original heading in one minute. At about 30 seconds after release, the smoke or flare is ignited enabling the bomb to be seen by the bombardiers. Two bombardiers are required to control the bomb. Each is equipeed with low powered field glasses and push buttons. One controls left and right movement and the other up and down movement in such a manner as to keep the target continuously eclipsed by the bomb. Minimum altitude for this type is 15,000 ft. After completing the turn, the airplane flies on to other targets. Mild evasive maneuvers being possible during this time especially toward the end of the flight. At the time of impact the airplane will be approximately 7 to 8 miles from the target from 15,000 ft.

5. Type of Targets and Accuracy: This bomb is usable against any target that can be seen -- that is resolved by the human eye. Direct hits can be expected if the target is clearly visible.

6. Advantages: Extremely accurate against a point target. It is strongly believed that it will be possible to hit any target which can be seen. The release point and turning back point will be outside the concentrated ring of enemy ack ack.

VII. TARGET SEEKING GLIDE BOMBS

1. Description: This title embraces several types of target seekers which will be enumerated in detail. The carrying vehicle is a 12 ft. wing span glider carrying a standard 2,000 lb. demolition bomb. It has a laminated ply wood nose added over the nose of the bomb in which the target seeking equipment is mounted. Gyro stabilized servo motors are connected to the rudder and elevator. Necessary relays to transform the electrical impulses from the target seekers into the required up, down, right or left motions of the control services are included.

2. Carrying Airplane: Two bombs may be carried on the external bomb racks of the B-17 and one by the B-25 airplane.

3. Special Maneuvers: No special maneuvers are required.

4. Method of Aiming and Control: These type bombs are aimed by aiming the entire airplane with the bombsight. The bombs should be dropped as accurately as possible with the bombsight. Control is possible after release by the seeking device automatically making necessary corrections to fly the bomb directly into the target. The dropping airplane may leave immediately after release.

5. Types of Seekers:

a. Offner: Heat seeker. Is a thermopile device which is sensitive to heat. Its function is chiefly against marine targets but targets such as blast furnaces or smelters would prove satisfactory. This equipment has not yet been tested with the glide bomb although very satisfactory tests have been made in an AT-11 equipped with this seeker.

b. Emerson Heat Detector: This is sensitive to heat differentials, especially useful on marine type targets.

c. Hammond Marine Head: This seeker scans the area and is sensitive to light differentials. It is useful only against marine targets and in daylight.

d. Fairchild Light Seeker: This is useful only against marine targets and still in the experimental stage.

e. Hammond Light Seeker: It is sensitive to light and usable only at night. It will guide the glide bomb to the light, picking out the largest area of light if several sources are available. Its range is limited to about three miles so it is necessary that the glide bomb be dropped sufficiently accurately so as to be within the limits of vision of the seeker when it has approached to within three miles of the target. Possible use against searchlight batteries or it will fly into fires previously started.

f. Infra-Red Devices: This equipment involves the illuminating of the target with a narrow beam of infra-red light; the bomb will be caused to home on it.

6. Advantages: Direct hits may be expected of every bomb dropped. May be dropped outside of range of enemy ack ack guarding marine targets, approximately one mile back for each 1,000 ft. of altitude and once released, it is not readily susceptible to interference by the enemy.

VIII. POWER DRIVEN BOMBS

1. Description: Power driven bombs are twin engined aircraft, designated BQ type, designed to carry up to 4,000 lbs. in bombs and to be flown directly into the target manually by means of radio and television or automatically by radar or target seeking devices. One of these power driven bombs being designed may be used as a torpedo plane or may drop its bombs and return to its base.

Several types of BQ airplanes are under consideration for this type of work. The prototype of the XBQ-2A model is now being tested. Remote control equipment for these airplanes has been developed and is being tested on AT-11 type aircraft. It is now ready for trials in BQ types.

2. Controlling Airplane: These bombs may be controlled from any aircraft which can keep up with the bomb and carry the necessary radio and television equipment.

3. Method of Aiming and Control: For effective control by radio it is necessary for the control plane to keep the BQ in sight or to remain to within 10 or 15 miles of the BQ which is the maximum range of the television equipment. When radar or target seeking equipment is installed it is only necessary to control the BQ to within sensing range of the seeking equipment where it takes control and automatically guides the bomb to the target. Any of the target seekers suitable for glide bombs will be suitable for BQ's. Telemetering equipment to enable the BQ to be flown on instruments is under consideration.

The BQ-3 may be flown by any of the means listed above and may either be used to drop bombs or torpedoes and return to the base or may be flown directly into the target. The XBQ-1, XBQ-2, XBQ-4, XBQ-5 jettison their landing gear after take-off and are intended to be guided into the target.

4. Types of Targets: These bombs are applicable against a variety of targets depending upon method of control or type of target seeker. For visual and television control targets must be such that they are easily visible. For the various target seekers, targets must, for the main part, be marine.

5. Types of Airplanes:

a. XB-1: This is a twin engine controllable bomb type aircraft. This aircraft is capable of carrying 1-2,000 lb. bomb. Maximum range of 1,500 miles.

b. XB-2A: This is a twin engine power driven controllable bomb type aircraft capable of carrying 1-2,000 lb. bomb.

c. XBQ-3: This is a twin engine power driven controllable bomb type aircraft with a gross weight of 15,100 lbs. It can carry either two torpedoes, 2-2,000 lb. bombs or 1-4,000 lb. bomb. It may be returned to the base or flown into the target.

d. XBQ-4: This is a twin engine monoplane type control bomb. The range is approximately 425 miles. The aircraft is capable of carrying either one torpedo or 2-650 lb. bombs and 2-325 lb. bombs.

e. XB-5: This is a twin engine monoplane type control bomb with a range of approximately 1,400 miles. It has the same bomb carrying capabilities as the XBQ-4.

ANNEX B

TACTICAL STUDY

1. HIGH ANGLE AZON TYPE BOMB.

1. Airplanes: For the present, this bomb is recommended only for heavy bombardment aircraft, inasmuch as this type normally operates above 15,000 feet, the minimum altitude from which the azon bomb should be released.

2. Type of targets:

a. The type targets for the Azon bomb are necessarily limited to those requiring 1,000 lb. bombs for their destruction. The equipping of 2000lb and 500 lb bombs with this device will increase the advantages of using Azon bombs, as then practically all type targets can be selected.

b. This bomb would be especially useful against long narrow targets such as bridges, railyards, certain buildings, and the like. Its advantages when used against a maneuvering ship are equally obvious. Deflection (azimuth) errors are greatly reduced, while the range errors remain approximately the same as conventional bombs.

3. Method of Attack:

a. The accuracy of this bomb when released at high and maximum altitudes should be far greater than present conventional bombing. This is particularly pertinent in the case of pressurized aircraft flying at and above 35,000 feet. Present combat errors from 25,000 feet are so large that up to the development of this bomb, bombing from above 30,000 feet did not appear practicable.

b. The fact that the carrying airplane must continue on its course, using only mild evasive action until the bombs hit might seem to preclude their use over heavily defended areas. It is believed, however, that they may be used at will over such areas in view of the fact that a change of altitude is the most effective evasive action, and such changes can be made as steep as desired without affecting the accuracy of these bombs.

c. Since the bombs are of standard size and fit in all bombers without modification, the only limitation is the number of individually controlled formation trains that may be released. At the present, more than 10 different frequencies for one attack is impractical. If duplicate frequencies are to be used, the attack must be so planned that the second wave does not release until the bombs of the first wave have hit.

d. Best tactical uses of these bombs remain to be proven. Tests should be conducted as soon as is practicable in order to determine the following:

(1) Effects of train and formation releases with all bombs on a single frequency.

(2) Maximum size formation whose bombs can be controlled by a single bombadier.

(3) Method to be used by large formations.

(4) Bomb smoke requirements (number and location) for (1), (2), and (3) above.

(5) Technique to be used against a maneuvering ship.

(6) Training and maintenance requirements.

II. CONTROLLABLE GLIDE BOMB, JULSET DATA.

1. Airplanes: This bomb is recommended for heavy bombardment aircraft although medium bombardment aircraft can carry one 2,000 lb. bomb of this type.

2. Targets: Present data indicates a circular error of about three (3) miles for this type of bombing. Due to the six to one glide ratio, the dispersion pattern of this glide bomb would be well absorbed by a large vertical plane or a series of setback vertical planes rising from a flat foreground causing shots to ricochet. Example would be a dock area, the sides of ships forming the first plane with storehouses behind them and tall buildings farther behind. Equally good would be an elongated target area, such as docks and industrial installations along the banks of a river.

3. Method of Attack: Considering hostile defenses and the lack of reserve power available to aircraft with glide bombs in large formations, an overwater approach against a coastal city would capitalize most fully the advantage of being able to release bombs a considerable distance from the target. Consequently, attacks may consist of combination of the following:

a. Main force on primary objective with two glide bombs per a/c.

b. Main force on coastal objective with one glide bomb per a/c, thence proceeding to primary objective and attacking with normal bomb loads.

c. Attacks by diversion forces on coastal cities or objectives. It is recommended that attacks be designed primarily to force the diversion of hostile fighters to coastal defense, thereby dispersing the enemy's fighter defenses.

[redacted]

III. TORPEDO CARRYING GLIDE BOMB.

1. Airplanes: Any heavy and medium type equipped to carry torpedoes.

2. Targets: This weapon may be employed against any target on which a normal torpedo is used.

3. Method of Attack: Its use against shipping at sea is rather doubtful because of lack of desired accuracy. It is believed that this weapon should be utilized to the greatest advantage against harbor installations and stationary shipping. The torpedo used should be the searching type which will circle until it hits a target. The surprise element of this weapon should be tremendous.

IV. RADAR CONTROLLED GLIDE BOMB. To be determined by test.

V. RADIO SMOKE OR RADIO FLARE GLIDE BOMB. The material in II above, controllable glide bomb with preset data, is likewise applicable to this bomb. However, the combining of tactical and aiming and control requirements is a problem requiring actual tests for solution. The use of special units to guide these bombs after release by a different force should also be investigated.

VI. TARGET SEEKING GLIDE BOMBS. To be determined by test.

VII. POWER DRIVEN BOMBS. To be determined by test.

[redacted]

ANNEX C

OPERATIONAL AND TRAINING PLANS

1. ORGANIZATION

It is the opinion of this office that to obtain maximum efficiency, maximum conservation of effort and technical personnel and at the same time give the most satisfactory results in the tactical application of the controlled missiles program, that it would be advisable to establish separate special weapons groups. It is felt that in accordance with the recommendations of the basic report, controlled missiles should be utilized only on specific missions and against very specific targets where their characteristics will render the greatest returns. In view of this, a group should almost be adequate to furnish the controlled missiles organization for any given theater at the present stage of development of the weapons. If necessary, this initial group could always be expanded or serve as a nucleus for similar organizations. It is, therefore, believed that the most satisfactory method of handling the operational distribution of controlled weapons is to insert all of these weapons into one group, creating therein special weapons squadrons, each squadron having its specialty and being adequately equipped with the proper type of aircraft and technical personnel. There is just about enough call and enough weapons to keep one group busy in any given theater. hence, it is not believed that an organization of this sort would tend to waste aircraft or personnel and at the same time it is believed that it would concentrate the highest technical skill towards the use of these controlled missiles whose development has been such that they should deserve special consideration. An organization such as this would also be a most satisfactory nucleus for the purpose of introducing any new controlled weapons into a given theater. Since these controlled weapons are still in the development stage with contemplated operational tests, it would furnish a most satisfactory center for research observation on the part of Tactical and Materiel Command project officers.

2. PILOT PERSONNEL

It is not believed that the pilot personnel required to equip special weapons organizations have to be of exceptional caliber as compared to normal bombardment organizations. The actual handling of the aircraft when equipped with all the known controllable missiles, does not appear to be anything which cannot be taught within a reasonable time to average combat crews. It is felt, however, that the bombardier or controlling personnel in the squadron which will handle television equipment may require special training of a very thorough nature, hence, this personnel might better be classed among the technical personnel of the group rather than a normal member of the combat crew.

3. TECHNICAL PERSONNEL

With the exception of the preset glide bomb and the azon bomb, highly technical radio, television and communications personnel will be prerequisite to the proper operation of controlled missiles organizations. It is believed that a special weapons group or organization must contain not only its normal complement of maintenance personnel for its aircraft, armament, and communications, but must also be equipped with factory trained civilian or military technicians who are thoroughly conversant with the intricacies of the weapons involved. In regard to the glide bomb and the azon bomb initially discussed, this technical personnel will not be quite as critical for the only complex unit appears to be the radio control unit itself and this unit is designed to be expendable, hence, need only be tested and if not functioning properly can be rejected for third echelon maintenance. Therefore, in the case of these two weapons, it has been found that normal enlisted personnel can be trained to handle their installation in a satisfactory manner during approximately the same period that it will take to train the combat crews to properly launch these weapons. The necessity of having these highly trained technicians available and under control for purposes of the specialized weapons is another specific reason why a separate weapons group would be more satisfactory for the initial introduction of controlled weapons than would be any attempt to arbitrarily train normal operational units such that they could on occasion be assigned a special weapons mission.

4. TRAINING

It is believed that a group graduating from the present training organizations could be given an additional two to four weeks of concentrated training in special weapons and that provided its personnel was supplemented by the technicians required for the more complex forms of maintenance and also provided that it was fully equipped with the necessary aircraft with all required modifications, that this training period would be sufficient before sending the group to a combat theater. This assumes that each squadron will specialize in a given type of missile and that only at a later date in the theater will the entire group become conversant with the operation of all types of missiles. Since the mother ship equipment for purposes of television control, powered control and other types of controlled missiles other than the most elementary, is very limited at present and will not be in mass production for some time, it is felt that an aircraft once equipped for use as a mother ship for controlled missiles should not be exposed to loss unless it is being utilized on a special weapons mission. This is another reason for not desiring to attempt to insert controlled missiles into normal operational units but rather to limit their use to a special weapons group which would automatically limit the theater's use of the weapons to specific targets and which would not unduly waste aircraft while at the same time obtaining maximum efficiency from highly technical personnel and equipment.

ANNEX D

EXTRA EQUIPMENT AND PERFORMANCE OF THE B-17F WHILE CARRYING GLIDE BOMBS

1. Extra equipment needed to use the B-17F for glide bombing:

a. Two external bomb rack units per airplane.

2. Performance of the B-17F when carrying two glide bombs: The performance of the B-17F when carrying two glide bombs will be somewhat different than when carrying bombs stored in the bomb bays. The gas consumption is increased, the ceiling is lowered and the cruising speed is lower.

a. Gas consumption: Will run about 270 U.S. gals/hr.

b. Operational ceiling: 25,000 feet.

c. Cruising speed: The indicated air speed has been reduced 10 to 15 miles per hour.

d. Maneuverability: The take off, climb and acceleration is slower but no trouble is experienced flying formation or in taking evasive action.

e. Range: The combat radius carrying two bombs and 1,700 U.S. gals. of gas is 400 miles. Combat radius carrying two bombs and 2,700 gals. of gas is 550 miles.

f. Power Settings: These are average power settings for the lead aircraft which will allow the wing men to maintain their proper position in the formation:

(1) Climb - 2,200 R.P.M. and 34 in. Hg.

(2) Cruise - 2,000-2,100 R.P.M. and 31 in. Hg.

(3) Glide - 2,300 R.P.M. and 34 to 36 in. Hg.

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

MEMORANDUM FOR HQ AFMC/HO
ATTENTION: DR. WILLIAM ELLIOTT

FROM: HQ AFMC/PAX

5 MAY 2000

SUBJECT: Security and Policy Review, Case AFMC 95-276

1. The reports listed in Attachment 1 were reviewed for security and policy IAW AFI 35-205 (now AFI 35-101), and were cleared for public release. According to our logs, the material was reviewed by HQ AFMC/PA and by SAF/PAS. It was our case number AFMC 95-276, and Air Staff's number SAF/PAS 95-0995. It was cleared for public release 22 Nov 95. All the material is releasable to the public, without restriction.

2. If you have any questions or comments, please call me at 77828. Thanks.

JAMES A. MORROW
Security and Policy Review
Office of Public Affairs

Attachment:
1. HQ AFMC/HO Ltr 12 Oct 95