

DEPARTMENT OF THE AIR FORCE  
OFFICE OF THE ASSISTANT SECRETARY

MEMORANDUM

November 1, 1966

Mr. Vance

This is the paper I propose to  
send to the ExCom. I would appreciate  
your comments on same.

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MEMORANDUM FOR THE NRP EXECUTIVE COMMITTEE

SUBJECT: Reorientation of the TAGBOARD Program

The contractor and Government investigations into the TAGBOARD launch accident which occurred on July 30 have now been completed. Unfortunately, the results are not entirely conclusive. However, as a result the contractor has reaffirmed his previous recommendation for a major change in the method of launching the drone.

The July 30 launch was the fourth in the TAGBOARD Program. The three previous launches from the modified A-12 aircraft (at Mach 3.2 speeds and approximately 75,000 foot altitudes) had taken place without incident. After launch, each drone flight had been more successful than its predecessor. And although a payload module had not yet been recovered, there was confidence that the cause of electrical power failures just prior to payload ejection from the drones on flights two and three had been identified and corrected.

In the July 30 launch, the drone separated normally from the A-12, rose to a height of approximately seven feet above the launch aircraft, yawed slightly to the left, and then began to roll to the left at a rate higher than the drone's elevons

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could stabilize. A few seconds later, the drone collided with the launch aircraft near the left vertical stabilizer and both aircraft subsequently disintegrated. The pilot ejected successfully with only minor injuries; the Launch Control Officer also ejected successfully but drowned before rescue from the sea.

Telemetry and chase-aircraft photography have permitted a reasonably complete reconstruction of the sequence of events which took place; however, the single factor or combination of factors which caused the accident have not been precisely identified.

The fourth TAGBOARD drone carried more fuel than those launched previously and was approximately 25 percent heavier. Although elevator control travel had been increased to compensate for the additional weight, the drone nevertheless separated from the launch aircraft at a slower rate than anticipated, and the two remained relatively close for a longer period than on previous launches. It should be noted that the aerodynamic flow patterns when the drone and carrier aircraft are in close proximity are not well understood, and this void has not been filled either in extensive wind tunnel testing or from flight test instrumentation. The accident therefore could have been

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the result of unusual and/or unique airflow interactions between drone and launch aircraft at the time of separation.

Other factors which might have caused or contributed to the accident could have been an out-of-limits center of gravity, the loss of a small fairing somewhere on the drone or carrier aircraft, excessive yawing of the carrier aircraft at launch, abnormal operation of the release mechanism, etc. However, there is no evidence to indicate that any of these conditions did exist. On the contrary, telemetry from the highly instrumented launch aircraft and drone showed that all equipment operated normally and the flight conditions at launch were within the specified envelope.

The contractor, as a result of his analyses, has reluctantly come to the conclusion that the TAGBOARD launch from an A-12 aircraft at Mach 3.2 is a marginal operation, in that launch accidents can occur as a result of only slight deviations from the norm in numerous areas. The Project Office and I share that belief on the basis of the limited evidence in hand.

A rather detailed study on the feasibility of alternative launch methods for the TAGBOARD drone was completed just prior to the accident (the study had been initiated because of problems associated with acquiring the third launch aircraft considered

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necessary for the operational program and the prospects of obtaining additional launch aircraft in the future in the face of possible attrition). The results of this study indicate that the program can be reoriented to a safer and probably more reliable method of launch, with minimal program slippage, and for modest cost. The most promising alternative technique is to launch the drone from a B-52 wing-pylon in the same manner that the X-15 and HOUNDDOG air-to-surface missiles are launched. I propose to reorient the TAGBOARD Program to this launch technique.

Briefly, the drone will be modified to permit attachment to a special pylon on a B-52H and to carry an external solid-propellant rocket booster which will provide approximately 30,000 pounds of thrust for about 70 seconds. The drone/booster combination will be dropped from the B-52 at Mach .8 at 40,000 feet. After a safe separation distance is achieved, the rocket booster will be ignited and will accelerate the drone to a speed in excess of Mach 3 at approximately 80,000 feet. During the rocket boost phase, the drone will be guided by the present flight control system (obviating the need for any gimbaling of the rocket nozzle). The booster and its attaching hardware will be jettisoned after ramjet ignition. From that

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point on, the drone would proceed on its flight in a manner identical to the present flight profile (Mach 3.3 cruising speed at 95,000 feet altitude, air catch of the payload, etc).

The B-52H is capable of carrying two drones. Modification of the B-52H consists of attaching a new pylon under each wing to existing attachment points and the installation of a dual launch control station in the present Fire Control and ECM Operator positions. It should require approximately six months to fabricate the pylons and modify the first B-52H launch aircraft, using existing control consoles and instrumentation, and eight months to procure additional control equipment and to modify a second B-52H. Two launch aircraft would provide a reasonable operational capability. The B-52H's can be made available from the SAC inventory.

A typical TAGBOARD mission against targets in South China and/or Viet Nam would begin at Area 51, launch the drone in the vicinity of Okinawa about 13 hours later, and return non-stop to Area 51 in a total elapsed time of about 24 hours. Two aerial refuelings would be required for the B-52. Recovery of the drone payload would occur approximately one and one-half hours after launch and take place in a "safe" area dictated by the mission profile (for example, in the Bay of Bengal or the

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South China Sea).

Assuming an early program go-ahead, it appears feasible to begin flight testing of the B-52H/D-21B combination early next Summer. It is estimated that at least three D-21B R&D launches will be required to prove out the launch/rocket boost concept, and that D-21B's with cameras installed could be launched thereafter at a one-per-month rate. Therefore, a limited operational capability is possible one year from go-ahead. All B-52 testing and operations would be conducted from Area 51. Should Area 51 not be available in the future, operations could be conducted from Beale AFB.

The original TAGBOARD Program included the two modified A-12 launch aircraft and 20 drones and cameras, of which 15 remain in the inventory (five drones have been expended thus far-- one in ground test, and four in flight test). A follow-on procurement of fifteen additional drones and cameras was approved in FY 66; however, the contractors were not authorized to begin production on this second increment until after the first drone launch had been accomplished. After the accident, this second increment was reduced from fifteen to seven drones. For the future, program planning had anticipated the modification of a third A-12 into a launch aircraft in 1967, and the procurement

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of a third increment of 24 drones and twelve cameras in FY 68.

The proposed new TAGBOARD Program includes the following major elements:

1. Two B-52H aircraft (already tentatively identified in the SAC inventory) will be modified into launch aircraft. The first B-52 can be modified in approximately six months, with the second following about three months later.
2. The 15 D-21 drones remaining from the original procurement increment will be modified into a D-21B configuration which is compatible with B-52 launch and rocket boost. The first of these can be ready in six months, and the fifteenth nine months later (December 1967).
3. The second procurement increment of seven drones (manufacturing has just begun) will be produced as D-21B models rather than the original D-21 version. The first of these would be delivered in January 1968, and the seventh in June 1968.
4. Field operations, if required, will begin in the Fall of 1967. For planning purposes, a one-per-month launch rate is assumed.
5. A third increment of sixteen drones will be procured for delivery between July 1968 and June 1969.

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A schedule for the proposed new TAGBOARD Program is included as Attachment 1.

Specifically, the following portions of the new TAGBOARD Program would require FY 67 funds:

1. Modification of the two B-52H launch aircraft.
2. Retrofit of the 15 D-21's remaining from the original procurement to the D-21B configuration.
3. Production of the seven additional drones and cameras from the second procurement increment into D-21B models.
4. Minor taxiway construction at Area 51 to accommodate the B-52H.
5. Long-lead time procurement against the delivery of sixteen drones and eight cameras in FY 69.

An estimated \$28.4 million of FY 67 obligating authority would be required for the B-52H/D-21B program, compared with the previous estimate of \$34.5 million for the A-12/TAGBOARD drone combination. A comparison of FY 67 fund requirements is attached as Inclosure 2. It should be noted that the reduction is primarily in the support area and reflects the fact that the A-12 carrier aircraft flight test program was terminated in September, and that the B-52H will be maintained by Air Force rather than contractor personnel.

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FY 68 fund requirements have been estimated on the basis of supporting B-52H launches of previously procured drones and cameras at a one-per-month basis, and completing financing of eight drones and four cameras in the third procurement increment, for which long-lead time procurement had been initiated in FY 67. The remaining eight drones and four cameras of the third increment buy of sixteen drones and eight cameras would be financed in FY 69.

It is estimated that \$31.6 million of FY 68 funds will be required for this proposed program. This total compares with the earlier estimate of \$71.7 million for new drone procurement and the support of A-12/TAGBOARD launches at a one-per-month rate. A more detailed cost comparison is set forth in Inclosure 3.

In summary, the analysis of the July 30 launch accident indicates that the TAGBOARD launch from an A-12 type aircraft is a marginally-safe operation; however, the program can be reoriented to utilize a B-52 launch platform/solid rocket booster launch technique with minimum program slippage and for less FY 67/68 funds than previously estimated. Although it is not likely that the TAGBOARD drone will be employed in large quantities on a routine basis in the near future, I believe there is a need for this unmanned capability in crisis reconnaissance situations and to augment satellite coverage when needed in special areas

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such as South China, and that such a drone is likely to be used increasingly in the future--particularly as ground and air defenses improve in certain areas.

It is recommended that the Executive Committee approve the reorientation and continuation of the TAGBOARD Program as described in this memorandum.

3 attachments

Alexander H. Flax  
Director  
National Reconnaissance Office

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TAGBOARD MEMORANDUM

|                       | FY 67 |   |   |   |       |   |   |   |       |   |   |   | FY 68 |   |   |   |       |   |   |   |   |   |   |   | FY 69 |   |   |   |   |   |   |   |  |  |  |  | CY |  |  |  |  |
|-----------------------|-------|---|---|---|-------|---|---|---|-------|---|---|---|-------|---|---|---|-------|---|---|---|---|---|---|---|-------|---|---|---|---|---|---|---|--|--|--|--|----|--|--|--|--|
|                       | CY 66 |   |   |   | CY 67 |   |   |   | CY 68 |   |   |   | CY 69 |   |   |   | CY 69 |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
|                       | J     | F | M | A | J     | F | M | A | J     | F | M | A | J     | F | M | A | J     | F | M | A | J | F | M | A | J     | F | M | A | J | F | M | A |  |  |  |  |    |  |  |  |  |
| B-52H MOD.            |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
| 15 D-21 RETROFIT      |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
| 7 D-21B & CAMERA BUY  |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
| FY68. D-21B BUY       |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
| 16 Drones & 8 Cameras |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
| FLW TEST              |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |
| OPERATIONAL LAUNCHES  |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |       |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |  |  |  |  |    |  |  |  |  |

Inclosure 1

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FY 67 TAGBOARD FUNDING REQUIREMENTS1. PREVIOUSLY APPROVED PROGRAM

|                                |                |
|--------------------------------|----------------|
| a. <u>Operational Support:</u> |                |
| (1) A-12 Launch Aircraft       | \$15.22        |
| (2) Drone Aircraft/Engine      | 5.10           |
| (3) Drone Camera               | .87            |
|                                | <u>\$21.19</u> |
| b. <u>Investment; (1)</u>      |                |
| (1) Drone Aircraft/Engine      | 34.56          |
| (2) Drone Camera               | 3.76           |
|                                | <u>38.32</u>   |
| <u>TOTAL:</u>                  | \$59.51        |
| <u>NET FY 67 NOA:</u>          | \$34.51(2)     |

2. PROPOSED PROGRAM

|   |                   |
|---|-------------------|
| Operational Support   | \$7.37            |
| Modify two B-52H's  | 4.40              |
| Modify original 15 drones   | 13.23             |
| Procure 7 additional drones   | 20.53             |
| Procure 7 additional cameras  | 2.17              |
| Minor construction at Area 51   | .38               |
| Long lead procurement for 16 drones and<br>8 cameras (FY 69 delivery) | 5.30              |
| <u>TOTAL:</u>   | <u>\$53.38(2)</u> |
| <u>NET FY 67 NOA:</u>   | <u>\$28.38</u>    |

(1) This covers the second procurement increment of 15 drones and 15 cameras, as originally planned. After the July 30 accident, the procurement increment was reduced to seven drones and seven cameras. Not included was a requirement for \$3.1 million to modify a third A-12 into a launch aircraft.

(2) Net total of FY 67 New Obligating Authority reflects carry-over of FY 66 funds.

Inclosure 2

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FY 68 TAGBOARD FUNDING REQUIREMENTS1. PREVIOUSLY APPROVED PROGRAM

|   |               |
|---|---------------|
| a. <u>Operational Support:</u>              |               |
| (1) A-12 Launch Aircraft                    | \$16.3        |
| (2) Drone Airframe/Engine                   | 3.7           |
| (3) Drone Cameras                           | .7            |
|   | <u>\$20.7</u> |
| b. <u>Investment (24 Drones/12 cameras)</u> |               |
| (1) Drone Airframe/Engine                   | 48.14         |
| (2) Drone Cameras                           | 2.86          |
|   | <u>\$51.0</u> |
| <u>TOTAL:</u>                               | \$71.7        |

2. PROPOSED PROGRAM:

|                                |               |
|--------------------------------|---------------|
| a. <u>Operational Support:</u> |               |
| (1) Drone                      | 8.90          |
| (2) Camera                     | .7            |
|                                | <u>9.60</u>   |
| b. <u>Investment (1)</u>       |               |
| (1) Drones/Cameras             | 22.0          |
| <u>TOTAL:</u>                  | <u>\$31.6</u> |

(1) Long lead for the third procurement increment of 16 drones and 8 cameras began in FY 67. This \$22.0 million will complete funding of the first 8 drones and 4 cameras and begin funding the remaining 8 drones and 4 cameras. Remainder of funds will be applied in FY 69.

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