March 18, 1968

MEMO FOR COLONEL WORTHMAN

SUBJECT: TAGBOARD Program Concept

The attached paper -- on subject matter -- was delivered through Mrs. White to you on March 14.

On Friday AM, March 15, I was asked by General Berg to attend a meeting in his office at 1000 to discuss the paper.

I quickly scanned the paper and attended. Those present:

General Berg
Colonel Hartley
Mr. Mazza
Lt Colonel Yost

Key points:

1. The paper was agreed to in principle.

2. Colonel Hartley indicated that although he had written the Security Section on page 16 as it appeared -- he did not favor a black (BYE) and a white (205-1) approach. He spent about ten minutes explaining "why not" -- at the conclusion of which General Berg related Dr. Flax's view that it be turned over completely to the Air Force. Mr. Mazza favors "complete black BYEMAN" control. Colonel Hartley does also. General Berg suggested that Dr. Flax may want a "hold" for a bit longer but felt sure he would decide to turn it completely white and transfer it to the Air Force for JRC operation. General Berg indicated that he and Col Hartley would discuss with Dr. Flax on way to WC Sunday evening, March 17.

Status of paper: held pending resolution of security item.

Lt Colonel Yost

WORKING PAPER

TAGBOARD PROGRAM CONCEPT

Purpose

The purpose of this plan is to describe in general terms the TAGBOARD system and its operation, to outline the steps necessary to achieve an operational status, and to establish a concept whereby its sole employment will be against reconnaissance objectives of National significance. This capability will supplement satellite operations by providing relatively large scale photography over specific objectives, and complement conventional aircraft by providing an unmanned alternative which destroys itself in the event of abort over enemy territory.

General

The management responsibility and control will remain in NRO channels as implemented by the Director, Program D. When declared operationally ready, the operational control of this system will be vested within the JCS(JRC).

Description

a. D-21 (Drone)

(1) The D-21 is a midwing monoplane of metal (primarily titanium) and plastic construction powered by one RJ-43 Marquardt ramjet. The interior arrangement may be considered as four sections in a fore to aft relationship. The first section is the engine air inlet with fixed spike and by-pass installation to control air flow and boundary layer removal. The second section is the equipment bay which houses the payload, recovery parachute, and high cost electronic gear. The third section consists of three inter-connected fuel tanks with a 5900 pound capacity. The fourth section is devoted to the installation of the engine, tail pipe and nozzle. The

external configuration of the aircraft is based on a modified delta wing platform. The forebody incorporates chines which reduce radar return and act as a canard-like surface. The engine which provides 1800 pounds thrust at operating altitudes is in the afterbody; the circular air inlet with its spike in the extreme forward nose resulting in a smooth, streamlined appearance. Physical dimensions are: span - 19.08 ft, length - 42.83, height - 7.08 ft, zero fuel weight - 5300 lbs, start of cruise weight 11,500 lbs. Performance is 3000 NM at a constant M 3.3; initial altitude 80,000 ft and after a cruise climb the profile will reach 95,000 ft.

(2) A solid propellant rocket booster providing an average of 31,000 lbs of thrust for 90-100 seconds is fitted to the bottom of the D-21. The vehicle is dropped from the B-52 at 40,000 ft and M = .83 in the same manner used for the X-15. The booster then ignites and accelerates the D-21 to M = 3.2 - 3.4 at an altitude of 80,000 - 85,000 ft. There the motor burns out and the booster case and pylon (attaching the booster to the D-21) are jettisoned. The rocket motor is 422 inches long including nozzle, 30 inches in diameter and weighs approximately 12,900 lbs. It is supported at the bottom centerline of the D-21 at three points. Two of these take vertical loads and the third supports against thrust and roll loads. The attachments are made with explosive bolts for simple reliable release; a thruster will apply a load to the casing at ejection at the approximate center of percussion of the casing in order to rotate it nose down and insure good separation. After jettison of the booster the D-21 accelerates or decelerates to its design M 3.3 and proceeds on a climbing profile.

(3) A Honeywell MH-390 (D) Inertial Navigation System, installed

on the equipment bay hatch, provides steering signals to the autopilot and command signals to the sensor. Thirty-two commands (turns, or D-21 functions at specified geographic positions) can be effected. D-21 position error may be updated to the accuracy of the B-52 immediately prior to launch. Maximum error at launch, using the stellar tracker in the B-52, will be 1.7 NM. During free flight the maximum rate of error buildup will be 1.5 NM/hour. Other INS functions are to turn booster ignition on, arm the destruct mechanism, turn the command receiver and TM on/off, turn payload on, select mode and shutter speed, turn the beacon and X-Band transponder on, and to terminate flight by cutting engine fuel.

(4) An in-flight check-out system is installed and controlled by the Launch Control Officer(s). The D-21 INS platform, altitude switches, command system, hydraulic system, fuel system, APU, and battery are monitored continuously at the LCO station. During mated flight the LCO controls the D-21 hydraulic and electrical systems, and updates the INS. Prior to launch, the LCO tests the flight control system, the INS, payload, electrical system, command receiver, and turns the fuel pumps on. A complete D-21 check except for engine operation is achieved. Any no-go situation which cannot be corrected in flight constitutes a fail safe abort condition.

(5) A telemetry system is installed in the D-21B to provide sufficient data to the B-52 to determine whether or not the D-21 is performing satisfactorily. TM is turned off automatically ten minutes after launch which allows approximately the first 300 NM of flight to be monitored. Some of the data transmitted to the B-52 is: altitude, Mach number, heading, time and navigation data, APU speed, burner pressure, booster separation, and inlet condition. Evaluation of these data provides for a

"command destruct" prerogative in the most critical part of free flight. The transmitter is an off-the-shelf component installed in the gyro well; a notch antenna is built into the trailing edge of the vertical stabilizer. The B-52 has two antenna blades mounted on top the fuselage to give omni-directional coverage in the horizontal plane. This eliminates the need for the B-52 to maintain constant heading during the ten-minute monitoring period. The TM signal is turned on again to assist in the recovery phase; however, since this equipment is not mounted on the jettisonable hatch, its transmissions are lost at the moment of payload ejection.

(6) A Hycon HR 335 camera (24 inch FL, F 5.6 lens, 9x9 format) weighing approximately 290 lbs provides the only D-21 reconnaissance capability. Resolution is 105 lines/MM AWAR on SO 206 (low contrast target) and 115 lines on SO 3400. IMC is achieved by tracking the scan mirror; a Perkin Elmer V/H sensor is provided. Magazine capacity is 4,500 ft of $9\frac{1}{2}$ inch wide thin base film providing 5600 exposures. The camera operates through five modes: vertical, and 19° and 36° either side of flight track. The three position mode will provide a continuous swath of photographic coverage 16NM by 3900 NM (approximate), and the five position mode 28 NM by 3020 NM (approximate). In flight data will be recorded on the film and will consist of latitude, longitude, time, oblique position, and exposure number. Ten cameras have been delivered with eleven more on order.

(7) There are two pyrotechnic devices installed; one ejects the equipment hatch at termination of flight, and the second is used to destroy the aircraft. The destruct system is armed by time or command radio after launch and is actuated by altitude during free flight, or by altitude/command during terminal phase. The payload cannot be destroyed after the hatch is ejected.

(8) A command receiver (430 MC) is the means whereby back-up control of the beacon, ramjet and booster ignition, booster eject, fuel on, fuel shut-off, package eject, destruct, destruct disable and destruct arm is effected by either the launch or the recovery aircraft. Back-up command is normally initiated immediately after INS programmed command.

(9) A Sarah beacon (243 MC) and X-Band transponder are installed on the equipment hatch to assist in recovery operations. The beacon provides directional information limited to line of sight; the transponder provides range and bearing to the extent of JC 130 APN-59 navigation radar capability as modified, approximately 500 NM.

(10) The raw reconnaissance data will be air recovered by JC-130. The equipment hatch, to be ejected, will include the camera, magazine, camera electronics, INS and computer, stability augmentation system, beacon, transponder, and command receiver. Package weight will approximate 880 lbs. Ejection of the package from the drone will occur at a predetermined altitude of 60,000 ft.

(11) There are 15 D-21's produced with 19 additional on order.

b. The B-52 is a standard "H" model modified for the carrier/launch mission; the main differences being the change of the ECM and gunner positions to Launch Control Officer (LCO) positions, a pylon under each wing for physically mating the vehicles, an umbilical interface for electrical and bleed air connections, and the addition of a Stellar-inertial navigation system. The two LCO positions provide completely independent launch control functions for each of the D-21B aircraft. This includes monitoring of D-21 status during mated flight, pre-launch check-out of go-no-go systems, and post launch monitoring of system status by

means of a telemetering (TM) function. A radio command system operating on a frequency of 430 MC is installed at the LCO stations as a back-up means of commanding D-21 functions normally initiated by INS or other sensor signals, and for commanding destruct. The system consists of two transmitters providing a total of ten channels, two 10 watt power amplifiers, and a top and bottom blade antenna selectable by a coax switch to insure reliable contact with the D-21 during both mated and free flight. Commands which can be transmitted from the LCO station are: ramjet and booster ignition, booster eject, fuel on, destruct arm, destruct disable, package eject, fuell off, beacon and TM on and destruct. The pylon installation allows full use of the flap system for take-off/landings. The pylons are attached through a bolt pattern which exists on the B-52 wing; no beef-up is required.

System Operation

After take-off the mated system will be air refueled, if necessary, to make good a desired penetration point and route. No provisions are made to refuel the D-21 from the B-52. During cruise the launch control officer will monitor D-21 go-no-go status by means of the in-flight check out system. Just prior to separation the D-21 INS is updated and all final checks concluded. Separation occurs at 40,000 ft, M = .83. The launch is similar to the X-15 and Hound Dog but less critical since the vertical tail does not pass through the B-52 wing. Downward acceleration is rapid to preclude lateral displacement into the B-52's engines or fuselage. The boost phase beings 5 seconds after launch when the D-21 is well away from the B-52. Booster ignition is initiated by the INS and time delays in the D-21 with back-up by the B-52 command radio (channel 8). Burn out nominally

occurs at 80,000 ft and M 3.3; however, actual conditions at burn out are dependent upon variations in booster thrust and impluse, launch conditions, atmospherics, and other factors. These variations are handled during transition to cruise by the automatic flight control system. After burn out the booster is separated automatically from the D-21 by means of explosive bolts, again with back-up command available from the B-52 radio (channel 6). Prior to booster burn out, approximately 2.8 M, the ramjet engine is lighted automatically. The D-21 then accelerates to M 3.3 and a cruise climb at constant Mach is maintained for sortie duration. Final altitude will be approximately 95,000 ft. Sixty seconds after launch the destruct mechanism is armed by the INS with backup through B-52 command (channel 4). From that point until the "destruct disable" function is actuated or the D-21 radio receiver turned off, or the D-21 is out of range, the D-21 may be destroyed by command (channel 11) from the B-52. Flight characteristics of the D-21 will be monitored by the LCO's from separation through the first ten minutes (approximately) of flight by means of TM. Any condition not meeting established minima can be followed by command destruct. When out of range of the B-52, the INS turns the D-21 receiver off to preclude inadvertent or intentional disruptive commands. However, the D-21 will destroy itself in the event of abort by passing through a pre-established altitude. The INS/computer combination provides all control of the flight throughout the profile. Thirty-two commands are possible. They can be consumed in turning the drone, changing mode of camera operation or exercising other options; i.e., beacon and TM on, destruct disable, fuel off, etc. Wherever possible, discrete functions such as beacon on, TM on, and destruct disable, should be planned

for those places in the profile where a turn has to be made. Since all commands must occur at a specified lat/long, the discretes can be accommodated at a desired change in track without consuming an additional command option. The navigational CEP is expected to be no greater than 4.7 NM at termination of flight with a 95 percent assurance that it will be no greater than 9 NM. With lateral coverage extending to 14 NM either side of flight track, no difficulty is envisioned in providing stereo photography of specific objectives. (The film supply is adequate for 3000+NM in the five position mode, therefore, no on-off operation of the camera or change of mode is necessary once it is turned on.) At a predetermined point, the INS turns the command receiver on in preparation for flight termination. The drone's beacon, TM and S-Band transponder is next activated, by either INS or command (channel 5) from the recovery aircraft, to provide a means for tracking by the JC-130 as necessary to reach the planned recovery area. Prior to this event, however, destruct disable must be commanded (channel 9) by the JC-130. After fuel off, the drone is programmed into a constant pressure descent to 60,000 ft where payload ejection will occur automatically with back-up command (channel 7) again provided by the recovery aircraft. Ten seconds later the destruct circuit is re-established and the drone is then destroyed as it passes through the altitude destruct zone, 52,500 ft. The JC-130 will be provided flight track, alunch time, time and place for acquisition aids to be turned on, time and place for fuel off, and programmed recovery area. They will be in the recovery area in advance and will monitor drone progress by means of its beacon, TM and transponder. The transponder will provide a relatively accurate means of insuring that back-up commands from

the JC-130's occur at the proper point in the profile. After recovery of the payload using standard technique, the JC-130's will return to their deployment base. The film will then be returned to the CONUS or as directed for processing and interpretation.

Flight Testing

a. Flight testing will conclude during 1968. One drone (not one of the 15 referred to earlier) has been used extensively in static tests. Mated flights have demonstrated the ability of the B-52 to carry the D-21 to drop speed, evaluated the effect of sub-sonic speeds on drone systems, and established the effect on B-52 performance, stability, and handling characteristics and structural integrity when carrying one/two D-21's.

b. The data to be accumulated and number of flights prior to separation is to be determined by the contractor. Several drones have been especially instrumented and are available for the test phase. Instrumentation includes photo recording panels and FM/FM telemetry systems for recording/transmission of those data needed to establish performance and verify profile capability. Specifically, booster operation, navigation tolerances, range capability, adherence to programmed flight, engine performance, sensor performance, and recovery operations will be demonstrated and/or established. Each free flight will be programmed for accomplishment of the maximum test objectives and unless other programs interfere, each will be a full range effort. At least one separation will be preceded by a 15-hour mated flight to establish INS rate error and the effects of cold soak. The R&D flights will be scheduled for the PMR; separation to occur just off the California coast or Hawaii with recovery in a predesignated area. Camera operation probably will be demonstrated over the Pacific Ocean. Tests

will be programmed for areas where relatively uninhabited islands can be overflown. With the addition of resolution targets on these islands, an accurate reading of camera resolution will be possible.

c. Use of the PMR has been negotiated. Down range monitoring and control functions such as radar tracking, space time positioning, telemetry acquisition and recording, and range safety from launch through destruction is available through the use of ships and range aircraft. Compatibility of equipments to function has been established. For range safety purposes during test flight only, a "C" band beacon has been added to the equipment hatch to provide an additional means of radar acquisition and tracking.

d. JC-130 air recovery aircraft will be required for both the test and operational phases. The 6594th Recovery Group has been augmented for this mission. Recovery equipment has been tested and is adequate for the D-21 package. Radio equipments for commanding D-21 functions and receipt of acquisition aids are compatible.

e. A new parachute system for air recovery of the payload has been tested and is available. (These items are purchases through the ADP and delivered to the 6594th Recovery Group to satisfy their training needs.)

f. One camera has been tested in the dynamic analyzer at WPAFB and others in actual flight under conditions simulating closely their anticipated environment. Final testing will be conducted when the D-21 flies full range over the PMR.

g. SAC and ADP have developed a MD-21B software program for operational sorties to be run on the 7090 computer and transmitted via the 1004 data link.

h. Flight test responsibilities

(1) Director, Program D, is responsible for all aspects of the TAGBOARD Program. He will provide guidance as necessary to the activities involved and insure that support for development/test/operations is made available as required. He will make inputs from time to time in those areas of the flight test program where information concerning tactics or system usage may be appropriate.

(2) Contracting and security are to be performed by the CIA.

(3) ADP is responsible for development of the D-21 vehicles, subcontracting for all subsystems except the sensor, modifying the B-52, and conducting the test flight program. ADP is charged with the requirement for timely identification of DoD assets not now available to them but which will be needed in fulfilling their responsibilities.

(4) [redacted] will provide materiel support.

(5) Hycon is responsible for development of the sensor and participating in the flight test program.

(6) Area 51 will support the TAGBOARD by providing use of fixed facilities during test and initial operational phases.

(7) B-52 maintenance will be blue suit except for those phases involving the special modification. Such maintenance and all D-21/sensor maintenance will be contractor performed.

(8) The military maintenance effort will be directed towards meeting flight schedules established by the ADP or as modified by the Program Director where range conflicts may exist. However, the final decision to fly a given sortie will be at the discretion of the senior AF

11

member and will depend upon assurance from both contract and blue suit maintenance that the total system is ready for flight.

(9) SAC will provide B-52 aircraft, flight and maintenance personnel, and materiel support as necessary.

Operational Concept

Policy:

Once TAGBOARD is considered operational and is so certified by the DNRO, control of all missions will be exercised by the Joint Chiefs of Staff through the operational commander. The Strategic Air Command will prepare mission profiles based on requirements as contained in the current COMIREX target list as approved by USIB. On a monthly basis, mission or program approval will be obtained from the 303 Committee for the forthcoming month. This will be accomplished by the Joint Chiefs of Staff concurrent with the normal monthly reconnaissance schedule submitted by the DNRO. When directed by the Joint Chiefs of Staff, SAC will execute the approved mission or missions.

All launches will occur from Beale AFB and the B-52 will normally return to Beale. Recovery of the payload will vary depending on the area of the mission. In all cases payload recovery will be outside radar range of the European/Asian communist countries.

Film Processing and Exploitation:

TAGBOARD film will be processed and exploited on a mission by mission basis as directed by DNRO. Film returned to CONUS will be processed by Eastman Kodak and exploited by the National Photographic Interpretation Center ~~(C)~~ (NPIC).

When directed by the DNRO, film processing and exploitation outside

CONUS will be accomplished at the Overseas Processing and Interpretation Center (OPIC) specifically designated. Duplicate film copy, Immediate Photo Interpretation Report (IPIR) and follow-on report distribution will be determined by the USIB.

Organization:

The flying organization will be a small SAC element assigned to Beale AFB, California, with duty at Area 51 until flight test and initial preparation phases are completed. The unit will consist of three crews and aminimum number of command, operations, and maintenance personnel responsive directly (operationally) to SAC. During the initial operating phase, all D-21 maintenance (airplane general, electronic, engine, navigation, communications, sensor) will be performed by a contractor team numbering approximately seventy personnel. The head of this team will function as the chief of special maintenance for the Deputy of Materiel of the operating detachment. Training for the "blue suit" capability for the D-21B and associated B-52 modifications was started on 15 January 1968. Maintenance of the TAGBOARD system will be eventually assumed by SAC; however, specialized contractor support is recognized as a continuing requirement. B-52 supply support will be normal; D-21 supplies will be provided through black contracts on an annual basis. Base shops, services and other facilities will be used to accomplish efforts beyond the capabilities of the TAGBOARD unit. Crews and operational personnel will have access to and usage of an operational planning room, personal equipment section, medical facilities, communications, weather, and such other facilities as may be required. Spares and AGE for the B-52, except for those peculiar to the mated system, will be made available from SAC resources; peculiar items will be provided by this headquarters.

Capability:

The flying organization will achieve a capability to launch two operational sorties per month. B-52 check out, continuation training to include air refueling, and operational readiness will be as prescribed by SAC directives. The flying hour program for this unit will be established by SAC; crew to aircraft ratio will be $1\frac{1}{2}$: 1. There will be no requirement for mobility or deployment planning or exercising of this unit.

Employment:

This system will be employed solely against targets of National significance. When authority to operate is granted, a requirements list provided by USIB will be forwarded by DIA in coordination with JCS/JRC to SAC. A computer flight plan (or plans) will be developed by SAC covering the established objectives. A weather watch will be instituted monitoring conditions for take-off, the refueling area, target conditions, and the recovery area. A JC-130 detachment with all flight plan data pertinent to the approved objectives will deploy to the area best suited to conduct air recovery. Similarly, an air refueling detachment will deploy if required. The Strategic Air Command (SACRECONCEN), as the operational commander, will closely monitor the weather in all approved operational areas. When the weather, as forecast by SAC Weather Control, is forecast to be satisfactory for the mission, SAC will notify the JCS and request authority to launch an approved mission. If approved by the JCS, the appropriate unified and specified commands will be directed by the JCS to execute and support the mission. On receipt of mission approval, the KC-135 refueling aircraft will take off, if necessary, to

be in the refueling area prior to ETA of the mated system. After refueling, the mission proceeds to the separation point where final check of the D-21's is concluded and one drone selected for the sortie. After separation, the B-52 again makes contact with tanker aircraft if necessary and returns to home base with the spare drone. After its sortie, the D-21 is met by JC-130 recovery aircraft where air snatch of the payload and drone destruction occurs. Operations are concluded by the JC-130 detachment when the film is returned for processing and exploitation.

Communications:

TAGBOARD teletype and data requirements will be supported within the existing NRO BYEMAN communications network. Data capability between SAC (WARM), Beale AFB (WAMPUM), and/or Area 51 (CABLE) is adequate for flight plan information. Teletype support will be provided between JRC and SAC by NRO/Pentagon relay (GUARD) which will also provide multiple addressing capability within the BYEMAN system. Additional circuits, equipment, or addressee indicators are not programmed at this time due to current capability of the BYEMAN communications network. Until the unit moves to Beale AFB, flight plans will be transmitted from SAC to Area 51 via CIA (ADIC).

Personnel:

Military personnel resources will be provided by SAC. The USAF Military Personnel Center will provide for a two-year stabilized tour for assigned personnel with a planned rotational program to preclude excessive losses of trained and cleared personnel at one time. It will also preclude the premature loss of specially trained personnel to USAF and SAC personnel levies.

Security:

In the event Project TAGBOARD remains at Area 51, the existing compartmentation of TAGBOARD within the Project OXCART security access will be maintained. The history, production, contracting, funding and operations will remain black.

However, if Project TAGBOARD moves to Beale AFB, security for the Project's operations, communications, contracting, procurement, funding and history will be compartmented within the BYEMAN Security Control System as a separate access apart from Project OXCART. This change will effect a separation between Project OXCART and Project TAGBOARD security. All other aspects of Project TAGBOARD at Beale AFB, not in the BYEMAN system as described above, will be governed in accordance with Air Force Special Access Program requirements (AFR 205-1). Overall TAGBOARD security control will remain with the Director, Program D, NRO. Maximum practicable security precautions will govern every phase of operations.

~~TOP SECRET~~

Handle via BYEMAN Control System

TAGBOARD System Project Office (SPO):

The TAGBOARD SPO currently located at Burbank will remain under the control of the Director, Program D. He will function as the Program D representative on those matters specified by the Director.

~~TOP SECRET~~