AFEHRI File 19-11-9

Research Materials/Source Documents
PERSONNEL

FILE TITLE: Enlisted Flight Systems Operators

Reviewed by:

AFEHRI Representative G.R. Akin **date** 4 Dec 97

EPC Representative _____ **date** 28 Jan 98

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GARY R. AKIN, CMSgt, USAF
Director
Air Force Enlisted Heritage Research Institute

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ABSTRACT

The Strategic Air Command conducted a test to determine the sibility of replacing the navigator on the KC-135 crew with an listed radar/systems operator while at the same time maintaining sion effectiveness. This crew composition was based on the results the previous dual Inertial Navigation System (INS) test, GIANT NGE. The results of that test indicated that reducing the crew plement to three with the copilot assuming navigation duties utiliz- a dual INS was not feasible. Additional workloads imposed on the lot and copilot during some phases of flight created potential ety problems. To alleviate this condition, a fourth enlisted crew ber was added to perform the duties of safety observer and systems rator. The test crew consisted of a pilot, copilot, radar/systems rator, and a boom operator. The exercise term assigned the test GIANT BOOM.

Fourteen productive missions were flown between Jul 76 and Sep 76 an aircraft configured with a dual INS. Test sorties were designed evaluate the aircrew's capability to perform the Emergency War Order O) mission as well as missions covering nearly the full range of air fueling squadron flying activities.

It was concluded that addition of the fourth crew member, a specially ined enlisted radar/systems operator, reduced pilot overload conditions ring emergencies and critical phases of flight. Although workloads on pilots were understandably increased during certain phases of the ight because of navigation responsibilities, at no time did pilot/ ilot overload condition constitute a discernible safety problem.

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BACKGROUND

1. The Strategic Air Command (SAC) has been involved in a continuing effort to modernize the avionics on board the KC-135 tanker fleet. Improvement/modernization of the KC-135 navigation equipment holds a high priority in this effort. SAC has been considering the installation of an Inertial Navigation System (INS) to provide the navigational accuracy necessary to accomplish the mission. CINCSAC directed that tests be conducted to determine the expanded capabilities of the KC-135 aircraft if a dual INS were installed. The INS equipment and the configuration of the aircraft used for the GIANT BOOM test were identical to that of the GIANT CHANGE test. The reliability of this equipment, its adaptability to the air refueling mission, and the fact that it does significantly expand the capabilities of KC-135 aircraft were all established during the conduct of GIANT CHANGE. This test (GIANT BOOM) was designed to examine the feasibility of altering the aircrew composition to replace the navigator with a specially trained, nonrated, enlisted crew member. The two persons chosen to fill this new position, for the test, were KC-135 boom operators with considerable experience. The pilots were to assume responsibility for aircraft navigation utilizing the dual INS system. The designation of the new enlisted aircrew member is the Flight Systems Operator (FSO).

2. Specific test objectives were:

a. To determine the capability of the Flight Systems Operator to perform those duties normally performed by the aircrew navigator with the exception of actual aircraft navigation which was the responsibility of the pilot/copilot. These duties included such items as:

(1) Equipment turn on/operation.

(2) Monitoring departure, cell join up, enroute cell procedures, and station keeping.

(3) Radar scope interpretation to include position fixing, weather detection, electronic rendezvous, and airborne radar directed approaches.

(4) INS position fixing and plotting.

(5) Monitor of aircraft position during copilot overload situations, i.e., refueling, emergencies.

(6) Monitor penetration and approaches.

b. To assess the impact of special communication procedures, mission changes while in flight, and emergency procedures on crew workloads.

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SECTION IV

DISCUSSION

The results of this study indicate that the enlisted Flight System Operators performed very well and were able to accomplish all aspects of all missions as required. They were able to run the rendezvous across all missions particularly well. The use of the radar for weather avoidance was accomplished with no difficulties (in contrast to the difficulties encountered by the copilots in interpreting weather returns in GIANT CHANGE). This was, no doubt, due to the FSOs having received considerably more training on radar interpretation than the copilot received in the earlier study. On the other hand, the FSO did have some difficulty in shooting ARDAs but this is considered a difficult task (even for personnel experienced in such procedures). In addition, the number of sorties flown in this study is not deemed sufficient to acquire a high level of proficiency in shooting ARDA's.

Initially, difficulties were encountered in using the FSO as conceptualized in the test plan. There was a strong tendency for the crews to employ the FSO in the same manner that navigators are currently used in the KC-135 refueling mission. In the first half of the study, the crew had to be constantly impressed with the fact that the copilot had prime responsibility for navigation and the FSO had responsibility for the radar function, rendezvous, and to relieve the copilot of navigation duties when the copilot was in an overload situation. This confusion was partially because no detailed and formalized crew procedures using an FSO had been developed prior to the test. As the program proceeded, the crews

did a good job of developing crew procedures and eventually developed excellent crew coordination and integration. If SAC does convert to use of an FSO, such formalized procedures should be further developed.

In line with this observation, the authors also noted that the FSO's workload was probably higher than necessary on the standard refueling mission. The 81 percent task load cited in the Results section reflects some self-imposed task loading such as performing extraneous navigation functions: using the radar to cross check the INS and taking radar fixes when not required. This was due to the FSO's not being sure of his function and his practicing navigation in anticipation of the later polar flights. It is felt that this artifact in the data inflated the task load figure approximately 20 percent so that the actual required workload on the standard mission would have been approximately 61 percent. In an operational situation with an experienced FSO, the authors feel that a realistic task load would be at this level (61 percent). The FSO task load on other portions of the test are considered accurate.

The addition of the FSO in this study reduced the copilot's task load approximately 40 - 60 percent depending on the type of mission. The additional crew member overcame all the disadvantages encountered in the GIANT CHANGE Program. The copilot's workload was reduced to reasonable levels, no critical checklist items were omitted and the concept of "see and avoid" was preserved. There were isolated instances of errors and some phases where the crews were fully loaded (but never overloaded). In short, the crew performance was dramatically changed from that observed in

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GIANT CHANGE. However, two observations that were similar were the requirement to have a better crew station layout than that in the test aircraft, and the necessity for more time to perform preflight checks (due to the INS procedures and warm-up).

Since the enlisted FSOs performed so well, the question has been raised: Is it possible that a less experienced individual could with adequate training also perform the required tasks? Our answer is a qualified "yes." The qualifications are:

a. Much more extensive training will be required.

b. Very careful selection procedures will have to be followed, so that candidates should show a high general aptitude as well as specific capacities in the skills required. Probably, a selection test for this AFSC should be developed.

c. Testing in selected squadrons should be conducted prior to operational implementation.

SECTION V

CONCLUSIONS

1. The results of this study definitely indicate that the use of an experienced enlisted FSO in conjunction with a copilot to perform the navigation function for refueling operations is feasible.

2. The task load figures show no overload situations nor any safety hazard.

3. The use of a less experienced FSO will require more extensive training and careful selection of candidate operators.

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS STRATEGIC AIR COMMAND
OFFUTT AIR FORCE BASE, NEBRASKA, 68113

TO CC

18 December 1976

CT: Final Report, "GIANT BOOM Test," Concerning Use of Enlisted Flight Systems Operator (FSO) KC-135, Dated 15 December 1976

O: DO (XP) DP AC

: CV/CSH 21Dec76

1. I have reviewed the comprehensive report prepared on subject test as conducted by DCS/Operations during the period June 1976 through September 1976. I compliment all concerned for the conduct of this test--specifically personnel of the Operations Deputate; the 509 BMW, Pease Air Force Base, New Hampshire; and the 93 BMW, Castle Air Force Base, California--and, certainly, the crew members participating in this test program. It was apparent that the success of this test was due in large measure to the airmanship and professionalism of SMSgt Haven J. Moore and MSgt Robert A. Whittier, 509 BMW, who served as the initial Flight Systems Operators (FSO) for the training at the 93 BMW and the conduct of this test at Pease AFB.

2. Now that this test has established, conclusively, that a basically qualified, experienced, and specially trained enlisted Flight Systems Operator can effectively support the pilot and copilot on dual INS equipped KC-135s (for routine and EWO-type aerial tanker missions) without compromising effectiveness or flight safety, I want a major SAC staff action initiated to determine the actions necessary to implement this program throughout the air refueling units of SAC.

3. DCS/Plans should take the lead in a full-scale analysis of all factors involved--working in conjunction with DCS/Operations and DCS/Personnel as required--and develop a plan for my approval that will implement the FSO concept throughout the air refueling units of SAC in an orderly, but expedited, program of selection, training, assignment, aircraft modification, and manning documents, etc., to phase this program in across-the-board within this command. I recognize the extensive ramifications involved in a program of this magnitude, and the extensive work this will require within the SAC staff and between SAC and the Air Staff . . . but want to get on with it, now. I recognize that a key to the success of this program is the equipping of our KC-135s with reliable, dual inertial navigation systems (INS), and that should be an essential portion of the programming effort. Also, I am aware of the need for resolution of the alignment time of the INS as it affects ~~phase~~ FAST RM action requirements of SAC's emergency war orders. DCS/~~Personnel~~ PLANS RM should resolve a planning solution that will provide ~~phase~~ FAST alignment RM.

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prior to launch or an inflight alignment capability. A career field must be established; selection programs for identifying entry requirements into the FSO career field, training programs, aircraft modifications, cockpit layout, preliminary and CCTS training procedures, check lists, and crew coordination procedures will also be required. The mix between FSO crew members on combat crews and rated navigators within the manning documents of our tanker units must be balanced; the extent to which our refueling units will require rated navigators must be established in the proposed UMD for SAC units. Time-phased decisions on aircraft modification and all of these personnel selection, training, and assignment actions must be incorporated into an overall flow chart for this program.

4. The program developed must be costed, and these costs must be compared to present crew force costs--direct and indirect. AC must be deeply involved in this aspect of the program from the outset.

5. I think we need to get on with this and request that it be undertaken immediately. As a first action, I would like for DCS/Plans to prepare a time-phased outline of the staff actions involved in the development of such a comprehensive program and provide an estimate of when we can expect completed action and command decision on such a plan. I would hope that we could have all of this wrapped up and ready for decision and initial implementation prior to 1 June 1977.

6. I am prepared to discuss this with you at any time in order to clarify SAC command positions needed during the development of this comprehensive action.

RUSSELL E. DOUGHERTY
General, USAF
Commander in Chief

3. Background: The E/OR has been employed as a management evaluation indicator by OSD and Congress. While no particular ratio has been specified as optimum, a high E/OR is thought to be beneficial and a low E/OR to be noncost effective.

The Air Force currently has the lowest E/OR within DOD. Table I compares the Air Force to the other Services.

TABLE I

Comparative E/OR Ratios for Selected Military Organizations

Organization	E/OR Ratio
US Air Force (FY 74)	4.83
US Army (FY 74)	6.42
US Navy (FY 74)	7.57

The Air Force ratio has unfavorably declined from over five in the 1950s and 60s to the 4.83 at the end of FY 74. There have been many factors that contributed to this ratio decline since the 50s. These include:

- increased crew ratios in the all officer Minuteman force
- dual-seated fighters
- conversion of enlisted-intensive support activities from military to civilian or contract manning
- enlisted-intensive support aircraft reductions
- advancements in technology which affect lower skill jobs
- demand for more senior and upper level managers in sophisticated management systems

Advancements in technology and evolving computerized management systems have also influenced the E/OR. These evolutions have two

officer positions and functions that have limited career potential but on the other hand would be real challenges to the enlisted ranks. In this regard it is noted that the original justifications for the E-8 and E-9 ranks included promises that added authority and responsibilities would be given to those selected. To date, little evidence exists that this has occurred. There have been cases where senior NCOs expressed a desire for added authority and responsibility, and in many instances they have demonstrated the capability to accept more challenging positions. Allowing them to do so will not only resolve the Air Force E/OR problem, but it will at the same time improve the morale of the enlisted force. Credible options that support these two objectives form the thrust of this study.

The study representatives recognize that the candidate list for conversion must include more than the undesirable type positions which are difficult to fill by satisfied career officers. Both "desirable" and "undesirable" career fields will be considered. The main criteria will be whether an NCO can perform the function without degrading mission effectiveness. Some career fields which require stringent educational prerequisites, i.e., doctors, lawyers, etc. will of necessity continue as officer positions. Generally, all other positions which do not require either an inordinate amount of pre-service or in-service schooling will be considered. It is felt that the pay and opportunity benefits in the Air Force for personnel with extensive specialized training which is useful in the civilian community would be insufficient to sustain an adequate retention rate for NCOs.

for a middle level manager is hard to imagine.

It was stated that the formal educational level of SNCOA graduates would not be initially considered. Such an evaluation is now in order. One qualification, however, should be stated; this data is taken directly from the individual's Personnel Records. Hence, it reflects mostly formal college courses taken. In many cases, little, if any, credit is from Air Force training courses. SNCOA Classes 73-A through 73-D were used. With a total of 840 students, the data sample is large enough to be statistically valid (N = 840). The average educational level of these classes was two years of college. However, some 79 had bachelor's degrees; 11 had master's degrees; 2 had some graduate work beyond the bachelor's; 44 more had over three years of college (90 semester hours). Thus, 11% of these classes had the bachelor's degree, or higher. An additional 5% were within a year of their degree.[6] The percentage of degree holders corresponds closely with the percentage of people in the 35-44 year age group in the United States in 1971 holding a degree (13,3%)[7] This is no mean achievement, as almost all these NCOs obtained their degrees after coming on

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to investigate the feasibility of utilizing selected senior noncommissioned officers (NCOs) as commissioned officers. The principle objectives were to (1) examine the qualifications and responsibilities of senior NCOs prior to 1940, (2) analyze the changes in senior NCO duties and qualifications from 1940 to 1973, and (3) evaluate the qualifications of these NCOs in light of their expanded formal and professional military education and training for commissions. In so doing this it became necessary to show the evolution of the commissioned officer throughout this period.

CONCLUSIONS

The following conclusions can be drawn:

1. There was a distinct gulf between the officer and the NCO corps in 1940, both from tradition, and in terms of their respective qualifications and duties. The officer corps had risen from the feudal chivalry and, in the case of England, had largely been drawn from the

landed nobility. Until 1940, this characteristic had persisted in modified form, with officers in the United States being drawn from the middle class. They were mostly West Point graduates, and almost all Regular officers. The NCOs had been promoted from the most intelligent of the enlisted men. The enlisted corps, in general, however, was drawn from the lower classes of society. Even in the Army Air Corps of 1940, middle class individuals, who could think for themselves, were a rarity. NCOs enforced discipline with their fists. High school graduates were rare.

2. <u>The NCO Corps changed rapidly during the period 1940-1973, becoming much better educated, and drawing on intelligent, self-disciplined men</u>. The requirements of weapons systems demanded men with a much higher education. These men had to be able to perform complex tasks requiring a high degree of reasoning ability and self reliance. Both because of these characteristics and because of retention problems, NCOs were now picked from the best technicians available. Management training was virtually non-existant until the early 1950s. With the advent of the NCO Academies in this decade, "team management" concepts were intro-

duced to the NCO corps. Concurrently came a rise in formal educational attainments. Due to both the AF off-duty education program and to the requirements of civilian jobs, more and more NCOs went back to school. Also, a more educated man was entering the enlisted force. By the end of the 1960s, degree-holding senior NCOs were begining to appear in fair numbers. In 1973, USAF opened a senior NCO Academy, designed to educate selected senior NCO in broad scale management and miltary theory.

3. The nature of the officer corps changed significantly between 1940 and 1973. The increasing complexity of weapons systems and the skills necessary to manage and operate them saw the AF require an all-degree officer corps. Officers were provided opportunities to go back to college at AF expense, not only to get the bachelor's degree, but also advanced degrees if in the forces' interest. At the same time, "management by objective" and "Team management" replaced the classic authoritarian leader in many areas in the force. Training in these techniques was speedily introduced into the officer PME system, but was not readily available for the young, junior officer.

4. The opening of the USAF Senior NCO Academy saw the completion of a full, formal PME system for NCOs. Spelled out in AFR 50-39, it established a three tier system, consisting of NCO Preparatory Schools, Command NCO Academies, and the Senior NCO Academy. Precise curricula and eligibility requirements were specified.

5. Senior NCO Academy students were handpicked. These represented the cream of the top two grades of the NCO Corps. Selection was done be command master selection board, using basically Chief Master Sergeant selection criteria. Actual criteria were established by Military Personnel Center.

6. Selected Senior NCO Academy graduates also met the bachelor's degree requirement for commissioning. Analysis of the first four SNCOA classes showed 11% of the 840 graduates had at least the bachelor's degree.

7. Junior officer retention after initial tour of duty was low, near 50%, causing a middle management gap.

8. Selected (degree holding) SNCOA graduates were well-suited for commissioning to fill this gap.

a. Completion of the two top NCO PME schools fully qualified the NCO for entry as a middle manager, with formal training at least equal to, if not superior to, the young officer. Backing this up was extensive experience in practical managerial responsibilities. Estimates of the comparable college semester hours of these two schools ran to about 60, with all being in the areas vitally concerned with middle management.

b. These selected SNCOA graduates are fully qualified, from all standpoints, to assume "officership." The restrictions placed on enlisted men in Dr. Huntington's famous study no longer apply in light of the changed job and educational requirements of these men.

c. Adopting such a program would tend to upgrade the status of the enlisted corps. This was vitally needed in order to attract intelligent, middle class young men.

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS STRATEGIC AIR COMMAND
OFFUTT AIR FORCE BASE, NEBRASKA, 68113

28 JAN 1977

General David C. Jones
Chief of Staff, United States Air Force
Washington, D. C. 20330

Dear Chief

You will recall our various conversations, and your letter of 24 April 1976 (Atch 1), concerning our tests of the feasibility of utilizing an experienced, trained enlisted crew member to assist the pilots with the front-end and cockpit duties with an Inertial Navigation System (INS) equipped KC-135 during expected tanker activities. We have completed the tests; and a copy of the final report, dated 15 December 1976 (Atch 3), is attached for your information.

Our testing program consisted of selecting two experienced boom operators (SMSgt Haven J. Moore and MSgt Robert A. Whittier, 509 BMW) and establishing an in-house training program at Castle--72 hours of academics, five navigation trainer missions, and four orientation flights. After this training program at Castle, we designated these NCOs as Flight System Operators (FSOs) and had each of them fly seven test missions in a KC-135 aircraft equipped with a dual Palletized Inertial Navigation System (PINS). The ASD Human Resources Laboratory people observed the tests at Pease AFB and reported their findings along with our test data.

In summary, we found that an experienced enlisted aircrew member could assimilate and utilize this sort of training as an FSO effectively to assist the pilot and copilot throughout the expected phases of flight activity in the KC-135. The test was so designed that the crew was exercised throughout the normal flight envelopes, plus simulated emergency procedures; i.e., polar navigation with simulated dual PINS failure to airborne radar assisted approaches without external aids.

These tests demonstrated that an experienced and similarly qualified, specially trained enlisted FSO can effectively support the pilot and copilot on dual INS-equipped KC-135s, under routine and EWO-type tanker missions, without compromising effectiveness or flight safety in the operation of our KC-135s. This test convinces me that we can proceed with the programming phase of staff and command activity; and I have directed the SAC staff, working with the Air Staff and others, as necessary, to determine the actions required to implement this program throughout air refueling units of SAC, and possibly the ARF-associated KC-135 units.

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A copy of my memo to the SAC staff directing the development of a comprehensive program to accomplish this is also attached (Atch 2). In this memo, you will note that I have requested the comprehensive program for implementation to be available for my decision by 1 June 1977. Immediately after my approval of our staff developed program, I will provide it to AF/XO and AF/PR for Air Staff review and recommendations to you. With your approval of the program we have developed, I think we can proceed with command-wide implementation.

Implementing such a program will not be possible without Air Force-wide support and enthusiastic assistance; but now that we have been satisfied that this can be done effectively and without compromise to flight safety, I am ready to proceed with definite programming actions--and we have this under way within SAC.

Respectfully

SIGNED

RUSSELL E. DOUGHERTY
General, USAF
Commander in Chief

3 Atch
1. CSAF/CC Ltr, 24 Apr 76
2. CINCSAC/CC Ltr, 18 Dec 76
3. GIANT BOOM Test Final Report, Enlisted Radar/Systems Operator, KC-135, 15 Dec 76

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5 AUG 1970

General David C. Jones
Chief of Staff, USAF
Washington, D. C. 20330

Dear Chief

For our discussions last week and your request for an update on the test of an enlisted man occupying the navigator position on a PINS equipped KC-135.

SAC training developed a test plan, nicknamed GIANT BOOM, to explore the possibility of using an experienced boom operator as a systems monitor in the navigator station as a third person in the cockpit. Two experienced boom operators from Pease AFB were given a specially designed training program at the Castle CCTS during 1-30 June. The special training consisted of 53 hours of academic training, 10 hours of synthetic trainers, and four flights. The purpose was to teach the two boom operators to operate the equipment at the navigator station and perform all functions necessary to support the pilots during possible periods of overload. As you indicated, there was no intent to train enlisted navigators, but rather to provide the skills necessary to assist the pilots in their navigation and rendezvous maneuvers.

During training, the boom operators proved to be enthusiastic students and did not encounter any difficulties learning their new tasks. However, at their request, extra sessions in the synthetic trainer were provided to improve their radar interpretation skills. The students flew the first three training flights and demonstrated above average progress. The fourth flight was an informal evaluation viewed by the Castle CCTS instructors and both produced excellent performances.

The operational test at Pease AFB began on 12 July. Both enlisted men flew on an orientation mission and received training by Delco on the PINS equipment which was not available at Castle. Two follow-on test missions have been flown so far and are being closely monitored by the Test Director, the Wing KC-135 Instructor Navigator, and by a representative from the Human Factors Branch at ASD.

OH

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A major test assumption is that the pilots are under stress the entire mission and must depend on this third person for navigation and rendezvous support at all times. This simulates a worst case condition and allows concentrated data gathering.

The enlisted men have performed well during the test; however, some problems have surfaced. While their equipment and procedural knowledge is excellent, there are indications adjustments to initial training will be required to ensure greater proficiency. Due to previous experience, the subjects possessed considerable airmanship; without this experience factor, additional training would be necessary. There is a tendency for aircrews to depend on the radar/systems operator as they previously depended on the navigator, thus shifting decision making responsibility for navigation from the pilot to the enlisted man.

The ASD people have requested the test be extended for two missions for each enlisted man to gather additional data for their evaluation, and we have agreed to provide these extra missions.

SAC representatives plan to attend a Crew Complement Conference hosted by HQ USAF. The conference is designed to have SAC, MAC, ASD, and Air Staff discuss the whole issue of aircrew complement and the preliminary data from the GIANT BOOM test should prove most helpful.

On completion of the GIANT BOOM test, a report will be prepared by the SAC Test Director with the assistance of ASD. Also, studies in other SAC directorates should be well advanced by that time and a comprehensive look at manning the KC-135 with an enlisted man should be available.

Respectfully

SIGNED

RUSSELL E. DOUGHERTY
General, USAF
Commander in Chief

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