

ADC Historical Study # 7

All-Weather Interceptor Weapons Training in  
the Air Defense Command 1950-1954

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ONE

## ESTABLISHING AN ALL-WEATHER INTERCEPTOR GUNNERY PROGRAM

### The First All-Weather Interceptors

Air defense interceptors had to meet two exacting requirements. First, they had to have the ability to fight in darkness and in any kind of weather. This meant that they had to have radar in order to "see" and to have such other devices as de-icers and instrument landing equipment so as to be able to operate in bad weather. Second, they had to have the rate of climb and the speed of jet fighters in order to cope with fast, high flying bombers. The relatively slow propellor-driven aircraft were practically worthless against the modern bomber.

Development of such an interceptor lagged far behind the need. Late in 1949, the Air Force accepted the proposal of the Lockheed Aircraft Corporation to refashion its twin-place jet trainer, the T-33, into a jet night interceptor by adding radar and armament so that an aircraft might be had which at least partially filled the bill. As the only twin-place jet aircraft in production at the time, the T-33 was the only aircraft which could be used. The modified aircraft, designated the F-94A, was first received by air defense squadrons in the fall of 1950. When the Air Defense Command was activated on 1 January 1951, sixty of the 365 aircraft assigned to the new command were F-94As. Delivery began to ADC squadrons of

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the first jet fighter designed for all-weather interception, the F-89A, some five months later, in June 1951.<sup>\*</sup> By the end of 1951, of the forty-one squadrons assigned, five were equipped with F-94As, five had the improved "B" model, and two had F-89Bs and F-89Cs which were later versions of the F-89A.<sup>1</sup> At the end of February 1953, just before a wholesale conversion began to rocket-armed interceptors, of a total of forty-eight squadrons, three had F-94As, seven had F-94Bs, and three had a combination of F-94Bs, F-89Bs, and F-89Cs.<sup>2</sup> By mid-1954, the gun-armed all-weather interceptors had been practically phased out of the command. In all, there remained only thirty-nine F-89Cs, eleven F-94As, and five F-94Bs.<sup>3</sup> By the end of the year, none remained.

All told, twenty-four squadrons had at one time or another these interim gun-armed jet all-weather interceptors. The maximum number of squadrons possessing these aircraft at any one time (in September 1952) was sixteen.

All of these early all-weather interceptors were equipped with the E-1 fire control system.<sup>\*\*</sup> This was an interim piece of equipment developed out of existing components to meet the need. The E-1 system was designed for two-man operation and consisted of a fire control radar, the AN/APG-33; an optical gunsight and computer, the A-1;

\* The F-94A and F-94B were not truly all-weather aircraft because they did not have adequate de-icing equipment. A more accurate term was night-fighter. A de-icing equipment modification was undertaken in 1952, but the equipment proved to be defective and was eventually wired in the off position.

\*\* Information on the development of the E-1 system, its components, and a description of its operation is given in Appendix I, this study.

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and two scopes, one for the radar observer and one for the pilot. With the E-1 system it was possible to track either visually or with radar.

All of these aircraft had fixed guns -- the F-94s the .50 caliber machine gun and the F-89s the 20mm cannon. With fixed guns it was necessary to use the lead-pursuit course attack because in order to deliver enough shells to score a kill, the guns had to be trained on a bomber for an appreciable time. To hit the target continuously and to provide the required lead angle for the guns, the aircraft had to be flown so that it was headed slightly ahead of the target and turned with the target.

Requirements for Gunnery Training

To train all-weather crews in the complete use of their fire control system required special equipment such as: targets which the radar could "see," i.e., would reflect the radar beam; tow target cable reels which could handle a cable long enough to make the target and the aircraft towing it distinct on the radar scope; aircraft to tow this cable and target at realistic speeds and altitudes; and a recording device to provide a means of evaluating the pilot's use of the fire control system. Unfortunately, all-weather interceptors were used in the air defense system long before these devices became available. In fact, the E-1 system aircraft were on their way out before anything other than makeshift equipment was in use.

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Lacking also were sufficient locations to conduct aerial gunnery training. The growing Air Defense Command found it exceedingly difficult to find ranges over which its squadrons could fire their guns.

The result of inadequate and improper facilities and equipment was a low state of gunnery proficiency. The situation was cogently summed up in a report on a survey of the Air Defense Command made in November 1951 by the Air Force Inspector General. The IG commented that:

The largest single training deficiency in Air Defense Command is the inability of the average fighter pilot to shoot accurately; the most vital phase of the fighter pilot's training has, as in the past, received the least emphasis. There are many reasons for this most serious deficiency which has plagued the fighter forces for the past five or six years. Basically, it stems from the lack of adequate planning and timely procurement of responsible agencies. The failure to provide adequate ranges, tow targets, and allied equipment, has long been the contributing factor.

Gunnery Ranges. The fundamental requirement for weapons training both for day and all-weather fighter squadrons was, of course, the use of areas over which firing could take place and nearby bases for the aircraft using the ranges. The ranges available to ADC (nearly all were in the north and over water) which were near to squadron bases were almost all unsatisfactory. Either they were closed much of the year because of inclement weather, or they were not large enough for jet air-to-air gunnery (100 by 50 miles was the desired size), or they were controlled by another command or service and they were crowded and their continued use was undependable. Some ranges had all three advantages.

\* See Appendix II for a list of the ranges available to ADC in 1951.

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The local range situation in the Western Air Defense Force was typical. Here four local air-to-air ranges were in use: the Queets, Washington Warning Area; the Oregon Coastal Warning Area; the Point Arena, California Warning Area; and the Camp Irwin, California Warning Area. <sup>5</sup> The Queets, Oregon Coastal, and Point Arena ranges were all controlled by the Navy. Bad weather prevented their use much of the time. The Army controlled the Camp Irwin range and its use was dependent upon the needs of that service.

To provide a supplementary range on which all of its squadrons could train, WADF began negotiating in 1950 for the use of the Williams Bombing and Gunnery Range in southwestern Arizona which was controlled by the Air Training Command. Because of the importance that this range and the staging base at Yuma, Arizona eventually assumed in ADC weapons training, emphasis at this point on their acquisition and initial development is warranted.

The Williams range was large enough for a number of squadrons to engage in either jet aerial gunnery or rocketry. Of great importance also was the fact that the weather conditions in this area permitted year-around operations. To use the range, a staging base was necessary. There were several bases in the area, such as Dateland Field, Gila Bend Field, Yuma County Airport (a former Army field), and Luke AFB. Only the latter, which was being operated by the Air Training Command, could be used immediately -- the other bases needed rehabilitation. Of the other bases, the Yuma County Airport required the least amount of work. It was also very well located for use of the range.

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An agreement for the use of the Williams range by ADC squadrons was completed on 1 March 1951.<sup>6</sup> Under the terms of the agreement, both ADC and ATRC aircraft were to have unhampered use of the range and ADC squadrons were to be based at Luke AFB as tenants. Looking to the future, an alternate plan was written into the agreement which provided that if ATRC's requirements prevented use of Luke AFB by ADC and the latter had to find its own base, the range was to be divided between the two commands. The alternate plan, written with the use of Yuma County Airport in mind, provided that the range was to be divided into an eastern and a western section. The western section plus a lane approximately ten miles wide adjacent to the Mexican border across the whole range was to go to ADC.

Headquarters WADF and ADC began almost immediately to take steps to acquire the use of the Yuma County Airport. Approval came from Air Force Headquarters for occupancy and rehabilitation of the field early in May.<sup>7</sup> Coinciding with this approval was an announcement by ATRC that an increase in its activities made necessary the full use of Luke AFB and that WADF units would have to move.<sup>8</sup> The process of acquiring the Yuma Airport was given to the Army's Corps of Engineers. A right of entry was obtained by the latter on 5 June 1951 from the county and the Bureau of Reclamation, both of which had rights to the field.<sup>9\*</sup>

\* During World War II, the Yuma field was used by the Air Corps Training Command as a gunnery school. In September 1946, the field was declared surplus by the Army and it was transferred to the War Assets Administration. The latter transferred it to the Bureau of Reclamation and also gave Yuma County rights to the field. After

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The following day, the gunnery detachment, which had been established at Luke AFB for support of WADF units, began moving in. <sup>\*\*</sup> On 7 June the detachment was discontinued and the 4750th Air Base Squadron (Gunnery Training) was established at Yuma to operate the base.

This organization was assigned to the 1st Fighter-Interceptor Wing (later changed to the 4705th Fighter-Interceptor Wing) until 1 March 1952 when it was assigned directly to Headquarters WADF.

In the area occupied by the Air Force there were two warehouses, a post exchange, an operations building, a barracks, and a large hangar. Construction of new facilities and rehabilitation of existing facilities had to progress along with operation of the base. The

\*(Cont'd) securing the right of entry, the Corps of Engineers drew up a Memorandum of Agreement for the Bureau and an agreement for the Civil Aeronautics Administration which was representing the county. Under the terms of these agreements, the title to the land held by Reclamation Bureau was to be transferred to the Air Force. The Air Force was in turn to give the Bureau and the county rights to certain areas. The county was also to get the right of perpetual easement over the runways. Neither of these agreements were ever signed, however. Operations at Yuma continued under the original right of entry. Settlement of the issue did not come until 1954. First, in December 1953, the CAA informed USAF that it agreed to the transfer provided the rights of the county were observed. Then in March 1954, an agreement was consummated with the Bureau of Reclamation which provided that the latter, which had its facilities scattered around the field, would be resettled in one area and buildings constructed for it if necessary. On 29 July 1954, the Department of the Interior issued a letter of intent stating that it agreed to the transfer of its holdings to the Air Force. The latter agreed to grant to the Bureau permanent right to the use of certain buildings and areas. The county was to be given right to its area and perpetual easement over the runways. See reference note number nine.

\*\* No request was made for activation of the Airport at the time of occupancy. A request was made of USAF and granted in February 1952. On 11 March 1952, ADC General Order number twenty-four placed Yuma County Airport on active status and assigned it to Western Air Defense Force.

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initial project -- repair of runways and taxiways, repair and modification of the fuel systems, and refurbishing of buildings -- was completed in November 1951. Troops had to be housed initially in the hangar.

Yuma Airport opened for business at the end of July 1951 with the barest minimum of facilities for handling one squadron. The first squadron arrived in the first week of September. WADF set up a schedule for each of its squadrons to go to Yuma for twenty days each six months. During the first six month period, only a few of its squadrons were able to go either because of a shortage of aircraft or crews, or of maintenance difficulties, or of other projects of higher priority, or of conversion to new aircraft types.

Early in 1952, as will be discussed in a subsequent chapter, ADC Headquarters decided, because of the common lack of gunnery ranges throughout the command, to establish a command-wide central gunnery camp at the Yuma Airport. By March 1952, although facilities were not entirely adequate -- troop housing, supply and maintenance support were insufficient -- ADC directed each Defense Force to send twelve to fifteen aircraft to Yuma County Airport monthly.

Meanwhile, the Eastern Air Defense Force, faced with a range problem similar to WADF's, acquired the use of the Air Proving Ground Command's Eglin range in Florida and the use of Eglin Auxilliary Field number six as a staging base.

The Air Proving Ground ranges in Florida were the only ones with nearby bases which were immediately available. Negotiations for the

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sending squadrons to the Yuma County Airport. As did the other Defense Forces, CADF studied various locations with the view toward establishing a central gunnery range for all of its squadrons. Consideration was given to the use of Houma Field near New Orleans, Louisiana. This plan, however, as well as EADF's, for establishing a permanent gunnery camp, was abandoned in favor of setting up a large, well-equipped, command-wide gunnery camp at Yuma County Airport.

Training Equipment. At the time of ADC's activation in January 1951, the gunnery training equipment in use was suitable only for training in day fighters of the relatively slow propeller-driven type. The equipment was inadequate for jet fighters. There was none for all-weather gunnery training. The urgent need for more advanced training equipment had long been recognized and development programs had been initiated. As early as January 1950, the Continental Air Command, which had responsibility for air defense at that time, had expressed concern over the lack of equipment for all-weather weapons training and asked that such equipment be procured as soon as possible. ConAC wrote to USAF that:

The urgency for this action is emphasized by the fact that no firing training facilities are available even though this command will receive the F-94A in the spring of 1950, the F-86D in October 1950, and the F-94B in February 1951. The fact that these aircraft have radically different tactical and technical characteristics necessitates new training equipment and procedures.

\* The F-94A was not received until the fall of 1950 and the F-86D until the spring of 1953.

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Higher headquarters replied that it was aware of the great importance of such training items and that development programs were underway for equipment such as cameras, targets, recording devices, and firing error indicators.<sup>19</sup> However, the availability of these items in the field, USAF continued, would probably be some time off.

One of the basic needs for all-weather gunnery training was a radar reflective tow target. The targets available at first could not even withstand towing at high speeds and altitudes. The targets in use until late in 1951, the A-6B, the A-25, and the Aero 25-A, either disintegrated completely or were torn to shreds when towed above about 20,000 feet and 200 knots.<sup>20</sup> To prevent loss of the target, ADC squadrons resorted to such expedients as wetting the targets before a mission or sewing cotton webbing across the ends.<sup>21</sup> Toward the end of 1951, a new A-6B banner target made of a plastic material, polyethylene, which could be towed at realistic speeds and altitudes,<sup>22</sup> was received by ADC squadrons.

This satisfied the need for a target for jet gunnery, but not for a target which could be "seen" by radar. A satisfactory answer as to how to make a banner target radar reflective simply had not been found. ADC Headquarters made this clear in a reply to a complaint of EADF's over the lack of such targets. Wrote ADC, "The inadequacy of present target configurations is recognized throughout the Air Force and every effort is being made by the many interested agencies to resolve this problem. Unfortunately there is no immediate solution in sight."<sup>23</sup>

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ADC squadrons had to resort again to expedients in order to have a radar reflective target. One of the means used was to sprinkle the target with chaff and secure it by spraying the target with dope.<sup>24</sup> A more satisfactory method was to fasten a metal radar reflector to the target.

A closely allied need was an aircraft which could tow the target at speeds and altitudes required for realistic jet aerial gunnery. Until late in 1951, targets were simply laid out on the runways and pulled into the air by F-51s. This often resulted in damage to the target and in some cases to the aircraft. A banner target carrier was developed in 1951, the Aero A-1, which could be attached to the T-33 trainer and to most of the current tactical jet aircraft.<sup>25</sup>

The Aero A-1 was limited, however, in that it could handle only 900 feet of cable along with the target. While radar ranging and visual firing was possible on a radar reflective target towed at 900 feet with the E-1 system, a cable of much greater length was necessary for safe scope firing.

A requirement was submitted to higher headquarters in October 1952 for a large tow aircraft capable of sustained flight at high altitude and speed.<sup>26</sup> ADC wanted at least twelve aircraft assigned which were able to tow a twelve by sixty foot target on two miles of cable at 250 knots, and 35,000 feet. In justification, ADC gave the opinion that "synthetic trainers, although adequate for learning procedures, are inadequate in maintaining proficiency. Thus provisions must be made which allow interceptor crews to train under more

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nearly combat conditions." <sup>27</sup> Washington refused ADC's request, however, stating that it was not Air Force policy to procure an aircraft specifically designed for a towing mission. <sup>28</sup> Unit tactical aircraft should be used until a drone aircraft, currently being developed, could be made available.

This was unsatisfactory, ADC explained. <sup>29</sup> In rocket-armed interceptors, firing from the radar scope would be necessary and a means had to be provided for actually scoring hits. A banner target was the device for this. With the greater ranges of the fire control system on rocket-bearing aircraft, a larger target than the six by thirty foot one would be required. This large target and the long cable required could not be handled by jet fighters. Therefore, a large aircraft with high performance characteristics was needed. However, if the requirement for an aircraft specifically designed for towing could not be filled, ADC said that it would be satisfied with the B-57 Canberra.

At this writing, this question has not been settled. In the meantime, ADC received B-45 jet bombers for towing, the first of which arrived in December 1953. No squadron equipped with the E-1 system aircraft trained with B-45s, however. By the time the B-45 aircraft were in service, early in 1954, the E-1 aircraft, rapidly being replaced with rocket-firing interceptors, were no longer being sent to the central training base at Yuma where the B-45s were operating.

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## Maintenance and Calibration

Peripheral to the actual training of pilots in gunnery, but nonetheless important in the acquisition of gunnery proficiency, was the maintenance and calibration of the guns and the fire control system and the maintenance of the aircraft itself. In several ways the condition of the equipment and the aircraft affected gunnery training: in order for the complete fire control system to be used, each component had to perform correctly; properly functioning equipment was necessary for the pilots to gain confidence in their fire control system; the guns had to be correctly harmonized in order for the pilots to get hits; and the aircraft including the armament system had to be in commission, of course, to be used in gunnery training. The latter problem, that of aircraft out of commission, as will be told later, became most serious in the training of crews in the F-89 equipped squadrons.

The problem in the acquisition of gunnery skill in the F-94 and F-89 squadrons, resulting from a lack of knowledge of the fire control equipment and the ability to maintain and calibrate it properly, was cogently expressed in a report made by the USAF Inspector General <sup>30</sup> following his survey of ADC in October 1951:

It would be logical to assume the gunnery capability would rapidly increase now that new targets and accessories are in the offing. The establishment of central gunnery camps in both WADF and EADF, wherein units assigned will go for yearly concentrated gunnery training, should increase the over-all capability. However, the reverse is true. Air Defense Command's gunnery capability is rapidly decreasing with the delivery of each new aircraft.

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The basic reason for this regression is the new fire control system installed in the new aircraft. Comparatively few pilots can qualify as expert aerial gunners with the new A-1CM gun sight APG-33 radar combination in the F-94 and F-89. Presently, the only fighter pilots that can consistently hit the target are flying F-51, F-80, and F-84 using the K-14 gunsight. The new fire control systems are undoubtedly vast improvements over the K-14 gun sight; however, the complete lack of qualified maintenance people to work on the fire control system, the lack of test equipment and spare parts to keep the set operational, and the extremely limited knowledge on the part of the operations personnel limits the sight's usefulness from the start. The additional factor of what really constitutes correct harmonization techniques has not been answered for the units in the field.

Proper maintenance of the fire control systems in ADC squadrons suffered from a lack of skilled people and sufficient spare parts and test equipment. From the Air Training Command's fire control system school at Lowry AFB, Colorado came enough weapons maintenance people, but they had to have intensive and lengthy on the job training before they acquired the skill required to adequately maintain the complex equipment. ADC had instituted a thorough OJT program, but it had difficulty making ground against the large turnover of personnel. The result was a chronic shortage of skilled technicians. An idea of the unstable personnel situation can be gained from a report made in June 1952 which showed that in the preceding twelve months there had been a command-wide turnover rate of airmen of 168 percent.<sup>31</sup> The turnover rate did not lessen. During Fiscal Year 1953, there was an airman turnover of 161 percent.<sup>33</sup>

\* For a more complete accounting of the whole training problem at this time, see Chapter Nine, pp 158-184, Air Defense Command Historical Report, No. Five (hereinafter cited as ADCHR).

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Even the most qualified people could do little without the proper test equipment. There was a continual shortage of such items as mockups, calibrators, tube testers, boresight kits, and signal generators. This too was an Air Force-wide condition. Explaining the maintenance difficulties to a USAF representative at Colorado Springs in August 1952, Colonel Thomas DeJarnette, then Director of Operations and Training, said, "there just isn't enough [test equipment] to go around for all our squadrons, now or in the foreseeable future. We are still short of test equipment on the A-1C sight, which has been in our unit for over three years."<sup>34</sup>

Procedures for correctly harmonizing the fire control system and the guns of the F-94 and F-89 aircraft were worked out in projects conducted by the 325th and the 84th Fighter-Interceptor Squadrons at ATRC's Nellis AFB, Nevada, at the end of 1951. At these tests, the project personnel concluded that for the E-1 system to be effective, it had to be very carefully and properly harmonized.<sup>35</sup> To accomplish this, the project officers recommended that an adequate firing-in range be provided at each fighter base, that harmonization at 1000 feet be required, and that complete harmonization equipment be supplied to each squadron such as transits, leveling bars, and a small spirit level.<sup>36</sup>

Although the various items of equipment required for harmonization became available, no more firing-in ranges than those already in existence were ever built. Only a very small number of bases had a 1000 foot range. Most ranges averaged from 250 to 450 feet.

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Some bases had no range at all. A requirement was established by ADC with USAF for 1000 foot ranges early in 1952. However, Air Force Headquarters had no construction criteria for ranges with the exception of the flexible gunnery type which was more elaborate and costly than required by ADC.<sup>37</sup> A design was submitted finally by ADC for a much less costly range, the reason being that the larger range was not needed for fixed guns and the ranges would be required for only a limited time. With the change from gun-armed to rocket-bearing interceptors, to begin early in 1953, firing-in ranges would no longer be required. The upshot of the whole affair was that with no construction started and not even any firm criteria established by mid-1952, the ranges programmed were cancelled with the exception of the one at Yuma. The range at the latter installation was not completed until May 1954.\*

As noted earlier, training of any type was almost impossible in the F-89 equipped squadrons during 1951 and 1952. For the first year that F-89s were operated, from June 1951 to June 1952, lack of enough spare parts, ground handling apparatus, and test equipment kept an excessive number of these aircraft on the ground.<sup>38\*\*</sup> During these twelve months, the in-commission rate of F-89s did not exceed fifty percent.<sup>39</sup> By mid-1952, the difficulties in supply, caused to a

\* By this date, ADC was sending only rocket-firing aircraft to Yuma.

\*\* For a more detailed discussion of F-89 maintenance during this period, see ADCHR #3, pp 232-236.

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great extent by lack of accurate consumption data, had been mostly ironed out, but an even more serious problem had developed -- an increasing number of engine failures.

Engine failures reached such proportion by April 1952 that all F-89 series aircraft were grounded until new or overhauled engines could be installed. Engine and structural defects continued to crop up, however, and in September all F-89s were again grounded. All of these aircraft were removed from the command beginning in January 1953 and sent to the Ogden, Utah Air Materiel Area depot and to the California plant of the manufacturer (Northrup) for overhaul. By mid-1953, all of the grounded F-89s had been shipped from ADC and overhauled F-89Cs were being returned. Neither the F-89As nor F-89Bs were returned to the command. Of the five squadrons which had F-89s at the time of their grounding, three were given F-94Bs which were reassigned from ATRC and the other two were re-equipped with day jets. When the F-89Cs returned, they were given to two of the squadrons which were originally equipped with this type aircraft and to a newly activated squadron.

The result of the poor in-commission rate and the later groundings of the F-89s was an extremely low state of crew proficiency in these squadrons. The example of the 176th Squadron (redesignated the 433rd) at Truax AFB, Wisconsin illustrates the situation which was true of all F-89 units in varying degrees depending upon the length of time that the squadron had F-89s. The 176th received F-89C aircraft in March 1952. Between that date and the grounding

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of these aircraft in September, the 176th's F-89s were grounded four times for a total of ninety days. <sup>43</sup> Only 520 hours were flown on these aircraft during this period. On examining this squadron early in September 1952, a USAF Inspector General team reported that "the 176th Fighter-Interceptor Squadron is not capable of performing its assigned mission. Frequent groundings of F-89 aircraft by higher authority has prevented aircrews from progressing beyond the transition phase."<sup>44</sup>

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