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THE ROCKETRY PROGRAM: AIRCREW TRAINING

The Problem

For the second time, ADC was faced with the problem of providing training on a new weapons system for which there were no suitable training equipment, or techniques. The old techniques were not applicable and the equipment used by the E-1 system aircraft squadrons simply did not meet the needs. For rocketry, greatly improved equipment was required: tow reels had to be able to handle a cable of much greater length; targets had to be larger and provide more reflectivity; and tow aircraft had to be able to pull a target and cable of the increased dimensions at high speed and high altitudes. Entirely new devices were needed -- there was no way of assessing rocket firing.

The lead-collision course interceptor pilots could not ignore their fire control system and fire visually for qualification as had been possible with the E-1 system aircraft. The old and relatively simple gunnery qualification procedures could no longer be used. The success of a lead-collision course attack was dependent upon team proficiency and not solely upon aircrew skill. New methods had to be developed for measuring combat readiness. Until these methods were worked out, ADC required that the rocket-armed interceptor pilots

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could be rated combat-ready simply by demonstrating proficiency in search, lock-on, and tracking through the breakaway signal; completing ten intercepts and thirty successful attacks; and showing knowledge of the use of the sight.[1*]

Adding to the problem was the fact that unlike the gradual, and never complete, conversion to gun-armed all-weather interceptors, the entire force was rapidly being switched to rocket-bearing aircraft. The need to bring together all of the right ingredients for training was urgent. But there were advantages over the 1950 situation. Most of the training equipment required was within reach, there was considerable experience in all-weather operation, and, possibly most important of all, there was a ready-made facility for establishing and conducting a training program -- the Weapons Training Center at Yuma, Arizona.

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The Centralized Training Program

ADC decided that the best way to train its crews in rocketry and to achieve a high level of combat readiness was through standardization of tactics and techniques. This concept required a centralized training program which, when possible, could be supplemented by home base training.

Authority was given to the Yuma center on 26 May 1953 to develop a lead-collision course and a controller training program.[2] This

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* This was in addition to the requirements of skill in other phases of interceptor operation such as instrument flying.

meant testing and development of equipment and procedures as well as the conduct of the training itself. Actual rocket firing training was to be accomplished no where else until the equipment and techniques for home-base training were developed. Local ranges were to be used in the interim by the remaining gun-armed aircraft equipped squadrons (after December 1953, no more gun-bearing interceptors were sent to Yuma). Initially, 1 October 1953 was set for the beginning of rocketry training at Yuma. As will be shown, the program could not be started until 1 February 1954. Six F-86Ds and six F-94Cs were assigned to the center early in May to carry out of the project.[3] It will be recalled that eight T-33s had arrived a short while after this date, and that a radar station had been set up early in the year.

Within a month after authority had been received, the weapons center personnel had evolved a concept for a rounded rocketry training program. Training for all three members of the air defense combat team -- the controller, the aircrew, and the maintenance personnel -- was envisioned. As explained by the center's commander, Colonel Robert F. Worley, all three had to be equally proficient, for the success of a mission in the lead-collision interceptors depended upon the skill of all three:[4]

> It follows then, that combat capability of an organization can no longer be measured with any degree of accuracy solely by an aircraft in-commission rate or combat crew status... effectiveness can only be determined by the overall effectiveness of the fighter unit combined with the AC&W unit... There exists then a requirement for proficiency training of aircraft controllers, and systems maintenance personnel, as well as fighter crews. This proficiency training should be conducted in several phases of operation which will weld the components referred to above into one team which can prove its combat effectiveness by actually firing rockets.

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To achieve this concept of combat team training, a three-phase program of instruction was to be established for both the lead-collision training and the controller course, geared to the time period set up for both. ADC decided that a squadron had to be at Yuma at least one month to receive the required training.[5] The squadron training program decided upon was as follows. The first phase was to provide familiarization and was to include lectures to aircrew members, armament systems personnel, and rocket-handling personnel. The aircrews were to make simple intercepts on T-33 target aircraft. A second phase of the same length of time, was to provide lead-collision "dry runs" on a towed banner target for target discrimination practice. The final phase, which equaled the first two in duration, was to consist of actual rocket firing passes on a towed banner target.

The controller course was to be of two-weeks duration, with a new class of eight controllers to arrive each week making a total of sixteen in training at all times. The three phases through which the course was to progress followed the lead-collision training program closely.* In the first phase, the controller was to direct a single interceptor against a target aircraft. In the second, he was to direct more than one interceptor on dry runs on a towed target. Finally, he was to direct actual rocket firing interceptions.

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* A more detailed account of the controller proficiency course is given in Chapter Six, this study.

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Equipment for the Central Weapons Training Program

Tow Aircraft. It was the lack of tow aircraft that was primarily responsible for delaying the start of rocketry training and for limiting it once it had gotten underway. Tow aircraft for rocketry had to meet very high requirements. To provide the distinct separation between the tow aircraft and the target on the radar scope required for safety, there had to be at least 5,000 feet of cable between the target and the ship towing it. To haul a cable of this length plus a large target at the speeds and altitudes required for realistic training was a job for a large jet aircraft. Back in October 1952, it will be recalled, ADC had requested that an aircraft meeting these requirements be developed and procured. Higher headquarters refused, stating that it was against Air Force policy to procure an aircraft specifically designed for towing. A second request was sent in December 1952, this time for the B-57 Canberra. No answer was received, so the requirement was again submitted in October 1953.[6] The B-57 requirement was still an open question at the end of 1954, although ADC's request was before the Air Council.[7]

While ADC continued to press for the assignment of B-57s as the only aircraft which had the performance to meet the required standards, other types of aircraft were tested for interim use by the ADC weapons center personnel. In addition, Air Force research and development agencies were testing various aircraft and tow reels. At Yuma, a B-29 was received from the Tactical Air Command on loan in August 1953 and a new tow reel, the Mark VIII which

which could handle up to 12,000 feet of cable, was installed in it. Test of this aircraft showed that the B-29 was not satisfactory, being incapable of sufficient altitude and speed.[8] Yuma next tested a B-45 jet bomber, which was also borrowed from TAC, with the Mark VIII tow reel. This aircraft proved to be much more satisfactory.[9]

On the basis of this, ADC asked and received approval from higher headquarters for fifteen B-45s. However, only eight were to be assigned in 1954, with the remaining seven to be delivered in the fall of 1955. In vain, ADC objected to this, pointing out that eight B-45s could provide only half of the minimum sorties required for the total of four squadrons which it planned to send to Yuma monthly.[10] Eight aircraft could provide training for only two squadrons because for each squadron, a minimum of two aircraft had to be flyable at all times and the in-commission rate of B-45s was expected to be fifty percent.

At any rate, the first B-45 arrived at the end of 1953. Four were on hand by March and the remaining four to be delivered in 1954 were at Yuma by the end of June.[11]

Meanwhile, with no tow aircraft available, the beginning of rocketry training had to be pushed back from 1 October 1953 to 4 January 1954. Training could have been started on a very limited basis at this time, but the commencement of the rocketry program had to be delayed another month, to 1 February, because of the grounding of all F-86Ds at the close of 1953, which was mentioned earlier.[12]

Once started, training was severely limited because of the small number of B-45s on hand and the very low in-commission rate of these aircraft.[13*] Also, the B-45s on hand were not too satisfactory because their J-35 type engine did not provide sufficient performance for realistic tow speeds above 20,000 feet nor long enough time on the range.[14] To rectify this, the eight B-45s assigned were to be retrofitted with a more powerful engine, the J-47. This modification was to begin in January 1955.[15]

Another deficiency was the shortage of tow pilots. For the fifteen B-45s, ADC was authorized thirty pilots. As late as September 1954 (eight B-45s on hand), only four B-45 pilots were assigned.[16] When pressed for more pilots, USAF advised that none were available and that the remainder would have to come from ADC sources. By September, ADC was checking out additional pilots in the B-45 at Yuma. In order to get more tow aircraft in the interim before additional B-45s were received (or B-57s were assigned), ADC agreed in August 1954 to accept B-29s.[17**]

Much of the training accomplished was by use of T-33s (there were sixteen at Yuma by May) to a greater extent than had been planned.

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* The first organization to go to Yuma, the 58th Fighter-Interceptor Squadron from Otis AFB, Massachusetts, accomplished a total of only fourteen rocket firing missions (39 sorties). For source, see reference note number thirteen.

** A total of thirty-six were to be assigned to ADC, twelve for the Yuma Weapons Training Center and twenty-four for the second training center. For information on the second center, see Chapter Seven, this study.

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Initially the plan was to use T-33s in the first or familiarization phase only. The shortage of B-45s made it necessary to use T-33s in the second or target discrimination phase.[18] This was accomplished by flying one T-33 aircraft 5,000 feet behind and 700 feet below another to simulate the tow ship and target arrangement. B-45s were reserved for the third or actual firing phase.

At one time it had been thought possible that the T-33 could be used for towing and the Mark VIII reel was installed in the rear cockpits of two of Yuma's aircraft early in 1954.[19] The testing which followed proved that T-33s were not capable of the tow job required.

The Mark VIII tow reel itself gave some trouble. With this device, around twelve minutes were required to launch each target and it was very difficult to reel in the large nine by forty-five foot target.[20] A requirement for an improved reel was sent to USAF, but none had been received by the end of the year.[21]

Targets. The only target available when the Yuma center began its research into a rocketry program was the six by thirty foot polyethylene banner which the E-1 system aircraft squadrons had used by tying a radar reflector to it. This target was not big enough because of the large rocket dispersion, nor was it sufficiently reflective with the one reflector for the greater radar detection and lock-on ranges of the rocket fire control system. To make possible the use of the maximum capabilities of the fire control systems and thereby provide realistic training,

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ADC wanted a large (at least nine by forty-five feet) target with self-contained reflectivity. One such target was in production at this time and various civilian and military agencies were working on others.[22] None of these, however, was entirely suitable. USAF's Air Proving Ground Command was given a project to develop a reflective target, but one had not become available at this writing.

In the meantime, the Weapons Center people discovered that a polyethylene banner with two ten inch spinning reflectors fastened to it gave fairly satisfactory results.[23] It was with these targets and reflectors that rocketry training was started in 1954. A larger banner target made of a lighter material, a nine by forty-five foot marquisette target, was supplied to Yuma in May 1954. The spinning reflectors were also used with this target.

Rocketry Scoring Equipment. In rocketry training, proper functioning of the equipment was as important as aircrew effectiveness. For this reason, measurement of proficiency required evaluation of the functioning of the entire system as well as of the performance of the pilot.

The method determined best for evaluating pilot performance was to record the attack display on the radar scope which, when played back, showed the pilot's steering techniques. The most satisfactory device for this purpose was a multi-channel magnetic tape recorder developed by the North American Aviation Corporation, called NADAR (North American Data Airborne Recorder). A requirement was established by ADC in May 1953 for installation of NADAR in all of its

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lead-collision course interceptors.[24] NADAR was slow in coming, however. The first aircraft (from production) equipped with the NADAR system were not delivered until early in 1955.[25] In the meantime, scope cameras were used for recording as they became available. The scope cameras and their mounts were also slow in coming. It was not until late in 1954 that most squadrons had them. Without scope cameras or NADAR, the only means of evaluation was counting hits in the target.

To evaluate the functioning of the system and along with it the proficiency of the maintenance crew, it was necessary to assess the rocket dispersion. Several devices for this purpose were under development such as electronic and accoustic firing error indicators, but in the interim, a method developed by the Navy was adopted and instituted at Yuma.[26] This was the stereo camera method of assessment. Two N-6 cameras, focused in a cross pattern, were mounted under the wings of the aircraft.

Chase Aircraft. In their research on rocketry training, the people at the Yuma training center determined that single-place fighters making lead-collision course interceptions should be accompanied by another aircraft to observe the firing.[27] As explained by the 4750th Training Wing:

> The purpose of a chase aircraft is simply to provide "life insurance" for the tow aircraft and its crew. By observing the relative positions of the interceptor and tow aircraft at the "20 seconds to go" point, the chase pilot insures that the interceptor's radar is not locked on to the tow aircraft. At "20 seconds to go" the chase pilot observes this relative position and instructs the interceptor pilot that he is clear to complete the pass or orders him to break off the attack.

Both T-33s and the tactical aircraft of the unit at Yuma were used for this purpose. The slow rate of climb and speed of the T-33s in comparison to the tactical aircraft made them unsatisfactory, while use of unit tactical aircraft limited the amount of training that the squadron could accomplish. In August 1954, therefore, ADC asked USAF to assign fifteen F-86Fs to Yuma for use as chase aircraft.[28] Air Force Headquarters offered F-94Bs and F-84Fs, but ADC turned them down.[29] The F-94Bs were considered unsuitable because of speed limitations and the F-84Fs unsatisfactory because of engine and airframe deficiencies. ADC again expressed the need for F-86 type aircraft, but by the end of the year its wishes had not been granted.

Status of Rocketry Training at Yuma

Training was started at Yuma, as noted earlier, on 1 February 1954. The first squadron to go to Yuma for rocketry training was the 58th Fighter-Interceptor Squadron from Otis AFB, Massachusetts. This squadron was equipped with F-94Cs. The extent and quality of training provided was very limited at first, only gradually increasing as tow aircraft, scope cameras, and associated equipment became available. During the first six months of operation, some eight squadrons went through the course.[30] No more than two squadrons were in training at Yuma at one time. All of the squadrons going to Yuma were either F-86D or F-94C equipped. The first F-89D equipped squadron did not go to Yuma until the last week of November.[31]

The ADC Unit Proficiency Directive for E-4, E-5, and E-6 fire control system equipped aircraft, issued in September 1953, required forty aerial rocketry sorties per year.[32] Of these, twenty-four were to be scored. In addition, each crew was required to fly twenty-four radar scope recording sorties each year. According to a report of an inspection made in August 1954 by the USAF Inspector General, aircrews were receiving an average of sixteen firing sorties during their training there.[33] No figure for non-firing sorties per individual crew was given, but up to the time of the inspection, 1260 sorties were made on the average by each unit of which 720 were non-firing.

It was almost impossible at this early stage to determine the increase in squadron capability that resulted from training at Yuma, but in this same report the IG stated that "an educated estimate is from forty to fifty percent. This figure of increased capability was based on discussion with personnel at Yuma and two TDY squadron commanders. This appears realistic when it is realized that ADC units have fired few if any air rockets prior to training at Yuma, irrespective of the length of time UE aircraft have been assigned."[34]

Home-Base Training

To supplement the one-period per year central training, a means had to be provided for units to train at their home bases. The only type of home training possible at this writing was simulated air-to-air attacks. Recording of the attack display made evaluation of aircrew performance possible, but this training was

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limited. Without assessment of rocket firing, evaluation of the system and the maintenance crew could not be made. However, even scope recording was not possible by most squadrons until late in 1954. As noted earlier, scope cameras and mounts were almost as slow in being made available as NADAR.

For actual air-to-air rocket firing, suitable ranges, targets, reels, and tow aircraft had to be put at the disposal of the squadrons in the field. By late in 1954, considerable progress had been made toward making a complete home training program possible, however. A target system was under development by the Weapons Training Center. Being developed was a light-weight frangible type target which would shatter and cause no damage if struck by an interceptor, and a light-weight reel.[35] Use of the T-33 for towing was planned. To make more ranges available, ADC asked USAF late in 1954 to allow firing on ranges smaller than fifty by one-hundred miles.[36]