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APPENDICES

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APPENDIX I

THE E-1 FIRE CONTROL SYSTEM\*

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The E-1 fire control equipment was developed on a crash basis by using existing bomber components with the least number of engineering changes possible to obtain an interceptor fire control system. The equipment used were the A-1C Gun-Bomb-Rocket sight without change, and the AN/APG-3 radar which was modified to the design later known as the AN/APG-33. Major engineering changes were made in the antenna, modulator, transmitter, and AFC circuits to increase reliability, range, and low temperature operation. The system was designed for installation in two-place fighters to detect targets in space forward of the aircraft, to present target data to permit the operator to select a target, and to cause the equipment to automatically track that target. Target data were then presented to the pilot to enable him to fly a computed lead pursuit course to the target for effective gun firing.

Two modes of operation were possible; one used optical tracking, and the other used radar tracking. Under conditions of good visibility, the target acquisition and tracking was performed by the pilot using optics. After selection of a target, the pilot flew the aircraft so as to maintain the optical tracking index in coincidence with the target. When stable flight had been established for a few seconds, the guns could be fired as soon as the target was within range. With optical tracking, either automatic radar ranging or manual stadiametric ranging was possible.

Under conditions of poor visibility, radar tracking could be used with the E-1 system. Both the pilot and the radar observer were provided with radar displays. The radar operator performed the function of target selection and acquisition. During radar search, the pilot's scope displayed only an artificial horizon. Following target acquisition, the pilot's scope displayed an artificial horizon, a tracking index in the form of a circle and a dot, and a range circle of variable diameter. Closing rate was displayed by the position of a break in the range circle. The pilot flew the aircraft so as to maintain the tracking index centered on the scope. When closing with the target, the diameter of the range circle began to decrease at the open fire range of 2,000 yards. When the range had decreased to 200 yards, the range circle shrank to the size of the tracking index circle. This was the signal to break off the attack.

Limitations in the systems included no provision for beacon navigation, limited range, attack on lead-pursuit only, and no blind firing on low-level attacks.

\* Drawn from "Evolution of Fire Control Systems," ADC Communications and Electronics Digest, I (March 1951), 17-18; and "Fire Control Systems," ADC C&E Digest, I (April 1951), 9-10. (HRF 904)

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APPENDIX II

BOMBING AND GUNNERY RANGES AVAILABLE  
TO THE  
AIR DEFENSE COMMAND IN 1951

Alamogorda, N.M. Under the control of SWC. SWC's requirements preclude ADC use. Additionally, we have no units deployed close enough for convenient use.

Ajo-Gila Bend. Under the jurisdiction of ATRC. ADC has an equitable joint use agreement with the possibility that jurisdiction may be transferred to this command. Units will stage from Yuma County Airport. Appropriate recapture procedures for Yuma County Airport have been initiated and right of entry requested.

Atlantic City. Under the jurisdiction of McGuire AFB. Utilized for air-to-air gunnery.

Betsie Point. Under the control of ANG. ADC has a joint use agreement. Of no use to this command at the present time as there are no units deployed in the immediate vicinity. Additionally, weather prohibits year-round use.

Cape Cod, Mass. Under the jurisdiction of the Navy. ADC has a joint use agreement. Utilized for air-to-air gunnery by the 33d Fighter Group.

Casco Bay. Under the jurisdiction of the Navy. ADC has verbal joint use agreement.

Chincoteague, Va. Under the jurisdiction of the Navy. Joint use with TAC. Of little value to this command as there are no units located in the vicinity.

Criehaven, Me. Under the jurisdiction of ADC. Can be utilized by the unit at Bangor. However, weather conditions prohibit satisfactory year-round use.

Eglin. Under the jurisdiction of APG. Both ADC and TAC have joint use agreements. While a very satisfactory range, heavy requirements of other commands have made it unsuitable for ADC use. Therefore, staging bases in the vicinity of the Sarasota air-to-air range are currently under study by EADF, i.e., Venice, St. Lucie County and Punta Gorda.

Source: Incl #2 to ADC, Planning Committee Report 10-51, 30 Apr 1951 (HRF 902)

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Glen View, Ill. Under the jurisdiction of the Navy. ADC has informal joint use, but the range is too small for jet air-to-air gunnery.

Kirtland, N.M. Under the jurisdiction of SWC. ADC has joint use of this small air-to-ground range. This range provides little more than familiarization in air-to-ground firing.

Lake Huron, Mich. Under the jurisdiction of ADC. Utilized by units at Selfridge AFB. Limited by weather and ice conditions on the lake which prohibit rescue activities.

Lake Superior. Under the jurisdiction of ANG, Minnesota. ADC has joint use. Can be used to a limited degree by the unit at Duluth. Again, weather prohibits suitable year-round use.

McGuire, N.J. Under the jurisdiction of the Army. ADC has joint use agreement. Utilized for air-to-ground training.

Moses Lake. Under the jurisdiction of ADC. Utilized for air-to-ground training.

Naragansett. Under the jurisdiction of the Navy. ADC has joint use agreement but is not utilizing it at the present time as units are closer to Cape Cod.

Oscoda. Under the jurisdiction of ADC. Can be utilized by the unit at Niagara Falls. A small range, with year-round use limited due to weather.

Pt. Arena, Calif. Under the jurisdiction of the Navy. ADC has informal joint use agreement. However, no units are stationed close enough for satisfactory use. Weather precludes satisfactory year-round use.

Rapid City, S. D. Under the jurisdiction of SAC. ADC has informal joint use agreement. The altitude ceiling of 14,000 feet has been lifted to unlimited. CADF is taking necessary action to enlarge the danger and impact area of this range. Will be utilized by the unit at Rapid City

San Miguel, Calif. Under the jurisdiction of the Navy. ADC has informal joint use agreement. No ADC units in the immediate vicinity. Additionally, the Navy has a heavy requirement for this range.

Sarasota, Fla. Under the jurisdiction of SAC. ADC has informal joint use. Contingent upon activation of suitable staging base, as indicated under the Eglin range, units of EADF will utilize this air-to-air gunnery range.

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Sheboygan, Wisc. Under the jurisdiction of ADC. Small over-water range, limited in year-round use by the weather conditions.

Ship Shoal Island, Va. Under the jurisdiction of TAC. ADC has joint use. ADC has no requirement for this air-to-ground range.

Tilamook, Wash. Under the jurisdiction of SAC. ADC has informal joint use. No requirement for this air-to-ground range.

Underhill, Vt. Under the jurisdiction of ANG, Vermont. ADC has informal joint use. A small air-to-ground range. ADC has little or no requirement.

Wendover, Utah. Under the jurisdiction of SAC. ADC has informal joint use. The present impact area is too small for jet air-to-air gunnery. Hq USAF has refused our request for expansion of the range and rehabilitation of the base.

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APPENDIX III

DESCRIPTION OF FIRE CONTROL SYSTEMS EQUIPMENT\*

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1. E-4 Fire Control System (F-86D):
  - a. AN/APG-37  
High powered X-band airborne pulse modulated fire control radar used in a single-place all-weather fighter aircraft. It also contains beacon and ground mapping facilities.
  - b. AN/APA-84 Ballistic Computer  
This equipment is a rocket ballistic computer for use with collision course fire control systems, utilizing positional and rate information from the radar, it automatically computes the trajectory for air-to-air rocket firing. An additional function is automatic control of rocket firing mechanism.
  - c. Elevation Computer  
Is used to automatically and continuously analyze quantities for computing the angle of attack of an airplane in flight, for use with a collision course fire control system, using rockets.
2. E-5 Fire Control System (F-94C):
  - a. AN/APG-40  
High powered X-band airborne pulse modulated fire control radar used with a ballistic computer AN/APS-84 for computing collision straight line approach for use in two-place all-weather fighter aircraft. Also contains beacon and ground mapping facilities.
  - b. AN/APA-84 Ballistic Computer  
Same as paragraph 1b.
  - c. Elevation Computer  
Same as paragraph 1c.
3. E-6 Fire Control System (F-89D):
  - a. AN/APG-40  
Same as paragraph 2a.

\*Source: ADC Manual Number 136-1, 1 Aug 1953, p 3. (HRF 301)

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b. AN/APA-84 Ballistic Computer  
Same as paragraph 1b.

c. Elevation Computer  
Same as paragraph 1c.

4. N-9-1 Fixed Reticle Gunsight (F-86D):

This equipment is a fixed reticle gunsight, i.e., non-computing sight, normally installed in aircraft using fixed guns. This sight provides a colimated image of the reticle pattern, which is reflected by a reflector glass to be visible from any point along the line of sight.

5. N-3-C Fixed Reticle Gunsight (F-94C):

This sight is similar to the N-9-1 and is used in the same manner.

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