DOCUMENT 201-82

TELECOMMUNICATIONS AND TIMING GROUP

CATALOG OF EXISTING AND PROPOSED COMMAND SYSTEMS

WHITE SANDS MISSILE RANGE
KWAJALEIN MISSILE RANGE
YUMA PROVING GROUND
DUGWAY PROVING GROUND
ELECTRONIC PROVING GROUND

ATLANTIC FLEET WEAPONS TRAINING FACILITY
NAVAL AIR WARFARE CENTER WEAPONS DIVISION
NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION
NAVAL UNDERSEA WARFARE CENTER DIVISION NEWPORT

30TH SPACE WING
45TH SPACE WING
AIR FORCE FLIGHT TEST CENTER
AIR FORCE DEVELOPMENT TEST CENTER
AIR FORCE WEAPONS AND TACTICS CENTER
DETACHMENT 2, SPACE AND MISSILE SYSTEMS CENTER

DOCUMENT 201-82

CATALOG OF EXISTING AND PROPOSED COMMAND SYSTEMS

Prepared by

COMMAND SYSTEMS COMMITTEE
TELECOMMUNICATIONS GROUP
RANGE COMMANDERS COUNCIL

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White Sands Missile Range,
New Mexico 88002

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FOREWORD

The Command Systems cataloged herein are the systems in use at member and associate member ranges of the Range Commanders Council. Range users are advised to contact the individual range of interest for more detailed descriptions of these systems.

1.0 INTRODUCTION

This document provides information to ranges developing new Command Systems or planning changes to their existing Command Systems. It provides ranges, range users, and other agencies with a descriptive outline of the systems installed at each facility and contains descriptions of types of Command Systems for command control. The manner in which the Command Systems are used must be approved by the respective range safety officer.

2.0 BASIC TYPES

The basic types of Command Systems in use by the ranges are:

AN/FRW-2

AN/URW-15

Microdot 2442

CTS-100

Some ranges have special systems which are described under the individual range listings.

3.0 DESCRIPTION OF TRANSMITTERS

3.1 GENERAL

The transmitting systems described in this document are designed for remotely controlling vehicles, missiles and/or various other functions by way of a frequency modulated carrier. Two transmitters are normally used in a master-standby arrangement. Transfer from master to standby occurs when either low incident or high reflected radio-frequency (r-f) power is sensed. The transmitted coded signals are received by compatible radio receivers which demodulate the r-f signal to provide control of selected functions.

3.2 AN/FRW-2(2A) TRANSMITTER

a. Radio transmitting set AN/FRW-2(2A), audio frequency coder KY-171/URW, and the 240D-2 power amplifier constitute the transmitting portion of a radio remote control system.

b. The power output of the transmitter is normally not less than 500 W nor more than 1000 W. The power amplifier output of the 240D-2 is normally 2000 W or 10,000 W.

NOTE

Narrow band modification (AN/FRW-2(2A)). The narrow band modification kit, when installed in the FRW-2 transmitter,

allows the transmitter to be used as a narrow-band, frequency-modulation system without impairing its performance in wide-band applications. This transmitter, using this kit, is classified AN/FRW-2A.

3.3 AN/URW-15 TRANSMITTER

The AN/URW-15 transmitter, coder KY-336/URW-14A, and the power amplifier AM 10-400/600 constitute a radio remote control system used at White Sands Missile Range. The output power of the transmitter is normally not less than 500 W nor more than 1000 W. By incorporating the AM-10-400/699 power amplifier, the output power of the system is normally between 2000 W and 10,000 W.

3.4 TRANSMITTER SET MODEL 2442

This set is composed of the transmitter-driven model 2435-B-3, audio frequency encoder model 2702, and the r-f power amplifier, model M 255. Each is a module with a separate power supply and all units are rack mounted.

3.5 52Q1-TH EXCITER

The dual command control exciter 52Q1-TH is an improved replacement for the AN/FRW-2 exciter. It consists of two electrically identical, but entirely separate, exciter systems. Each system is a multichannel frequency-modulated exciter designed to provide a nominal output power of 100 W to drive a power amplifier such as the 240D-2.

3.6 COMMAND TRANSMITTER SYSTEM MODEL CTS-100

This system is a 1-kW r-f transmitting system containing six modular subassemblies mounted in standard electronic equipment racks. The unit incorporates a solid-state 50-W driver and 1-kW output amplifier as well as a 20-channel encoder with frequencies adjustable from 7.5 kHz to 73.75 kHz.

4.0 TRANSMITTER CHARACTERISTICS

4.1 FREQUENCY RANGE

a. AN/FRW-2. The r-f carrier range is 406 to 549 MHz and consists of 144 fixed channels spaced at 1-MHz intervals.

b. AN/FRW-2A. The r-f carrier range is 406 to 549.5 MHz and consists of 288 fixed channels spaced at 0.5-MHz intervals.

c. AN/URW-15. The r-f carrier range is 406 to 549.5 MHz and consists of 288 fixed channels spaced at 0.5-MHz intervals.

d. Transmitter Set Model 2442. The r-f range is 406 to 550 MHz and consists of 145 fixed channels spaced at 1-MHz intervals.

e. 52Q1-TH. The r-f carrier range is 405 to 500 MHz and consists of 95 fixed channels spaced at 1-MHz intervals.

f. CTS-100. The r-f carrier range is 406 to 549 MHz, synthesizer controlled with available frequencies spaced at 0.5-MHz intervals.

4.2 R-F POWER OUTPUT

a. AN/FRW-2 (2A). The transmitter will supply a power output of 500 W of r-f power when connected to a nonreactive load of 52 ohms.

b. AN/URW-15. The transmitter will supply a power output of 1100 W, ± 20 percent.

c. AN/URW-14A. The AN/URW-14A will supply 75 W nominal power and is also used to excite the AN/URW-15.

d. Transmitter Set Model 2442. The transmitter will supply a 1000-W output to a 50-ohm load over the frequency range.

e. Transmitter-driver model 2435B-3. The transmitter will supply a 100-W output into a 50-ohm load over the frequency range.

f. 52Q1-TH. The exciter will supply a variable power output between 0.5 to 100 W to excite a power amplifier.

g. CTS-100. The transmitter will supply a 1000-W output into a 50-ohm load.

4.3 R-F POWER AMPLIFIER 240D-2 OR AM 10-400/600

Power amplifier 240D-2 consists of a klystron amplifier stage and the power supplies necessary for operation of the klystron. A three-cavity klystron is used. The tube is cooled by both water and air. Four magnetic coils, which encircle the tube, focus the electron beam. The drive power is coupled to the input cavity which is initially tuned for minimum voltage standing wave ratio (VSWR) on the input line. Drive power must be supplied to the power amplifier at the desired operating frequency. The power amplifier is set to any frequency in the operating range of 400 to 550 MHz by tuning the three cavities and adjusting the output coupling and magnetic currents for optimum power output and bandwidth. Directional couplers are employed as r-f power monitoring devices on the input and output lines. A selector switch and front panel meter associated with each coupler allow reflected and direct power to be read from both transmission lines. Output from the directional coupler in the output line also is connected to a monitor-protector subassembly which closes alarm contacts if the output direct power becomes too low or the reflected power on the output line becomes too high. The monitor-protector subassembly also causes high voltage to be removed from the klystron if the reflected power reaches a preset value. The 240D-2 power amplifier has an output capability of 15 kW, but for longer tube life and more reliability the 240D-2 is operated at a 10-kW output. The AM 10-400/600 operates essentially the same as the 240D-2 amplifier.

4.3.1 POWER AMPLIFIER 240D-2 CHARACTERISTICS

a. Frequency Range: 400 to 550 MHz

b. Drive Power Required: 26-W maximum for 3-MHz bandwidth at 10-kW power output

c. Power Gain: 27 dB for 3-MHz bandwidth at 10-kW power output

d. Power Output: (Nominal): 10 kW

e. Power Output: (Maximum): 15 kW

f. Bandwidth: 3 MHz at 3-dB points

g. Distortion: Noise and FM distortion 60 dB below maximum deviation.

4.3.2 POWER AMPLIFIER AM 10-400/600 CHARACTERISTICS

The AM 10-400/600 amplifier has essentially the same characteristics as the 240D-2 amplifier with the following exceptions:

a. A four-cavity klystron is used.

b. A frequency range from 400 to 600 MHz.

c. Requires 100 mW to drive power to obtain an output of 10,000 W.

d. A power gain of 50 dB.

4.4 POWER AMPLIFIER 778 V

a. Frequency Range: 406 to 549 MHz

b. Driving Power Required: 80 W

c. Input Impedance: 50 ohms

d. Power Gain: 10 dB

e. Power Output: 800 W

f. Output Impedance: 50 ohms

4.5 POWER AMPLIFIER 964A

a. Frequency Range: 400 to 610 MHz

b. Driving Power Required: 5 W

c. Input Impedance: 50 ohms

d. Power Gain: 33 dB

e. Power Output: 10 kW

f. Output Impedance: 50 ohms

5.0 DESCRIPTION OF MONITORING SYSTEMS

5.1 RADIO, RECEIVER R-669A/URW

The radio receiver R-669A/URW provides a continuous check on transmitted signals from radio transmitters AN/FRW-2 and AN/FRW-2A. The R-669A/URW receiver receives its input signal directly from the transmitter power output.

a. Frequency Characteristics: The R-669A/URW receiver operates on each of the 144 channels spaced at 1-MHz intervals within the range of 406 to 549 MHz.

b. Receiver Sensitivity: The R-669A/URW receiver has a sensitivity of 0.05 V with a minimum signal plus noise-to-noise ratio of 30 dB measured at the receivers output with a deviation of ±300 kHz.

c. Frequency Stability: Center frequency drift is ±0.01 percent or less.

d. Bandwidth: The R-669A/URW receiver is capable of accepting deviations from 0 to ±300 kHz. The overall 6-dB bandwidth will not exceed 2.0 MHz nor be less than 1.4 MHz.

e. Receiver Fidelity: The R-669A/URW receiver has a response characteristic such that the output does not vary more than ±1 dB when the modulating frequencies are between 1 kHz and 25 kHz and not more than +1 dB or -3 dB between 300 Hz and 100 kHz when compared to the output at a reference frequency of 10 kHz.

f. Blocking: The receiver will not block when signals of 2 V or less are applied.

g. Audio Output: The audio output has been designed for an external load impedance of approximately 560 ohms with a resistive path to ground. For one tone at ±300-kHz deviation, the output voltage has an adjustment range from 1.4 to 7 V peak. Six audio tones can be received simultaneously. The output voltage is controlled by a locking-type adjustment.

5.2 RECEIVER AN/URW-16

The radio receiver AN/URW-16 provides a continuous check on transmitted signals from radio transmitter AN/URW-15. The AN/URW-16 receives its input signal directly off the air.

a. Frequency Characteristics: The AN/URW-16 receiver operates at 0.5 MHz intervals within the range of 406 to 549.5 MHz.

b. Receiver Sensitivity: The AN/URW-16 receiver has a low-high sensitivity of 5 or 50,000μV with a minimum signal plus noise-to-noise ratio of 20 dB with a deviation of ±300 kHz.

c. Frequency Stability: Center frequency drift is ±.005 percent or less from the selected frequency.

d. Bandwidth: The AN/URW-16 receiver is capable of accepting deviations from 0 to ±300 kHz. The overall 6-dB bandwidth will not exceed 2.0 MHz nor be less than 1.4 MHz.

e. Receiver Fidelity: The AN/URW-16 receiver has a response characteristic such that the output will not vary more than ±1 dB when the modulating frequencies are between 1 kHz and 25 kHz nor more than +1 dB or -3 dB between 300 Hz and 100 kHz when compared to the output at a reference frequency of 10 kHz.

f. Blocking: The receiver will not block when signals of 2 V or less are applied.

g. Audio Output: The audio output has been designed for an external load impedance of approximately 560 ohms with a resistive path to ground. For one tone at ±300-kHz deviation, the output voltage has an adjustment range from 1.4 to 7 V peak. Six audio tones can be received simultaneously. The output voltage is controlled by a locking-type adjustment.

5.3 RECEIVER R-729/FRW-3

The Radio receiver R-729/FRW-3 is part of the AN/FRW-3 receiving set.

a. Frequency Characteristics: The R-729/FRW-3 receiver operates at 1-MHz intervals within the range of 406 to 549 MHz.

b. Receiver Sensitivity: The receiver threshold sensitivity is 5μV minimum.

c. Frequency Stability: Center frequency drift is ±.01 percent or less from the selected frequency.

d. Bandwidth: The R-729/FRW-3 receiver is capable of accepting deviations of up to ±300 kHz. The overall 6-dB bandwidth is 1.7±0.3 MHz.

e. Receiver Fidelity: The audio response is 300 Hz to 100 kHz and an output distortion of less than 2 percent.

f. Audio Output: The audio output level is between 1 and 5 V with an output impedance of 560 ohms.

6.0 ANTENNA SYSTEMS

a. An antenna system consists of an antenna and, where applicable, the control system used to steer it. Numerous types of omnidirectional and

directional antennas are used on the individual ranges. Refer to the appendixes for lists of the antennas available at each command site.

b. Specifications for the antennas follow.

6.1 GABRIEL MODEL AT-781/U

a. Type: Omnistacked array inclined dipoles

b. Gain: 5 dB over isotropic

c. Pattern: Spatial coverage throughout a cylindrical volume with range to height ratio of 5:1. Solid cover above an elevation angle of approximately 6°.

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 1 kW

g. Voltage Standing Wave Ratio: 1.4:1 to 1.8:1 over band

6.2 GABRIEL MODEL AT-782/U

a. Type: Omnistacked array inclined dipoles

b. Gain: 10 dB over isotropic

c. Pattern: Spatial coverage throughout a cylindrical volume with range to height ratio of 10:1. Solid cover above an elevation angle of approximately 6°.

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 2 kW

g. Voltage Standing Wave Ratio: 1.4:1

6.3 UNIPOLE

a. Type: Omni

b. Pattern: Spherical

c. Frequency Range: 400 to 550 MHz

d. Polarization: Vertical

e. Rated Power: 10 kW

f. Voltage Standing Wave Ratio: 1.5:1

6.4 ANDREW MODEL 59080

a. Type: Corner reflector

b. Frequency Range: 410 to 450 MHz

c. Polarization: Vertical

d. Rated Power: 2 kW

e. Voltage Standing Wave Ratio: 2:1

6.5 ESCO TRI-HELIX

a. Type: Tri-Helix

b. Gain: 17 dB

c. Pattern: 18° by 30° elliptical beam

d. Frequency Range: 400 to 500 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.6 AFETR MANUFACTURER HELIX (10 kW)

a. Type: 6-turn Helix

b. Gain: 10 dB

c. Pattern: 45° conic beam

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 10 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.7 AFETR MANUFACTURER HELIX (600 W)

a. Type: 6-turn Helix

b. Gain: 10 dB

c. Pattern: 45° conic beam

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 600 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.8 AINSLIC

a. Type: Parabolic dish

b. Gain: 23.5 dB±1 dB

c. Pattern: 10° beamwidth with sidelobes 11-dB down

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 2:1

6.9 AGA

a. Type: Parabolic dish

b. Gain: 25 dB

c. Pattern: 8.5° conic beam

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.10 ANDREW 8-FOOT PARABOLIC

a. Type: 8-foot parabolic dish with helicone feed

b. Gain: 17 dB over isotropic

c. Pattern: Conic half-power beamwidths 21° by 21°

d. Frequency Range: 406 to 549 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.11 ANDREW 10-FOOT PARABOLIC

a. Type: 10-foot parabolic dish with helicone feed

b. Gain: 19 dB over isotropic

c. Pattern: Conic half-power beamwidths 19° by 19°. Sidelobes more than 14 dB down

d. Frequency Range: 406 to 549 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.12 CANOGA 8-FOOT PARABOLIC

a. Type: 8-foot parabolic dish with helicone feed

b. Gain: 16 dB over isotropic

c. Pattern: Conic half-power beamwidths of 23° by 23°

d. Frequency Range: 406 to 550 MHz

e. Polarization: LHC

f. Rated Power: 1 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.13 PMR MANUFACTURER 6-FOOT PARABOLIC

a. Type: 6-foot parabolic dish with helicone feed

b. Gain: 16-dB isotropic

c. Pattern: Conic half-power beamwidths 26° by 26°

d. Frequency Range: 406 to 550 MHz

e. Polarization: LHC

f. Rated Power: 1.5:1

g. Voltage Standing Wave Ratio: 1.5:1

6.14 PMR MANUFACTURER 8-FOOT PARABOLIC

a. Type: 8-foot parabolic dish with helicone feed

b. Gain: 19 dB over isotropic

c. Pattern: Conic half-power beamwidths 23° by 23°

d. Frequency Range: 406 to 456 MHz

e. Polarization: LHC

f. Rated Power: 1 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.15 TEMEC PARABOLIC

a. Type: Parabolic dish

b. Gain: 25 dB

c. Pattern: 8.5° conic beam

d. Frequency Range: 400 to 500 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.16 ANTLAB MODEL 7674

a. Type: Quad Helix

b. Gain: 18 dB over isotropic

c. Pattern: 20° beamwidth

d. Frequency Range: 406 to 470 MHz

e. Polarization: LHC

f. Rated Power: 10 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.17 EGLIN MANUFACTURER QUAD HELIX

a. Type: Quad Helix

b. Gain: 15 dB over isotropic

c. Pattern: 56° by 17° beamwidth with sidelobes down 14 dB

d. Frequency Range: 406 to 549.9 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 2.5:1

6.18 GABRIEL QUAD HELIX

a. Type: 4 helixes in line

b. Gain: 14.5 dB over isotropic

c. Pattern: 56° horizontally by 16° vertically with sidelobes more than 16 dB down

d. Frequency Range: 406 to 549 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 2.5:1

6.19 STERLINE HELIX

a. Type: Four-bay helix

b. Gain: 15 dB over isotropic

c. Pattern: 17° by 55° beamwidth

d. Frequency Range: 400 to 550 MHz

e. Polarization: LHC

f. Rated Power: 10 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.20 TEMEC QUAD HELIX

a. Type: Quad helix

b. Gain: 18 dB

c. Pattern: 20°-beamwidth

d. Frequency Range: 400 to 500 MHz

e. Polarization: LHC

f. Rated Power: 15 kW

g. Voltage Standing Wave Ratio: 1.5:1

6.21 WHITE SANDS MISSILE RANGE ANTENNA SYSTEM

a. Type: Sleeved turnstile above a ground plane (basic) with yagi type directors (high gain)

b. Gain: +2 dB over isotropic (for basic) up to +14 dB over isotropic (for high gain)

c. Pattern: Hemispherical (for basic) to 25° (for high gain)

d. Frequency Range: 400 to 550 Mhz (for basic), high gain available for assigned frequency

e. Polarization: LHC

f. Rated Power: 1 kW

g. Voltage Standing Wave Ratio: Less than 1.7:1 reference 50 ohms

APPENDIXES

In the following appendixes, a list of the basic Command Systems at each range is provided. For specifications on a particular piece of equipment, refer to the appropriate section in this document.

APPENDIX A

KWAJALEIN MISSILE RANGE (KMR)

The KMR system consists of two sites; one at Roi-Namur and one at Kwajalein, Marshall Islands.

Roi-Namur Site

Two AN/FRW-2 command transmitters

One steerable ESSCO tri-helix

Kwajalein Site

Two encoders, part of r-f subsystem 8695-8696, manufactured by Metric Systems, Fort Walton Beach, Florida. Kentron Spec HV-6020-115-76.

Two r-f sources, HP 8660C generator w/86602 r-f section and 86632B modulation section

Two r-f final, MCL model 10533, Kentron Spec HV-6020-165-75, 8 kW

Two antennas, steerable, 25-dB gain parabolic, beam width greater than 7° at half power, 20 feet.

APPENDIX B

WHITE SANDS MISSILE RANGE (WSMR)

The WSMR command transmitter sites for flight safety operations are equipped as follows. The carrier frequency of all transmitters is held within ±0.1 percent of the channel frequency value.

FIXED SITES

"C" Station

Two CTS-100 transmitters

Two log spiral antennas (TECOM)

Clark Site

Two CTS-100 transmitting sets

Two log spiral antennas (TECOM)

Mobile Van 1

Two Microdot 2442 transmitting sets

Two log spiral antenna systems (TECOM)

Mobile Van 2

Two CTS-100 transmitting sets

Two log spiral antenna systems (TECOM)

Mobile Van 3

Two CTS-100 transmitters

Two log spiral antenna systems (TECOM)

Salinas Peak

Two CTS-100 transmitters

Two log spiral antennas

APPENDIX C

YUMA PROVING GROUND (YPG)

YPG drone flight data is displayed and commands are originated at Drone Mission Control, Building 3125. The YPG Command Control Site is equipped with the following equipment:

Two AN/URW-15 transmitters

Two TECOM model 201096 omniantennas

APPENDIX D

NAVAL WEAPONS CENTER (NWC)

The NWC system consists of three transmitting sites, two stationary and one mobile, with one additional mobile proposed. Each site has dual transmitters with automatic switchover and nondirectional antennas.

Fixed Station #1 B Tower

Two CTS-100 command transmitters

Two Gabriel AT-781A/U antennas

Fixed Station #2 Bldg #30997

Two CTS-100 command transmitters

Two Gabriel AT-781A/U antennas

Mobile Station #1 Van #192299

Two AN/FRW-2 command transmitters

Two Gabriel AT-781A/U antennas

Proposed Mobile Station #2

Two CTS-100 command transmitters

Two AT-781A/U antennas

APPENDIX E

PACIFIC MISSILE TEST CENTER (PMTC)

The PMTC drone control sets are equipped with the following transmitting equipment:

Point Mugu

Integrated Target Control System (ITCS)

Two AN/TSW-10(V)2 Command/Control transmitters
(to be located on Laguna Peak after 1 October 1981)
1200 W
4.4 to 4.8 GHz, 160 channels, tunable

Two 8-foot parabolic antennas (32 dB)

Van Mounted Equipment

One AN/USW-4 drone control set
(located near Bldg 53, Range Operations, until October 1981)
150 W minimum
4.4 to 4.8 GHz, 160 channels, tunable
FM modulated
F9 emission designation
±2 ppm frequency stability
One 4-element helical array (23 dB)
RHC polarization

San Nicolas Island

ITCS

Four AN/TSW-10(V)2 Command/Control transmitters
1000 W
4.4 to 4.8 GHz, 160 channels, tunable

Four 8-foot parabolic antennas (32 dB)

Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii

Two 1-kW transportable vans each equipped as follows:

Two AN/FRW-2 Command/Control transmitters

One kW power output
406 to 550 MHz

One 8-foot parabolic antenna (15 dB)

One omnidirectional antenna

Transmitting equipment planned for Makaha Ridge are as follows:

Two AN/TSW-10(V)X - August 1983 (same as above)

Two AN/TSW-10(V)X - August 1984

APPENDIX F

ATLANTIC FLEET WEAPONS TRAINING FACILITY (AFWTF)

The AFWTF Command/Control Systems are composed of five transmitter sites each with automatically redundant transmitting systems and with controller selectable antenna systems. One is stationary and omnidirectional and the other is steerable and 12-dB gain.

North Delicias Site (P.R.)

Two AN/URW-15 command transmitters

One Gabriel AT-781/UC antenna

One Motorola 4-Stacked 3606E-Z

St. Thomas Site (Crown MT.)

Two AN/URW-15 command transmitters

One Gabriel AT-781/UC antenna

One Motorola 4-stacked 3606E-Z

St. Croix Site (St. George Hill)

Two AN/URW-15 command transmitters

One Gabriel AT-781/UC antenna

One Motorola 4-stacked 3606E-Z

Pico Del Este Site (P.R.)

Two AN/URW-15 command transmitters

One Gabriel AT-781/UC antenna

One Motorola 4-stacked 3606E-Z

APPENDIX G

NAVAL AIR TEST CENTER (NATC)

No Command Systems for command destruct or drone control are owned or operated by NATC.

APPENDIX H

ARMAMENT DIVISION (AD)

The Eglin AFB Control and Flight Termination System has displays and commands originating from the Centralized Control Facility (CCF) Site A27.

The transmitter sites are equipped as follows:

Site A-3

Two AN/FRW-2 transmitting sets (each redundant)

Two Gabriel AT-781/U omniantennas

One directional antenna, pie-pan type

Four audio coders (KV-171)

Site D-3

One AN/FRW-2 transmitter set (redundant)

Two Gabriel AT-781/U omniantennas

One directional antenna, pie-pan type

Two audio coders (KV-171)

NEW DEVELOPMENTS

Work is in progress to install a system using components of the IBM Drone Formation Control System (DFCS). WSMR is providing some equipment and computer programs to control surface as well as airborne vehicles. The system will be known as the Multilateration Tracking, Ranging and Control System (MTRACS). A test area, Range 70, is being instrumented to prove the concept and develop vehicle control software and equipment. The CCF will be the master control with a van at Range 70 to provide for local checkout of equipment. For additional information, contact Mr. Joe Taylor, 3246 TESTW/TFD at AUTOVON 872-2694.

APPENDIX I

AIR FORCE FLIGHT TEST CENTER (AFFTC)

No Command Systems for command destruct or drone control are owned or operated by AFFTC.

APPENDIX J

AIR FORCE SATELLITE CONTROL FACILITY (AFSCF)

No Command Systems for command destruct or drone control are owned or operated by AFSCF.

APPENDIX K

AIR FORCE TACTICAL FIGHTER WEAPONS CENTER (AFTFWC)

No Command Systems for command destruct or drone control are owned or operated by AFTFWC.

APPENDIX L

EASTERN SPACE AND MISSILE CENTER (ESMC)

ESMC flight data is displayed and commands are originated from the Rance Control Center at Cape Kennedy AFS, Florida.

The Air Force Eastern Test Range (AFETR) Command/Control Sites are equipped with the following transmitting equipment.

Station 1 (Cape Kennedy)

Two Recreation Instruments Inc., model 6031 r-f exciters

Two ARF Products model ASG-8 audio encoders

Two Collins 240 D-2 10-kW amps

Two Canoga steerable antennas

One Melpar high power omni

One Gabriel low power omni

Station 3 (Grand Bahama Island)

Two Collins 52Q1-TH r-f exciters

Two Collins 240D-2 10-kW amps

Two Esco steerable antennas

One Temec dish antenna, steerable

Station 67 (Bermuda)

Two Recreation Instruments, Inc., model 2031 r-f exciters

Two KY 171 audio encoders

Two Collins 240 D-2 10-kW amps

Two Canoga steerable antennas

APPENDIX M

WESTERN SPACE AND MISSILE CENTER (WSMC)

The four WSMC Command/Control Sites are equipped with the following transmitting equipment:

Sites No. 1, 3, 4, and 6

Two HP 8660A synthesized signal generators

Two 3-Dbm 10-W amps

Two FEC SK11982AG1 audio coder units

Two Aydin model 1206A 10-kW amps

One Andrew 63608 omniantenna

One Directional antenna system, Canoga P52S-1C

APPENDIX N

NASA WALLOPS STATION RANGE (NASA-WALLOPS)

NASA-Wallops Station missile flight safety data is displayed and commands originated from the Range Safety Control Facility, Wallops Island, Virginia.

The NASA-Wallops Station Command/Control Sites are equipped with the following transmitting equipment:

Wallops Mainland Site

Two Aleph CTS-100 Command Systems

Two Antlab quad helix antennas

Mobile Van System

Two AN/FRW-2A transmitting sets

One Antlab quad helix antenna

APPENDIX O

TONOPAH TEST RANGE (TTR)

The TTR Sandia National Laboratories, flight safety data is displayed and commands are originated at the Operations Control Center.

The TTR Command/Control Site is equipped with the following equipment:

Two Babcock AN/URW-15 transmitting systems

Two Aleph, Inc. 431-1818-001 50-W exciters

Two Babcock coders, audio frequency
- One BCC-6E
- One BCC-30

One Taco helical antenna, model G-1257-B
with Sandia-designed remote control

One omnidirectional antenna, AT-948U, P/N 872915

APPENDIX P

AIR DEFENSE WEAPONS CENTER (ADWC)

ADWC operates command destruct and drone control equipment as follows.

Command Destruct

Two AN/FRW-2 transmitters*

One Gabriel AT-781/U antenna

One Gabriel AT-782/U antenna

DRONE CONTROL

One Vega Drone Tracking Control System located on Tyndall AFB, Florida, permits Command/Control, tracking and telemetry of PGM-102 and BQM-series targets. The system possesses two organic radars and also uses two AN/FPS-16 radars at Cape San Blas, Florida, to extend the coverage area. The radars operate C-band with the Command/Telemetry cycle occurring once each PRF interval.

Command/Control of aircraft is also exercised using 15 AN/UPA-35 radar scopes displaying data from an AN/FPS-64 area surveillance radar. The AN/FPS-64A radar is owned and maintained by the Federal Aviation Administration (FAA) and covers a 65,000-square mile (nautical) area of the Gulf of Mexico. UHF/VHF air-ground radios and wire communications are controlled by AN/GTA-6.

Two CTS-100 command transmitters are programmed to replace the two AN/FRW-2 transmitters listed above.