DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE FOR OPERATIONAL HEALTH (AFMC)
BROOKS CITY-BASE TEXAS

18 AUG 2004

MEMORANDUM FOR ACC PMS/SCM

FROM: AFIOH/SDR
2350 Gillingham Drive
Brooks City-Base TX 78235-5103

SUBJECT: Consultative Letter, IOH-SD-BR-CL-2004- 0084 , Radio Frequency Radiation Hazard Assessment, USAF Tethered Aerostat Radar System Site, Cudjoe Key, FL

1. Introduction: TSgt Mark Randall, Functional Ground Radar System Program Manager, requested AFIOH support to assess radio frequency radiation (RFR) hazards to personnel at the USAF Tethered Aerostat Radar System (TARS) site located in Cudjoe Key, FL. From 26-29 Apr 04, 2Lt Marcus Grant and TSgt Donald Carbajal conducted an on-site RFR hazard assessment and power density measurements.

2. Background:

a. The RFR emitter systems surveyed primarily were the L-88VA and AN/UPX-37 Interrogator. The TARS is mounted inside of the windscreen (see attachment 4, figure 1) of a tethered aerostat that carries the unit to different altitudes to conduct surveillance of the Gulf of Mexico. TSgt Randall requested a hazard evaluation because the site recently installed a new radar that utilizes different operating parameters. AFIOH also reviewed the RFR safety program for the facility.

b. Air Force Occupational Safety and Health (AFOSH) Standard, 48-9, *Radio Frequency Radiation Safety Program*, 1 August 1997, establishes the maximum permissible exposure limits (PELs) for controlled and uncontrolled environments. A controlled environment is an area that may be occupied by personnel who accept potential exposure as a concomitant of employment or duties, by individuals who knowingly enter areas where such levels are to be expected, and by personnel passing through such areas. Uncontrolled environments are locations where RFR exposures do not exceed the PEL values for controlled environments or locations such as living quarters, workplaces, or public access areas where personnel would not expect to encounter higher levels of radio frequency energy. The standard is based on the Institute for Electrical and Electronics Engineers (IEEE) C95.1-1991, *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz.* The personnel hazard distance is the distance where the power density equals a specific PEL. Measurement locations

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with associated power density levels and general findings are listed in the following section. PELs are listed in Attachment 2.

3. Results:

a. The TARS is anchored to a 46,000 square foot controlled pad. Persons who come within this area are trained and aware of the safety hazards from RFR. Measurements were taken at the closest accessible location to each emitter, at a height of up to 30 feet above ground level (AGL), within the aerostat windscreen (see attachment 4, figure 2), accessible locations surrounding the windscreen, and on other emitters located on the roof of Building 12920 (see attachment 4, figures 3a-d). Measurements were collected around the TARS recovery pad, underneath the windscreen, Northpad Blockhouse (see figure 4), and surrounding windscreen at 10-30 feet AGL. Ambient RFR background was 0.02 mW/cm^2. The emitter was located 18-20 ft AGL inside of the windscreen.

b. The windscreen houses the L88VA Radar, AN/UPX-37 Interrogator, AN/UPX-37 Interrogator Diff OMNI, and L88VA Telemetry Downlink Antenna (see attachment 4, figure 2). Measurements were taken at the work platform, gimbal, windscreen mat, and Plexiglas. Measurements at these locations inside the windscreen were below 0.2 mW/cm^2 for the L88VA Radar, AN/UPX-37 Interrogator and AN/UPX-37 Interrogator Diff OMNI. The highest reading obtained from the L88VA Telemetry Downlink Antenna (located south of the radar pad) was 8.0 mW/cm^2. These measurements did not exceed the controlled PEL limits applicable to this area.

c. In order to measure the L-88VA Radar and the AN/UPX-37 Interrogator, it was necessary to enter the windscreen of the TARS. 2Lt Grant and TSgt Carbajal performed measurements simultaneously inside and outside of the aerostat windscreen while each emitter transmitted independently and simultaneously to one another. The L-88VA transmitted at a frequency of 1.3 GHz and with a max power of 10 kW. The AN/UPX-37 Interrogator transmitted at a frequency of 1.03 GHz and with a max power of 0.13 kW. The highest reading from the L-88VA radar was 2.1 mW/cm^2 and 0.8 mW/cm^2 for the AN/UPX-37 antenna when measurements were taken from the pad surrounding the TARS. Readings in all other areas at ground level surrounding the TARS were 0.2 mW/cm^2. Measurements taken surrounding windscreen at 10-30 feet AGL exceeded the controlled PEL values for each emitter. Measurements performed on the L88VA Radar indicated that the controlled PEL was exceeded at 27 ft and 3 inches outside of the windscreen at a height of 10-30 feet AGL or in the vertical plane at the equipment housing on the TARS (see attachment 4, figure 5). The AN/UPX-37 readings did not exceed the controlled PEL value.

d. Measurements were later taken on the Aydin Vector T102U, AT150TSO Altitude Reporting Antenna, and Aydin Vector TT202S Telemetry Portable Command Unit (see attachment 4, figure 6 and 7). The Aydin Vector T102U highest reading was 1.2 mW/cm^2. The reading from the AT150TSO Altitude Reporting Antenna was at background levels. The highest reading from the Portable Command Unit was 13.3 mW/cm^2. Measurements indicated that the Aydin Vector T102U and AT150TSO Altitude Reporting Antenna did not exceed the controlled

PEL limits applicable to this area. The Aydin Vector TT202S exceeded the PEL at 5 inches away from the antenna.

e. Measurements were also taken on the Aydin Vector T102U Telemetry Antenna helix (440 MHz), Aydin Vector T102U Telemetry Antenna (445 MHz), L88VA Telemetry Uplink Antenna, and Triton X Weather Radar. These emitters are located on the roof of Building 12920. The T102U (440 MHz and 445 MHz) readings exceeded PEL limits with readings of 2.0 mW/cm^2 on contact. The L88VA Telemetry Uplink Antenna's highest reading was 4.5 mW/cm^2 on contact. The uplink readings and Triton X Weather Radar did not exceed the PEL applicable to this emitter.

f. Once measurements of the TARS were completed, we requested information from the site safety officer regarding their RFR safety awareness-training program. The information requested included overexposure reporting procedures, normal operating procedures in relation to the antenna and emitters, and number and location of all emitters on-site. We were provided with a copy of their standard operating procedures titled *RF Radiation Hazard GOI 91-1, 3 October 2003, Site Operating Instructions SOI91-06, 7 January 2004,* and *Site Operating Instruction 91-09, 12 April 2004*. Records indicated that training was given annually.

4. Recommendations:

a. Our survey identified several systems or areas that exceeded the PEL values for controlled and uncontrolled environments. The system with the greatest hazard is the Aydin Vector T102U Portable Command Unit. On contact, the antenna had a reading of 13.3 mW/cm^2. Personnel must ensure that the antenna for this system is inaccessible through normal operations while transmitting. The L88VA Radar has a measured hazard distance of 27 feet and 3 inches at 10-30 feet AGL. We recommend that personnel never be within this radius while the radar is transmitting. Our measurements also indicated that there are no RFR hazards from the radar and antenna past the aerostat's pad including building 12920. The Aydin Vector T102U 440MHz and 445MHz, L88VA Telemetry Antennae Uplink and Downlink are contact hazards. Post signs in areas to ensure persons are aware of these hazards.

b. The RFR safety program was reviewed. The information provided was sufficient because it addressed the potential RFR hazards as part of their normal duties. Personnel should continue to ensure that the North Pad is accessible by site personnel. Site personnel should be aware of all potential RFR hazards and maintain appropriate distance away from the controlled hazard distance provided in this report. Continue to use red beacon indicators to notify persons on the pad when the radar is transmitting. This site should utilize AFOSH Standard 48-9 for guidance of their safety program and suspected overexposures.

5. Our office wishes to acknowledge Mr. Ronald Morrow and the entire TARS site staff for their hospitality and help. If not for their support and escort, the survey would not have gone as smoothly as it did. If you have questions concerning this report or follow-up survey

measurements, please contact 2Lt Marcus Grant at DSN 240-5562 or marcus.grant@brooks.af.mil or the ESOH Service Center at 1-888-232-ESOH. In order to improve our services, please complete and return the attached critique.

SCOTT M. NICHELSON, Lt Col, USAF, BSC, CHP, CIH
Chief, Radiation Surveillance Division

Attachments:

1. Administrative Data
2. TARS Site Inventory
3. AF Form 2759
4. TARS Site Photos
5. Measurement Data
6. RF Radiation Hazard GOI 91-1, 3 October 2003
7. Site Operating Instructions SOI91-06, 7 January 2004
8. Critique

Administrative Data

1. Personnel Contacted

TSgt Mark Randall, ACC PMS/SCM
Stan R Zduniak, ACC/ACC PMS/SUT
Charles Brant, USAF TARS Quality Control Officer

2. Equipment Used

Narda Meter 8712, S/N 20005, Calibrated 09/03
Narda Probe 8733, S/N 04018, Calibrated 12/03
Narda Probe 8721D, S/N 08031, Calibrated 09/03
Narda Probe 8721, S/N 15035, Calibrated 01/04
Narda Meter 8718, S/N 01023, Calibrated 01/04

Cudjoe Key Radiofrequency Inventory

Nomenclature Measurements	Location	Measured PD (mW/cm2)	PELc (mW/cm2)	HD c (feet-est.)	HD c (feet-mea.)	PELuc (mW/cm2)	Frequency (MHz)	Peak Power (kW)	Pulse Width (usec)	PRF (pulses/s)	Gain (db)
Aydin Vector T102U (Telemetry) 440 MHZ	Bldg 12920	1.6	1.47	1.21	Contact	0.3	4.40E+02	4.00E-03	CW	CW	3.00E+00
Aydin Vector T102U (Telemetry) 445 MHZ	Bldg 12920	1.5	1.48	1.21	Contact	0.297	4.45E+02	4.00E-03	CW	CW	3.00E+00
L88VA Telemetry Antenna Uplink (two Antannae)	Bldg 12920	4.5	10	0.23	0.23	3.27	4.91E+03	1.00E-03	CW	CW	8.00E+00
Triton X Weather Radar System	Bldg 12920	0	10	4.21	0	6.08	5.44E+00	2.00E-01	2.00E+01	1.40E+03	3.05E+01
Motorola Base Station	Bldg 12920	0.8	1	3.28	0	0.2	1.65E+02	4.50E-02	CW	CW	4.45E+00
Aydin Vector T102U (Portable Command Unit)	North Pad	13.3	1.48	0.68	Contact	0.2	1.82E+03	4.00E-03	CW	CW	7.00E+00
AT150TSO Altitude Reporting	North Pad	3.3	3.63	3.43	0	0.7	1.09E+03	2.50E-01	4.50E-01	0.00E+00	3.00E+00
L88VA Radar	North Pad	4.3	4.33	237	27	0.8	4.70E+03	1.00E+01	1.34E+00	7.38E+02	3.46E+01
AN/UPX-37 Interrogator Diff OMNI	North Pad	0.5	3.43	1.57	0	0.68	1.03E+03	5.00E-01	1.34E+02	7.38E+02	3.00E+00
L88VA Telemetry Antenna Downlink	North Pad	8	10	0.2	0.5	3.13	4.70E+03	1.00E-03	CW	CW	8.00E+00
AN/UPX-37 Interrogator	North Pad	0.8	3.43	2.31	0	0.68	1.03E+03	1.26E-01	8.00E-01	7.38E+02	3.46E+01
Aydin Vector T102U Telemetry	North Pad	1.5	1.48	0.68	0.5	0.28	1.72E+03	4.00E-03	CW	CW	7.00E+00

Attachment 2

RADIOFREQUENCY EMITTER SURVEY

DATE (YYMMDD): 040328

WORKPLACE IDENTIFIER: 2759.DOC

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BASE: USAF TARS Site

ORGANIZATION: USAF

WORKPLACE:

BLDG NO / LOCATION: Bldg 12920

ROOM / AREA: TARS Site

NAME OF KEY CONTACT	GRADE	POSITION	ORGANIZATION/OFFICE SYMBOL	DUTY PHONE
MSgt Mark Randall	E-7	Functional Ground Radar System Program Manager	ACC PMS/SCM	574-9187

HAZARD EVALUATION AND CONTROL DATA

NOMENCLATURE	Aydin Vector T102U	Aydin Vector T102U	L88VA Telemetry Antenna Uplink	Triton X
DESCRIPTION	Telemetry	Telemetry	Two Antennae	Weather Radar System
LOCATION OF EMITTERS	Rooftop of Bldg 12920	Rooftop of Bldg 12920	Rooftop of Bldg 12920	Rooftop of Bldg 12920
QUANTITY	1	1	2	1
FREQUENCY (MHZ)	440	445	4910	5.44
PULSE WIDTH *(microsec.)*	CW	CW	CW	20
PULSE REPITITION FREQ *(pps)*	CW	CW	CW	1400
PEAK POWER *(KW)*	0.004	0.004	0.001	0.2
ANTENNA CODE				
ANTENNA SIZE *(ft.)* *(hor./ver.)*				
ANTENNA BW *(deg)* *(hor./ver.)*				
ANTENNA GAIN *(dB)*	3	3	8	30.5
SCANNING CODE				
SCAN RATE *(rpm)*				
ESTIMATED HAZARD DISTANCE *(ft)*	1.21	1.21	0.23	4.21
HAZARD CODE(S)				
HAZARD CONTROL CODE(S)				
HAZARD DISTANCE MEASUREMENTS *(ft)*	Contact	Contact	0.23	0

SURVEYED BY (Name, Grade, AFSC)

REVIEWED BY (Name, Grade, AFSC)

AF FORM 2759 Jan 82 COMPUTER GENERATED **PREVIOUS EDITIONS WILL BE USED**

RADIOFREQUENCY EMITTER SURVEY

DATE (YYMMDD): 040328

WORKPLACE IDENTIFIER: 2759.DOC

(Use this space for mechanical imprint)

BASE: USAF TARS Site

ORGANIZATION: USAF

WORKPLACE:

BLDG NO / LOCATION: Bldg 12920/North Pad

ROOM / AREA: TARS Site

NAME OF KEY CONTACT	GRADE	POSITION	ORGANIZATION/OFFICE SYMBOL	DUTY PHONE
MSgt Mark Randall	E-7	Functional Ground Radar System Program Manager	ACC PMS/SCM	574-9187

HAZARD EVALUATION AND CONTROL DATA

NOMENCLATURE	Motorola Base Station	Aydin Vector T102U	AT150TSO	L88VA Radar
DESCRIPTION	N/A	Portable Command Unit	Altitude Reporting Unit	Aerostat Radar
LOCATION OF EMITTERS	Rooftop of Bldg 12920	NorthPad	NorthPad	NorthPad
QUANTITY	1	1	1	1
FREQUENCY (MHZ)	165	1820	1090	4700
PULSE WIDTH *(microsec.)*	CW	CW	0.45	1.34
PULSE REPITITION FREQ *(pps)*	CW	CW	0	738
PEAK POWER *(KW)*	0.045	0.004	0.25	10
ANTENNA CODE				
ANTENNA SIZE *(ft.)* *(hor./ver.)*				
ANTENNA BW *(deg)* *(hor./ver.)*				
ANTENNA GAIN *(dB)*	4.45	7	3	34.6
SCANNING CODE				
SCAN RATE *(rpm)*				
ESTIMATED HAZARD DISTANCE *(ft)*	3.28	0.68	3.43	237
HAZARD CODE(S)				
HAZARD CONTROL CODE(S)				
HAZARD DISTANCE MEASUREMENTS *(ft)*	Contact	Contact	0	27

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RADIOFREQUENCY EMITTER SURVEY

DATE (YYMMDD): 040328

WORKPLACE IDENTIFIER: 2759.DOC

(Use this space for mechanical imprint)

BASE: USAF TARS Site

ORGANIZATION: USAF

WORKPLACE:

BLDG NO / LOCATION: Bldg 12920/North Pad

ROOM / AREA: TARS Site

NAME OF KEY CONTACT	GRADE	POSITION	ORGANIZATION/OFFICE SYMBOL	DUTY PHONE
MSgt Mark Randall	E-7	Functional Ground Radar System Program Manager	ACC PMS/SCM	574-9187

HAZARD EVALUATION AND CONTROL DATA

NOMENCLATURE	AN/UPX-37 Interrogator	L88VA Telemetry Antenna	AN/UPX-37 Interrogator	Aydin Vector T102U
DESCRIPTION	Diff OMNI	Downlink	Main Aerostat Antenna	Telemetry
LOCATION OF EMITTERS	Northpad	NorthPad	NorthPad	NorthPad
QUANTITY	1	1	1	1
FREQUENCY (MHZ)	1030	4700	1030	1720
PULSE WIDTH *(microsec.)*	134	CW	0.8	CW
PULSE REPITITION FREQ *(pps)*	738	CW	738	CW
PEAK POWER *(KW)*	0.5	0.001	0.126	0.004
ANTENNA CODE				
ANTENNA SIZE *(ft.) (hor./ver.)*				
ANTENNA BW *(deg) (hor./ver.)*				
ANTENNA GAIN *(dB)*	3	8	34.6	7
SCANNING CODE				
SCAN RATE *(rpm)*				
ESTIMATED HAZARD DISTANCE *(ft)*	1.57	0.2	2.31	0.68
HAZARD CODE(S)				
HAZARD CONTROL CODE(S)				
HAZARD DISTANCE MEASUREMENTS *(ft)*	0	0.5	0	0.5

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REVIEWED BY (Name, Grade, AFSC)

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Figure 1, Aerostat Windscreen

Figure 2, Inside Windscreen

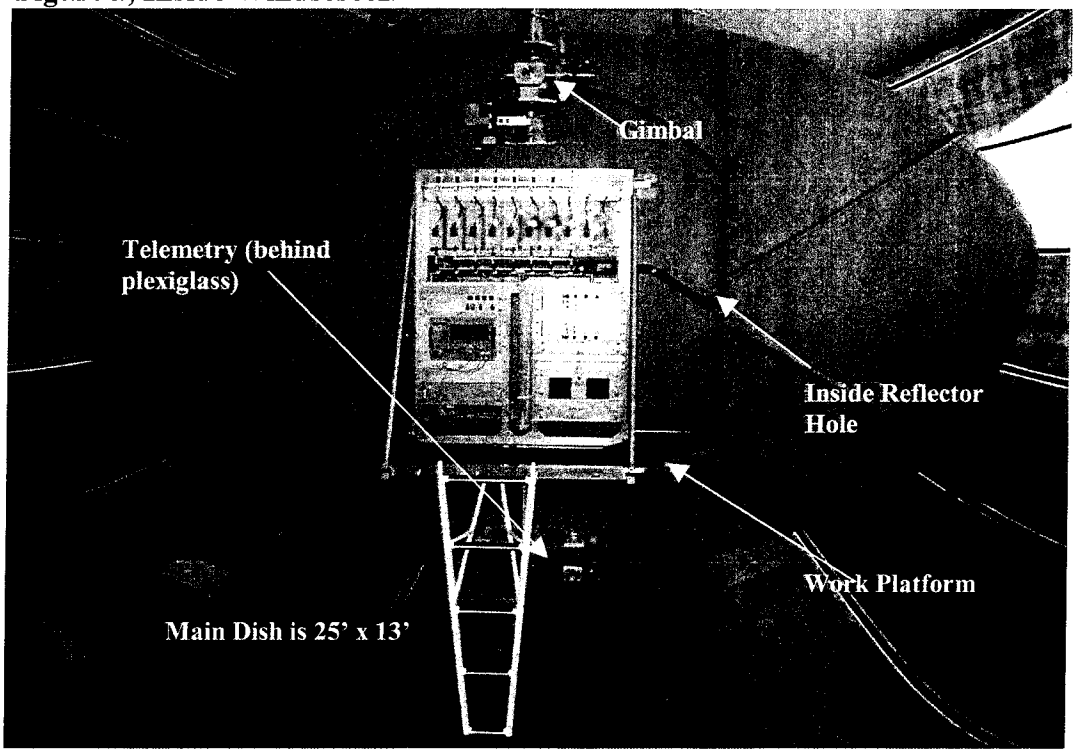


Figure 3a, Emitters on Roof of Building 12920

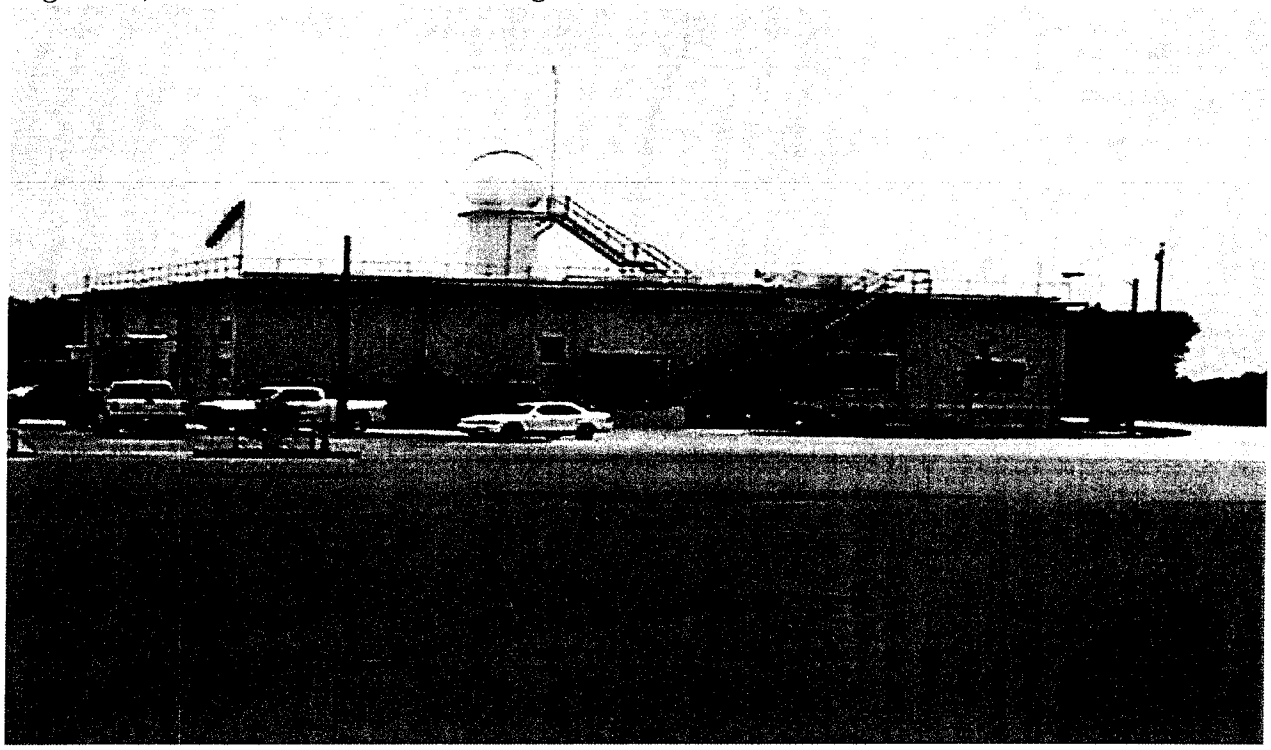


Figure 3b, Emitters on Roof of Building 12920

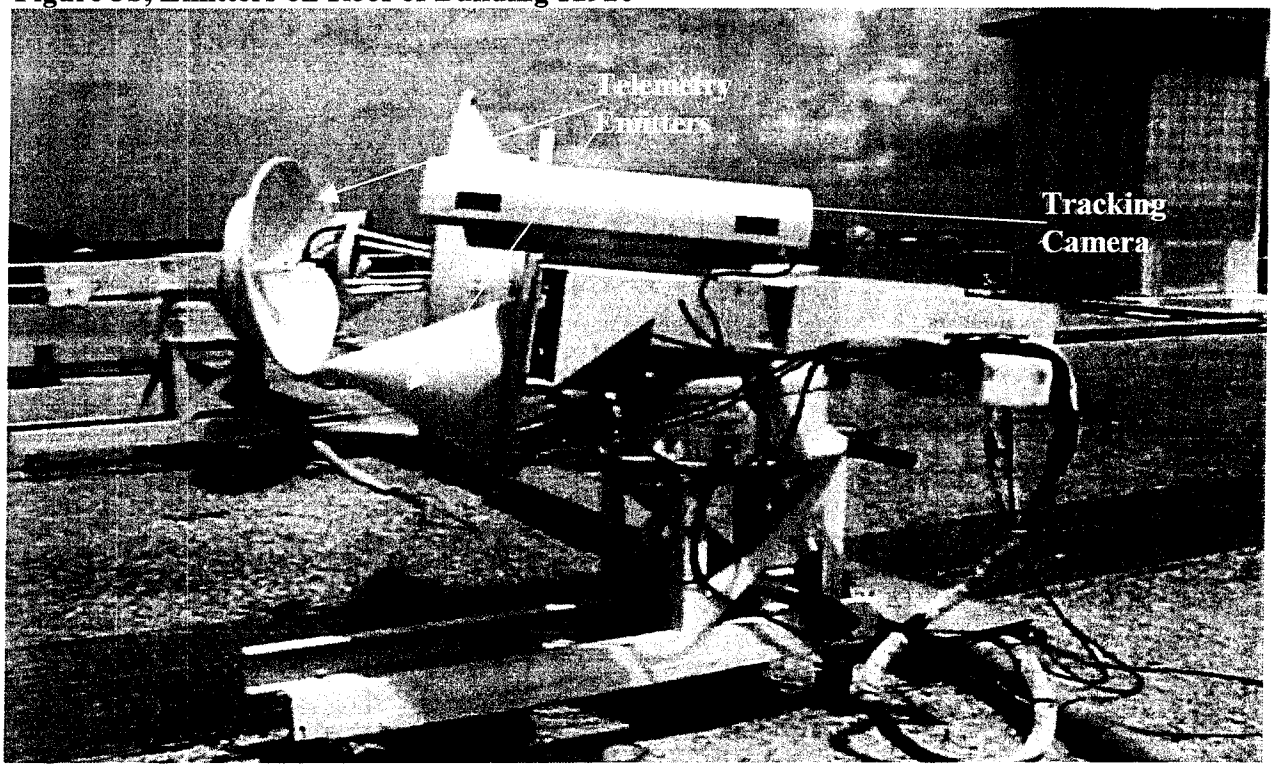


Figure 3c, Emitters on the Roof of Building 12920

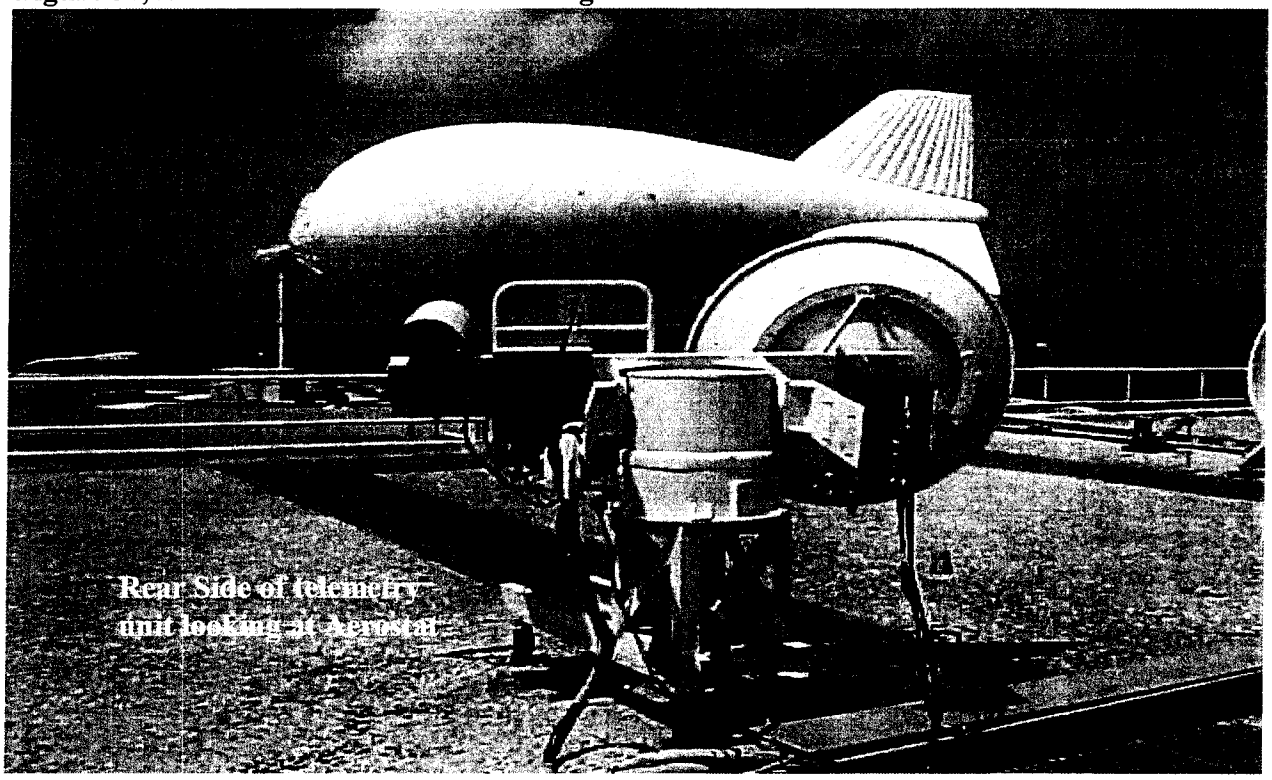


Figure 3d, Emitters on the Roof of Building 12920

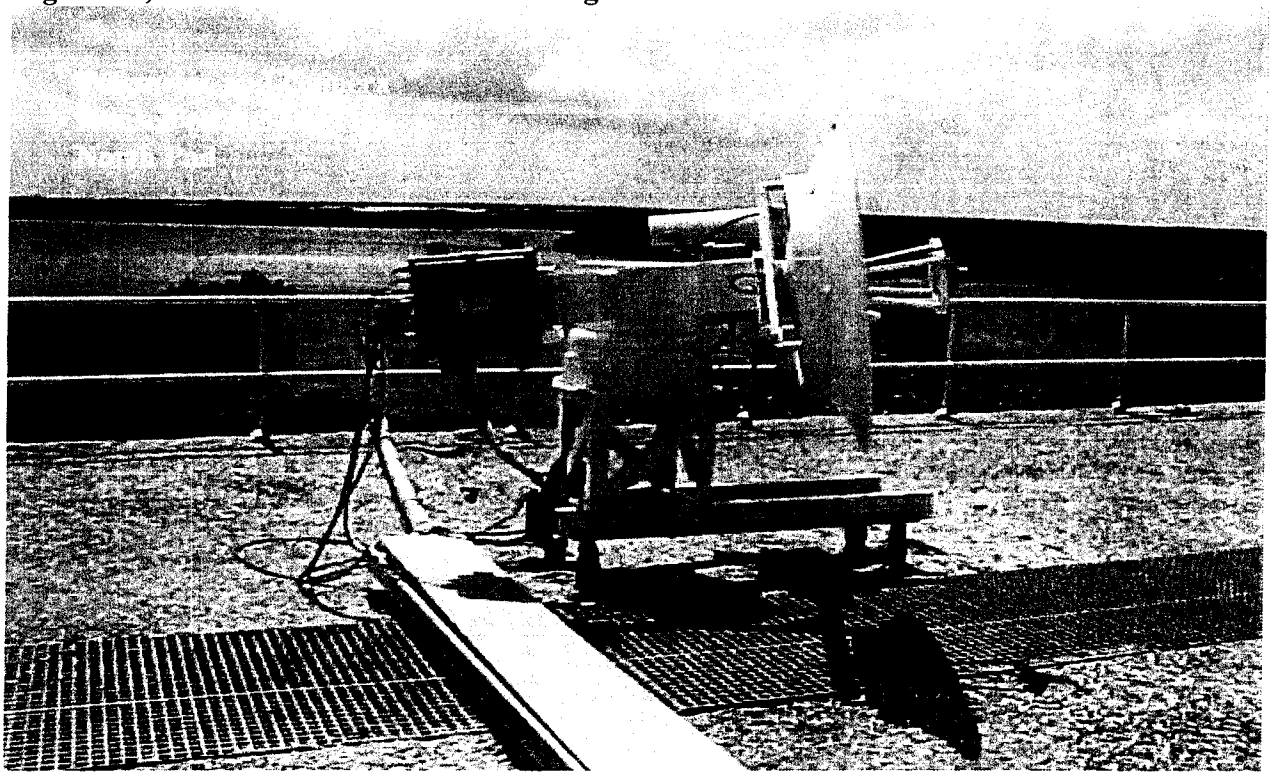


Figure 4, Northpad Blockhouse

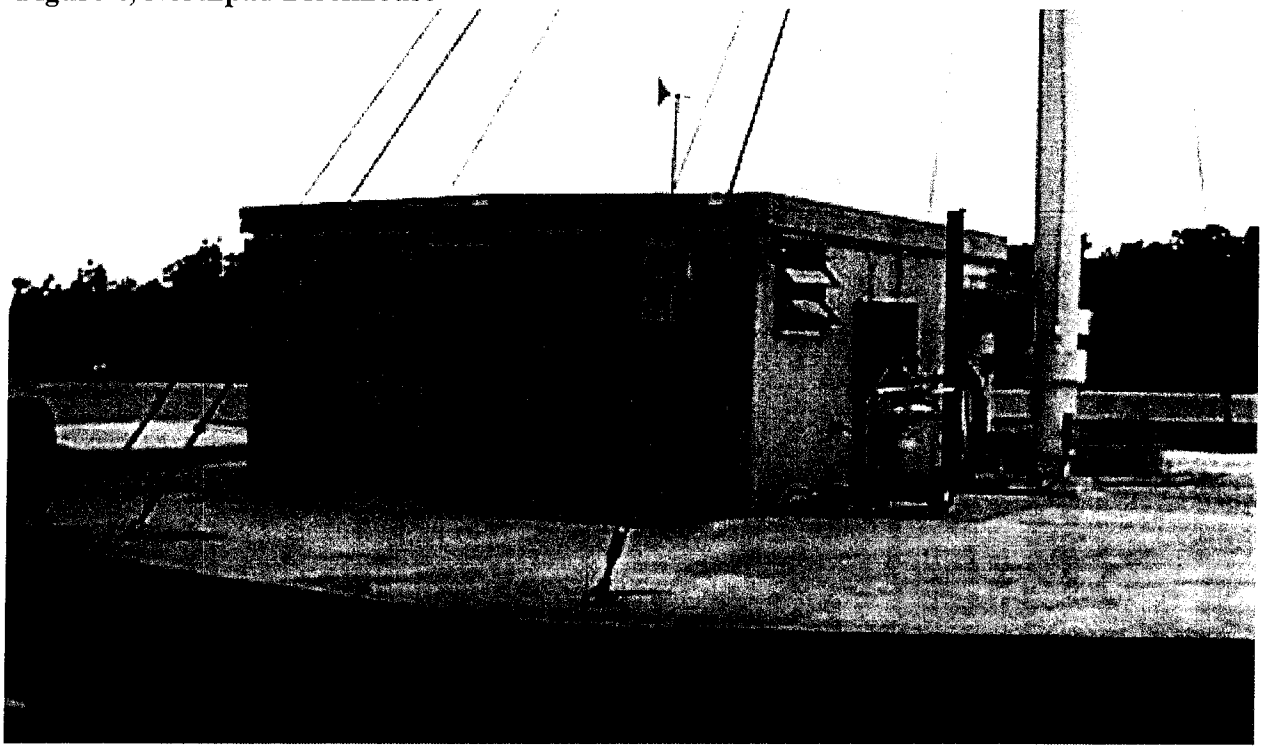


Figure 5, Equipment and Blower Housing of TARS

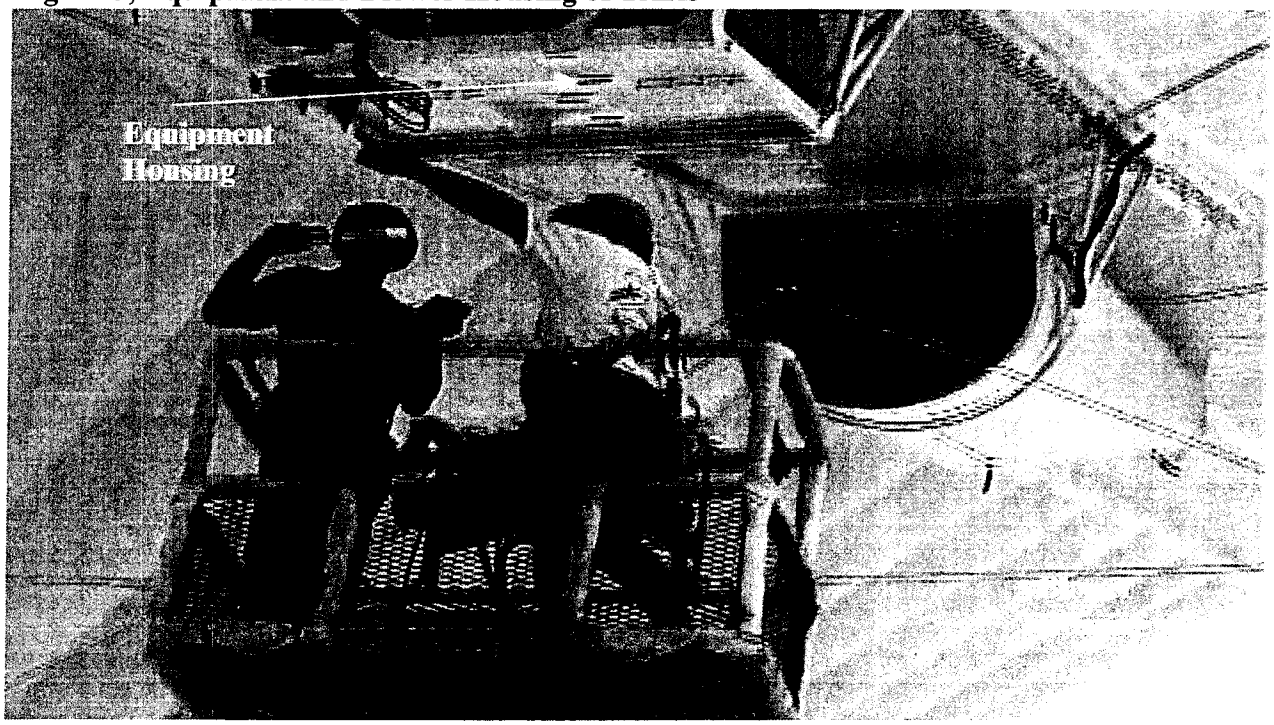


Figure 6, Portable Command Unit

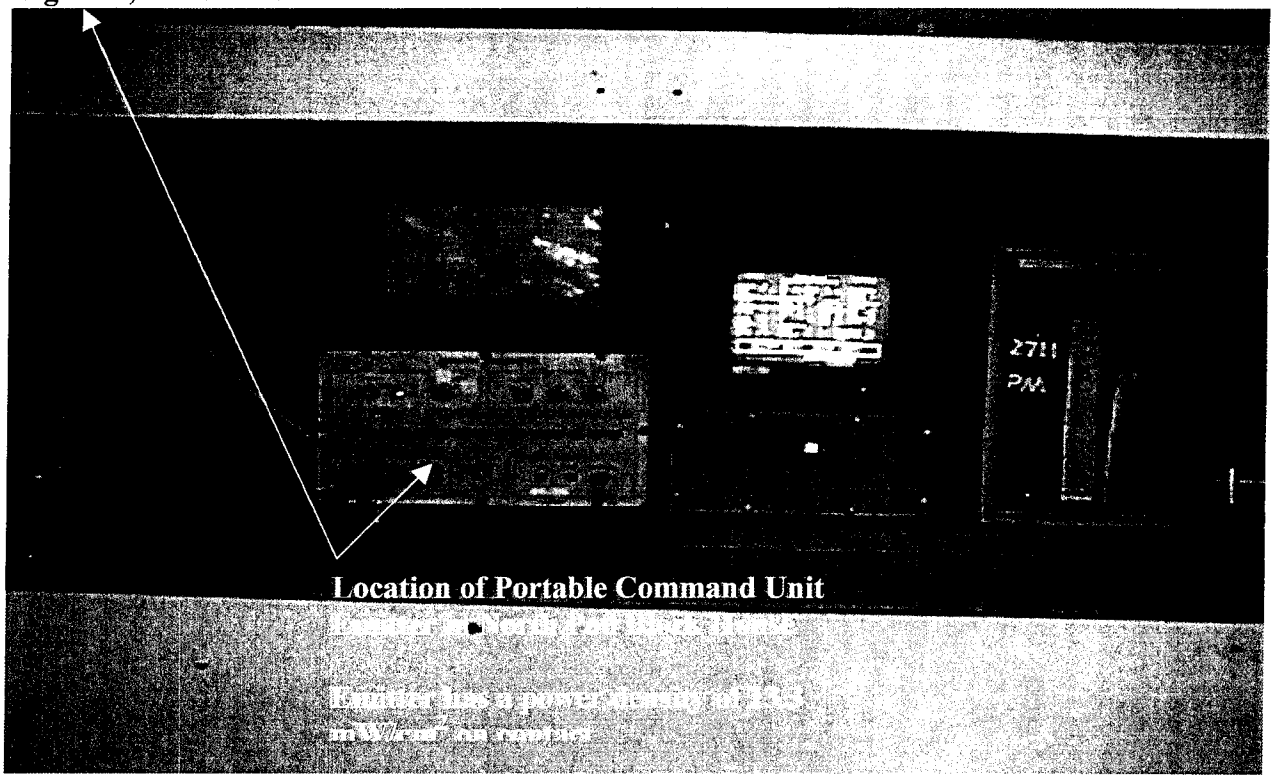
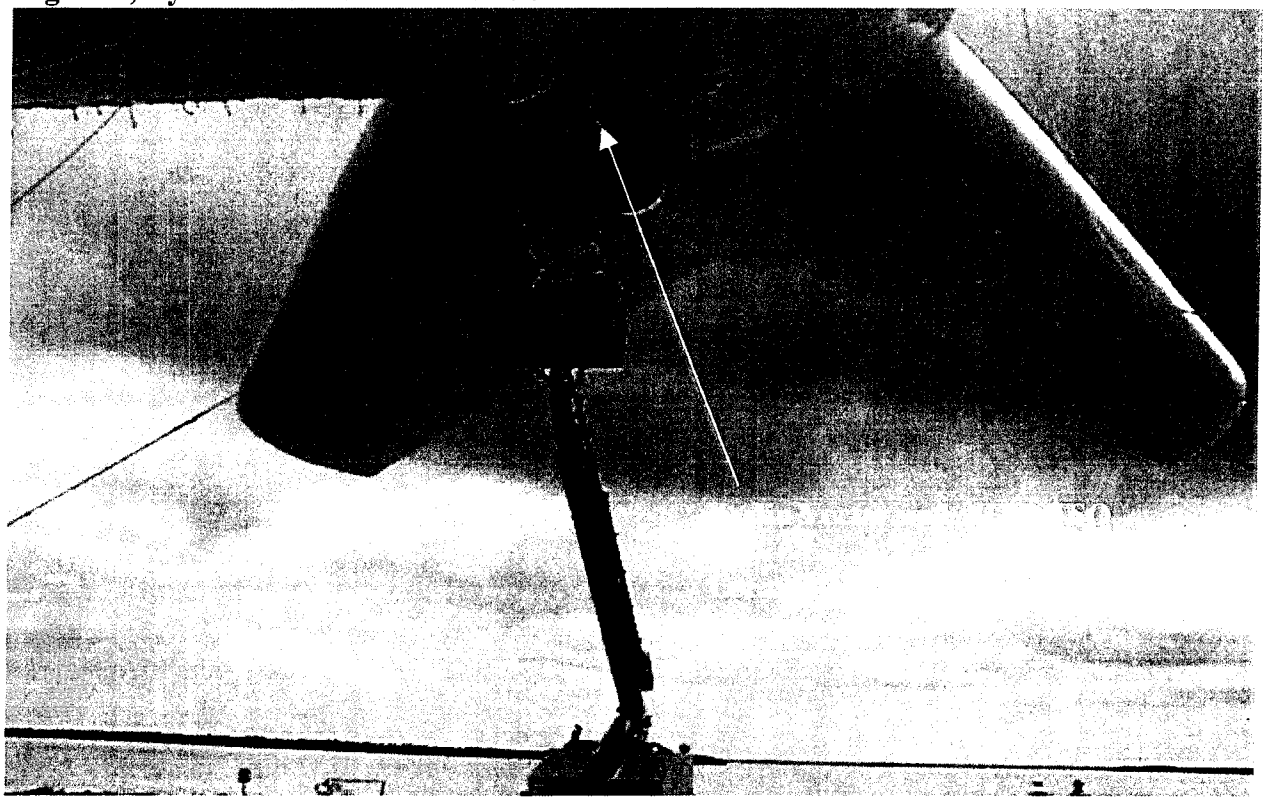


Figure 7, Aydin Vector and AT150TSO



MEASUREMENT DATA

EMITTER	MEASUREMENT (mW/cm2)	LOCATION	DISTANCE from Emitter	Controlled or Uncontrolled
AN/UPX-37 IFF Interrogator OMNI	0.5 mW	Contact	0	Uncontrolled
L88VA Telemetry Downlink	8.0 mW	Contact	0	Uncontrolled
AN/UPX-37 IFF Interrogator	0.02 mW	Relector Hole	0	Uncontrolled
L88VA Radar/Reflector Hole	14 mW	Inaccessible Contact Hazard	0	Controlled
L88VA Radar	0.05 mW	Gimbal Height	8 feet	Uncontrolled
L88VA Radar	0.05 mW	Work platform	5 feet	Uncontrolled
L88VA Radar	1 mW	Windscreen Mat	8 feet	Uncontrolled
L88VA Radar	0.06 mW	plexiglass	3 feet	Uncontrolled
L88VA Radar	4.1	Equipment Housing @ 10ft	27 feet and 3 inches	Controlled
L88VA Radar	4.3	Equipment Housing @ 20ft	27 feet and 3 inches	Controlled
L88VA Radar	4	Equipment Housing @ 30 ft	27 feet and 3 inches	Controlled
L88VA Radar	3.9	Equipment Housing @ 40 ft	27 feet and 3 inches	Controlled
L88VA Radar/Interrogator	0.25	Blower Housing @ 10 ft	49 feet	Uncontrolled
L88VA Radar/Interrogator	0.24	Blower Housing @ 20 ft	49 feet	Uncontrolled
L88VA Radar/Interrogator	0.22	Blower Housing @ 30 ft	49 feet	Uncontrolled
L88VA Radar/Interrogator	0.25	Blower Housing @ 40 ft	49 feet	Uncontrolled
L88VA Radar	0.8	Ground Level	Ground Below Windscreen	Uncontrolled
L88VA Radar/Interrogator	4.1	Blower Housing @ 10 ft	27 feet and 3 inches	Controlled
L88VA Radar/Interrogator	4.2	Blower Housing @ 20 ft	27 feet and 3 inches	Controlled
L88VA Radar/Interrogator	4.3	Blower Housing @ 30 ft	27 feet and 3 inches	Controlled
L88VA Radar/Interrogator	4	Blower Housing @ 40 ft	27 feet and 3 inches	Controlled
AN/UPX-37 IFF Interrogator	0.2	Equipment Housing @ 10ft	49 feet	Background
AN/UPX-37 IFF Interrogator	0.2	Equipment Housing @ 20ft	49 feet	Background
AN/UPX-37 IFF Interrogator	0.2	Equipment Housing @ 30 ft	49 feet	Background
AN/UPX-37 IFF Interrogator	0.2	Equipment Housing @ 40 ft	49 feet	Background
AN/UPX-37 IFF Interrogator	0.2	Ground Level	Ground Below Windscreen	Background

Attachment 5

CHAPTER 8, RF RADIATION HAZARD

8.1GENERAL

These instructions describe how employees handle, operate, maintain and service ionizing-radiation producing devices and radioactive sources. This chapter describes how TARS employees will be protected from potential exposure to radio frequency (RF) radiation.

8.2SCOPE

These procedures apply to all TARS, visitors, and contractors.

8.3SITE SPECIFIC PROCEDURES

Each TARS site, at the discretion of the Site Manager, may publish more stringent Site Operating Instructions (SOI) than those contained in this chapter. The SOI must be submitted to the TARS CMO ES&H Coordinator for review and approval prior to implementation.

8.4RF RADIATION SOURCES

The following is a list of the typical RF radiation sources found at a TARS site:

- Aerostat radar system
- Aerostat beacon system
- Aerostat telemetry system
- Weather radar system

8.5RF ENERGY QUESTIONNAIRE

In December each year, each site will fill out and maintain TARS Form 91-003, RF Energy Questionnaire, for each of the RF emitters located on their site. Upon completion and certification by a qualified individual, usually the MSS or senior E-Tech, a copy will be forwarded to the TARS CMO ES&H Coordinator for review.

8.6RF RADIATION DATA

The following site-specific RF radiation hazard data, and a description of the emitter's radiation hazard zone(s) for each RF emitter must be included on the RF Energy Questionnaire. The site's RF Radiation Survey and equipment technical manuals should be used as the source of this information. If a site-specific RF radiation survey has not been conducted, the manufacturer's recommendations or representative RF radiation information from a survey conducted at a like site may be used. Requests for survey results from a like site will be made to the TARS CMO ES&H Coordinator. The TARS Form 91-003, RF Energy Questionnaire must contain the following information:

- Equipment nomenclature
- Location on site
- Equipment parameters
- Radiated Frequency
- Pulse Width
- Pulse Repetition Frequency
- Peak Power
- Horizontal and Vertical Antenna Beam Width
- Antenna Gain

- Scan Rate
- Radiation hazard zone(s)

8.7RF RADIATION HAZARD WARNING SIGNS

RF Radiation Hazard Warning signs will be posted at access points to areas in which radiation levels may exceed the Permissible Exposure Limits (PEL) values listed in the RF Hazard Survey.

8.8PROCEDURES

8.8.1 Aerostat Radar and Beacon Systems

8.8.1.1 Individuals will not enter the aerostat windscreen while the aerostat radar or beacon systems are radiating.

8.8.1.2 The aerostat radar and/or beacon systems may be activated and may radiate while the aerostat is moored to the tower under the following conditions:

- On-duty Flight Director approves the need to radiate. No less than five (5) minutes prior to transmitter testing an announcement will be made over the public address system stating that radar transmitter tests will commence and the direction of the radar antenna.
- All personnel are cleared from the aerostat pad and perimeter fence area. Any warning lights, alarms, etc., used by the site will be activated.
- On-duty Flight Director confirms the radar antenna is pointing to a predetermined azimuth (e.g. away from populated buildings or storage areas).
- At the completion of the transmitter testing, an announcement will be made over the public address system stating that transmitter testing has been completed and all warning lights, alarms, etc., used by the site will be deactivated.

8.8.1.3 Lajas TARS may radiate the payload while the Aerostat is moored on the tower or when directed by the Government.

8.8.2 Aerostat Telemetry System

8.8.2.1 Individuals are prohibited from performing maintenance on the telemetry antenna systems while the unit is radiating.

8.8.3 Weather Radar System

8.8.3.1 TARS employees are prohibited from ascending the weather radar tower while the unit is radiating.

8.9RF RADIATION EXPOSURE INCIDENTS

The following steps should be taken in the event of an actual or suspected exposure to RF radiation levels in excess of the PEL values listed in the RF Hazard Survey:

8.9.1 Obtain prompt medical assistance in case of overexposure or suspected overexposure.

8.9.2 Notify the TARS Control Center (TCC) of the incident. File a Pollution Incident/Mishap Report IAW CDRL A022 (see Appendix 1). Include the name of the individual, type and duration of exposure, medical assistance provided and general condition of the individual.

8.9.3 Fill out TARS Form 91-002, RF Radiation Exposure Incident Report. Fax a copy to the TCC and TARS CMO ES&H Coordinator, within 24 hours after incident.

8.10 QUALITY CONTROL (QC) INSPECTIONS

The site QC/ES&H Technician will perform an RF Leakage Test and Inspection for each RF emitter in the following manner:

8.10.1 Inspection Frequency

An RF Leakage Test and Inspection for each RF emitter will be performed:

- During the annual equipment technical inspection performed IAW QC Inspection Program.
- Following completion of any waveguide repair that required waveguide disassembly.

Note:
Employees <u>will not</u> be allowed to work in or around the emitter while it is transmitting until the wave-guide leakage test is conducted.

8.10.2 Inspection Requirements

The QC/ES&H Special inspection will consist of:

- Visual inspection of all equipment RF connectors, waveguide, antennas, feed horns, etc.
- Review all TARS Form 91-003, RF Energy Questionnaire's
- Verify by measurement using a Broadband Radiation Meter that waveguide/connector leakage does not exceed the PEL values listed in the RF Hazard Survey. The QC/ES&H Technician will coordinate with the TMDE Monitor to ensure the availability of the Broadband Radiation Meter.
- Review the equipment historical records for maintenance performed on the transmitter or waveguide during the past year.
- File the inspection in the equipment historical record and retain a copy in the QC/ES&H Technicians file

8.11 RF RADIATION HAZARDS

The following paragraphs contain a description of the sources and effects of RF radiation:

8.11.1 Non-Ionizing (RF) Radiation Sources

8.11.1.1 Natural

- Sun
- Lightning

8.11.1.2 Man-Made

- Semiconductors
- Klystrons
- Magnetrons
- High-Power Amplifier Devices

8.11.2 Effects of Exposure to RF Radiation

8.11.2.1 Major concern is thermal

- First, warmth
- Then, perspiration, elevated body temperature, and labored breathing
- Severe cases are similar to heat exhaustion

8.11.2.2 Lower frequencies are most dangerous

- Lower frequencies are induced or absorbed into the body without the skin effect, which can warn an individual of danger.
- The body is more susceptible at these frequencies.

8.11.3RF Energy and the Human Body

8.11.3.1 There are many factors that affect absorption into the human body.

- Dielectric Composition: RF energy typically passes through the fatty tissue and is deposited in the muscle or brain tissues.
- Size of the Body: Absorption rates vary based on the size of the body and the wavelength.
  - Wavelength greater than the body: In this region, there is little absorption and a uniform and equal distribution of energy. Safety standards are based on shock or burn hazards rather than direct absorption.
  - Wavelength equal to the body: In this region, absorption is highest and the energy is distributed unequally. Hot spots may be generated.
  - Wavelength less than the body: Lower absorption of energy and heating confined to irradiated area.
- Shape, Orientation, and Polarization: The human body in a vertical position absorbs 10 times more energy in a vertically versus horizontally polarized emission.
- Complexity of the RF Field: Most standards are based on the far field relationships and their interaction with the body. Near field exposures are difficult to measure and almost impossible to calculate. Combined with the three previous factors determining absorption, the total variables become staggering.

8.11.4 Non-Thermal Effects

- There are many non-thermal effects claimed.
- Only a few have been verified.
- There is no consensus on the danger of non-thermal effects.

8.11.5 Common Terms Used (29 CFR 1910.97)

- Electromagnetic Radiation: Portion of the spectrum defined as the radio frequency region, which includes the microwave frequency region.
- Partial Body Irradiation: Case in which part of the body is exposed to the incident electromagnetic radiation.
- Whole Body Irradiation: Case in which the entire body is exposed to the incident electromagnetic energy or in which the cross section of the body is smaller than the cross section of the incident radiation beam.
- Radiation Protection Guide: For normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz, the radiation protection guide is 10 mW/cm^2 as averaged over any possible 0.1-hour period. This guide applies whether the radiation is continuous or intermittent.

- Warning Symbol: The warning symbol for radio frequency radiation hazards consists of a red isosceles triangle above an inverted isosceles triangle, separated and outlined by an aluminum color border. The words "Warning -- Radio-Frequency Radiation Hazard" will appear in the upper triangle.

8.12 TRAINING

The following RF Radiation Hazard training will be provided to TARS employees upon their initial site in processing:

- TARS General Operating Instruction, GOI 91-1, Chapter 8, RF Radiation Hazard.
- Specific Site Operating Instructions (SOI's) (if applicable)
- Location and Type of Site RF Emitters
- Location of RF Radiation Hazard Zones

All training will be documented in accordance with GOI 36-1, TARS Training Program.

USE OR DISCLOSURE OF DATA CONTAINED ON THIS SHEET IS SUBJECT TO THE RESTRICTION ON THE TITLE PAGE OF THIS GOI.

SITE OPERATING INSTRUCTION
SOI 91-06
07 January 2004

SUBJECT: Cudjoe Key Site Specific Radiation Hazards

REFERENCE: 275K Red Book, Page 95

There are three areas at CKAS where an RF radiation hazard may exist and wherein special safety procedures may be in effect at specific times. The areas and times are as follows:

Both aerostat pads from tower to the perimeter when an aerostat is moored and the L88(V)3 or AN/DPS-5 airborne radar, mounted in the aerostat windscreen, is in the radiate mode. Radiation will be indicated by the flashing red light on the corner of each blockhouse and PA and radio announcements at 15 minute intervals.

At building 12920 on the weather radar antenna pedestal above the first landing of the access stairway. The hazard is from the Rockwell Collins WRT-701C weather radar transmitter and is present at all times except when special maintenance is in progress.

The following procedures and restriction will apply to the airborne radar transmitter while moored:

~~Prior approval to radiate must be received from the Flight Director.~~

The Ground Station technician will make a PA and radio announcement of the intention to radiate in five minutes specifying the hazard area relative to the aerostat, i.e., aft port, forward starboard, etc. if not in scan mode. Upon hearing the announcement, the Pad Coordinator will:

Open the windscreen access cover flap and verify that the antenna is in fact pointing in the direction announced by the Ground Station.

Clear the hazard area of all personnel and advise Ground Station when these steps have been completed.

If personnel are in the windscreen, the antenna will be pointed to the starboard side of the aerostat, providing it is not directed towards a habitable building. If it is directed towards a habitable building, the antenna will be pointed towards the port side of the aerostat. The Pad Coordinator will be notified as to which side the antenna is pointed.

While radiating in this mode, a ground restriction exists ± 15 degrees from in front of the antenna to the pad perimeter.

One min[illegible] radiation, [illegible] make a PA and radio announcement of the intention to radiate in one minute.

The Ground Station will get a verbal acknowledgment from the Pad Coordinator that the message was received. If the Pad Coordinator needs more time to clear the pad, he will inform the Ground Station.

Before radiation, the Ground Station will make a radiation commencing PA and radio announcement and will receive a verbal acknowledgment from the Pad coordinator that the message was received. The Pad Coordinator will turn "on" the blockhouse "radiate warning light" at this time. If radiation exists for longer than a 15 minute period, a radiation in effect PA and radio announcement will be made at the 15 minute point and at every subsequent 15 minutes thereafter. Each announcement will include the hazard area relative to the aerostat.

SITE OPERATING INSTRUCTION
SOI 91-06
07 January 2004

When radiation is secured, the Ground Station will make a PA and radio announcement and receive a verbal acknowledgment from the Pad Coordinator that the message was received.

If any restrictions are violated, The Flight Director will be notified immediately and a report given to the Radiation Protection Officer (RPO). When advised of a violation the Flight Director or the RPO will immediately meet with the individuals involved and complete TARS form 91-002 RF Radiation Exposure Report.

When it is reasonably suspected that an individual or individuals have been endangered by exposure to RF radiation, the Radiation Protection Officer (RPO) or Flight Director will immediately contact TCC.

Personnel are to remain clear of the weather radar pedestal unless the transmitter is secured and the appropriate sign is posted on the weather radar control console.

R.L. Morrow
Site Manager
Cudjoe Key TARS

Ron Morrow.

AFIOH/SDR, Radiation Surveillance Division
Customer Service Satisfaction Survey
Updated: 5/27/2004

POINT OF CONTACT:	**2LT Grant**	**BASE NAME:**	**Brooks City-Base**
POC PHONE:	**DSN 240-5562**	**DIVISION:**	**AFIOH/SDR**
STINFO NUMBERS:	**IOH-SD-BR-CL-2004-** 0084		

This survey is used to help us improve our service to you. Your answer will be held in confidence and will significantly impact on how we allocate resources to meet your needs. Please return this completed form promptly.

SCOTT M. NICHELSON, Lt Col, USAF, BSC, CHP, CIH
Chief, Radiation Surveillance Division

Grading Scale:

1	2	3	4	5	6
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Slightly Satisfied	Satisfied	Extremely Satisfied

A	Timeliness: did you receive your results within the published time limits?	1	2	3	4	5	6
B	Accuracy: Is the report in the proper format? Are your address and other data correct?	1	2	3	4	5	6
C	Content: Does the report answer your questions and provide the necessary data? Are our services per dollar adequate when compared to civilian sector?	1	2	3	4	5	6
D	Customer Support: Have we been courteous and helpful in meeting your special needs (priority service, reporting, format, etc.)?	1	2	3	4	5	6
E	Consult Service: Have we answered your questions and provided necessary materials or reviewed to support your mission requirements?	1	2	3	4	5	6
F	Overall Rating: How would you rate our overall service to you?	1	2	3	4	5	6

Comments / Suggestions: Are there other services that you would like provided in the future? Are there any specifics of your current service you would like to discuss? (Use back of page if more space is required?

(fold)

OFFICIAL BUSINESS

RETURN TO: **AFIOH/SDR**
2350 Gillingham Drive
Brooks AFB TX 78235-5103

Attachment 8