

**COLLABORATIVE ADAPTIVE SENSING OF ATMOSPHERE
RADAR HOST SITE AGREEMENT
BETWEEN THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS
AND CITY OF FORT WORTH, TEXAS**

This Radar Host Site Agreement (the “Agreement”) is made and entered into as of February 3, 2015 (“Effective Date”) by and among the **North Central Texas Council of Governments (NCTCOG), a Texas political subdivision and non-profit corporation with offices located at 616 Six Flags Drive, Arlington, Texas 76011**, and the **CITY OF FORT WORTH (“HOST”)**. In the event that Host is a local government as defined under the Texas Interlocal Cooperation Act, Chapter 791, Texas Government Code (Act), this Agreement shall be subject to the terms of such Act.

RECITALS:

WHEREAS, CASA is the Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere at the University of Massachusetts, which is a National Science Foundation Engineering Research Center, with the University of Massachusetts, Amherst, MA as the lead University and the Board of Regents of the University of Oklahoma, Norman, OK, The Board of Governors of the Colorado State University System, by and through Colorado State University, Fort Collins, CO, and the University of Puerto Rico-Mayaguez, Mayaguez, Puerto Rico as Core Institutions, (hereinafter “CASA”);

WHEREAS, CASA currently operates a four-radar, lower-atmospheric observing system located in Oklahoma for detecting, predicting, warning and responding to hazardous weather. The primary funding comes from the National Science Foundation (“NSF”) and ends September 2013. CASA seeks to demonstrate the system’s public safety and economic benefits in a densely populated urban environment;

WHEREAS, NCTCOG is a regional planning commission that serves the 16-county region of North Central Texas, which is centered around the two urban centers of Dallas and Fort Worth. This area experiences severe weather events such as flash flooding, severe storms and tornadoes during 9 out of 12 months each year; and

WHEREAS, the Texas Government Code, Chapter 791, the “Interlocal Cooperation Act” authorizes local government entities to enter into interlocal contracts for governmental purposes, specifically including parks and recreation;

WHEREAS, pursuant to the Interlocal Cooperation Act, any and all payments arising under this Agreement for the performance of governmental functions or services must be made from current revenues available to the paying party; and

WHEREAS, the HOST is a local government and wishes to house one of the CASA radars within their city limits.

NOW, THEREFORE, the parties hereby agree as follows:

ARTICLE I **OBJECTIVES / PHASES**

1.1 DFW Urban Demonstration Network Goals

The parties hereto wish to undertake the deployment of the CASA testbed system to North Central Texas to achieve the following objectives:

- to demonstrate the system's public safety and economic benefits in a densely populated urban environment;
- to improve the capacity of the North Central Texas emergency management, environmental, and transportation systems and other benefits; and
- by increasing the potential public and private impact (by bringing the testbed to a more densely populated area), to increase total funding for demonstration projects from Federal, state, local, foundation and private funding sources.

ARTICLE II **OBLIGATIONS**

2.1 HOST's Obligations

During the Term of this Agreement, the HOST agrees to the following:

- Comply with all HOST radar site requirements listed in **Appendix A** of this Agreement.
- Handle the process of securing all applicable waivers or permits for all applicable zoning restrictions.
- Be responsible for expenses associated with site preparation and radar installation as described in **Appendix B**. The radar may be mounted on a short tower structure, a tall tower structure, or on a rooftop. The computing equipment housing may be located within fabricated shed, a trailer, in an existing building, or in a large, secured, weatherized box. Based on the particulars of the selected site, the cost of installation can vary. **Appendix B** lists the estimated installation costs as projected by CASA. Radar installation will take place with the assistance of licensed and bonded contractors.

- Provide additional installation materials (such as concrete, cabling, lightning rods, etc.) needed for radar installation. These items will be expensed by the contractors and will be the responsibility of the HOST.
- Take possession of the radar listed on **Appendix C** and maintain the radar at the HOST site specified on **Appendix C**. HOST acknowledges and agrees that the radar is the property of University of Massachusetts Amherst (“OWNER”). HOST agrees that it shall not remove the radar from the HOST site and it shall not take any action that is inconsistent with OWNER’s interest. HOST shall keep the radar free and clear of all liens and encumbrances, including mechanic’s liens;
- During the Term of this Agreement, the HOST site shall meet the site requirements, as specified in **Appendix A**, at the HOST’s expense (if applicable). In particular, Host agrees to:
 - Provide a certified technician to assist CASA with general maintenance/ground support for their respective radar(s). Specifically, CASA engineers will require technical assistance/ground support in order to cost effectively operate the radar network. This involves brief trips to the radar sites required for local troubleshooting and maintenance. Problems with the radars can usually be diagnosed and fixed remotely over the network, but sometimes hardware resets are required to be done on site. Host sites must provide this service at their own cost;
 - Provide a 10 Mbps guaranteed (wired or wireless) service between the radar sites and the DFW Radar Operations Control Center (DROCC). The service provider (or providers) will also be required to provide and install communications equipment (i.e. dish antenna, etc.) on site. In addition, the service provider(s) must provide support throughout operations (troubleshooting, repairs, etc.); and
 - Provide general commercial liability insurance on the site and equipment in amounts and coverage acceptable to NCTCOG and CASA to cover claims arising from the Host site and installation/use of the equipment supplied by CASA.

2.2 NCTCOG’s Obligations

During the Term of this Agreement, NCTCOG agrees to the following:

- Dedicate time and resources to identifying financial support and approval for the launch of the DFW Urban Demonstration Network;
- Deliver coordination between CASA and the HOST; and
- Create and maintain a CASA WX Executive Council.

NCTCOG further agrees to coordinate with CASA for the provision of (i) computing and data storage equipment required at each individual radar site; (ii) equipment required for testing algorithms; and (iii) a radar system, along with the required air conditioning units, UPS equipment, and computing equipment.

2.3 Joint Obligations

During the Term of this Agreement, both parties hereto agree to the following:

- Make every reasonable effort to ensure that the health and safety of all participants are protected during the performance of their duties as it relates to the CASA program;
- Neither party shall assign or require the other party to perform duties which would jeopardize their safety or cause them to sustain injuries; and
- Avoid placing any participating member in a role that would constitute a conflict of interest.

ARTICLE III TERM; TERMINATION

- 3.1** The initial term of this Agreement will be one year from the Effective Date with the ability to renew in one (1) year increments upon the agreement of the parties. Either party may terminate its participation under this Agreement upon sixty (60) days advance written notice to the other party.
- 3.2** This Agreement is contingent on continued funding through CASA and the NCTCOG. Should CASA determine that it is not in its best interest to keep the radar at the host site due either to a failure to secure adequate funding, termination of the Master Agreement between the University of Massachusetts/CASA and the NCTCOG, or other mitigating circumstances, it shall notify the NCTCOG as soon as practical and this agreement will be terminated.
- 3.3** Immediately upon expiration or earlier termination of this Agreement, CASA shall be entitled to come onto the HOST site to retrieve the radar and shall bear the costs associated with removal. CASA shall be completely unfettered by the host in its efforts to retrieve the radars from the site.

ARTICLE IV HOLD HARMLESS

4.1 NCTCOG, to the extent allowed by law shall protect and hold harmless HOST from any and all, liabilities, judgments, losses, claims, assessments, suits in law or in equity, expenses, attorney's fees, and damages arising from NCTCOG's negligent acts or omissions, failure to perform its obligations under this Contract as well as any actual or alleged infringement of any United States or foreign patent, trademark or copyright in connection with this Contract. This provision shall not be deemed to waive any right or immunity that may exist in favor of NCTCOG pursuant to the Texas Tort Claims Act or any other constitutional or statutory provision of the United States or the State of Texas or at common law. Nothing contained herein shall ever be construed so as to require NCTCOG to create a sinking fund to fund its obligations under this Paragraph.

4.2 HOST, to the extent allowed by law, shall protect and hold harmless NCTCOG from any and all, liabilities, judgments, losses, claims, assessments, suits in law or in equity, expenses, attorney's fees, and damages arising from HOST's negligent acts or omissions, failure to perform its obligations under this Contract as well as any actual or alleged infringement of any United States or foreign patent, trademark or copyright by HOST in connection with this Contract. This provision shall not be deemed to waive any right or immunity that may exist in favor of HOST pursuant to the Texas Tort Claims Act or any other constitutional or statutory provision of the United States or the State of Texas or at common law. Nothing contained herein shall ever be construed so as to require HOST to create a sinking fund or to access, levy, assess, and collect any tax to fund its obligations under this Paragraph.

ARTICLE V

Miscellaneous Covenants

5.1 Amendments/Whole Agreement. This Agreement and any amendment hereto may be executed in counterparts, and all such counterparts taken together shall be deemed to constitute one and the same instrument. The University of Massachusetts Amherst is expressly intended to be a third party beneficiary of this Agreement. This Agreement embodies the entire understanding of the Parties with respect to the subject matter herein, and any prior or contemporaneous representations, either oral or written, are hereby superseded. No amendments or changes to this Agreement shall be effective unless made in writing and signed by authorized representatives of the parties.

5.2 Dispute Resolution. The parties to this Agreement agree to the extent possible and not in contravention of any applicable State or Federal law or procedure established for dispute resolution, to attempt to resolve any

dispute between them regarding this Agreement informally through voluntary mediation, arbitration or any other local dispute mediation process before resorting to litigation.

5.3 Availability of Funding. This Agreement and all claims, suits, or obligations arising under or related to this Agreement are subject to and limited to the receipt and availability of funds which are received from the funding agencies by NCTCOG dedicated for the purposes of this Agreement.

5.4 Governing Law and Venue. This Agreement shall be governed by and construed in accordance with the laws of the State of Texas. The mandatory and exclusive venue for the adjudication or resolution of any dispute arising out of this Agreement shall be in Tarrant County, Texas.

5.5 Force Majeure. It is expressly understood and agreed by the Parties to this Agreement that, if the performance of any provision of this Agreement is delayed by force majeure, defined as reason of war, civil commotion, act of God, governmental restriction, regulation or interference, fire, explosion, hurricane, flood, failure of transportation, court injunction, or any circumstances which are reasonably beyond the control of the Party obligated or permitted under the terms of this Agreement to do or perform the same, regardless of whether any such circumstance is similar to any of those enumerated herein, the Party so obligated or permitted shall be excused from doing or performing the same during such period of delay, so that the period of time applicable to such requirement shall be extended for a period of time equal to the period of time such Party was delayed. Each Party must inform the other in writing within reasonable time of the existence of such force majeure.

5.6 Notice. Notice from one Party to another Party regarding this Agreement shall be in writing and shall be delivered to the addresses shown below:

If to NCTCOG: North Central Texas Council of Governments
Attn: Molly Thoerner, Director of Emergency Preparedness
616 Six Flags Drive
P. O. Box 5888
Arlington, Texas 76005-5888

If to Fort Worth: City of Fort Worth
Attn: Director of Emergency Management
1000 Throckmorton
Fort Worth, Texas 76102

With Copy to: City of Fort Worth

**Attn: City Attorney
1000 Throckmorton
Fort Worth, Texas 76102**

The above contact information may be modified without requiring an amendment to the Agreement.

[NEXT PAGE IS SIGNATURE PAGE]

IN WITNESS WHEREOF, the parties hereto, intending to be legally bound, have caused this Agreement to be executed by their authorized representatives as set forth below.

CITY OF FORT WORTH

**NORTH CENTRAL TEXAS
COUNCIL OF GOVERNMENTS**

By _____

By _____

Name _____

Name _____

Title _____

Title _____

Date _____

Date _____

APPENDIX A

RADAR SITE REQUIREMENTS & SITING OPTIONS

1. OVERVIEW

This document presents a minimal list of requirements for potential CASA radar sites in the DFW area. The site is required to house a small weather radar that shall scan over the hemisphere and provide data to users.

Each installation is composed of two subsystems:

1) An electronic transmitter and digital receiver, antenna and pedestal all enclosed inside an opaque structure called a radome. Hereafter this is referred to as the Radar (Figure 1).



Figure 1

2) Computing equipment housed both inside the Radar Unit structure and outside. The external computing systems may be located inside an existing building, housed in a small shelter, or contained inside a weatherized box. Cabling must be run between the Radar Unit structure and the external computing systems to support Gigabit speed data transfer.

Therefore the 2 subsystems should be nearly collocated. Figure 2 depicts these subsystems.

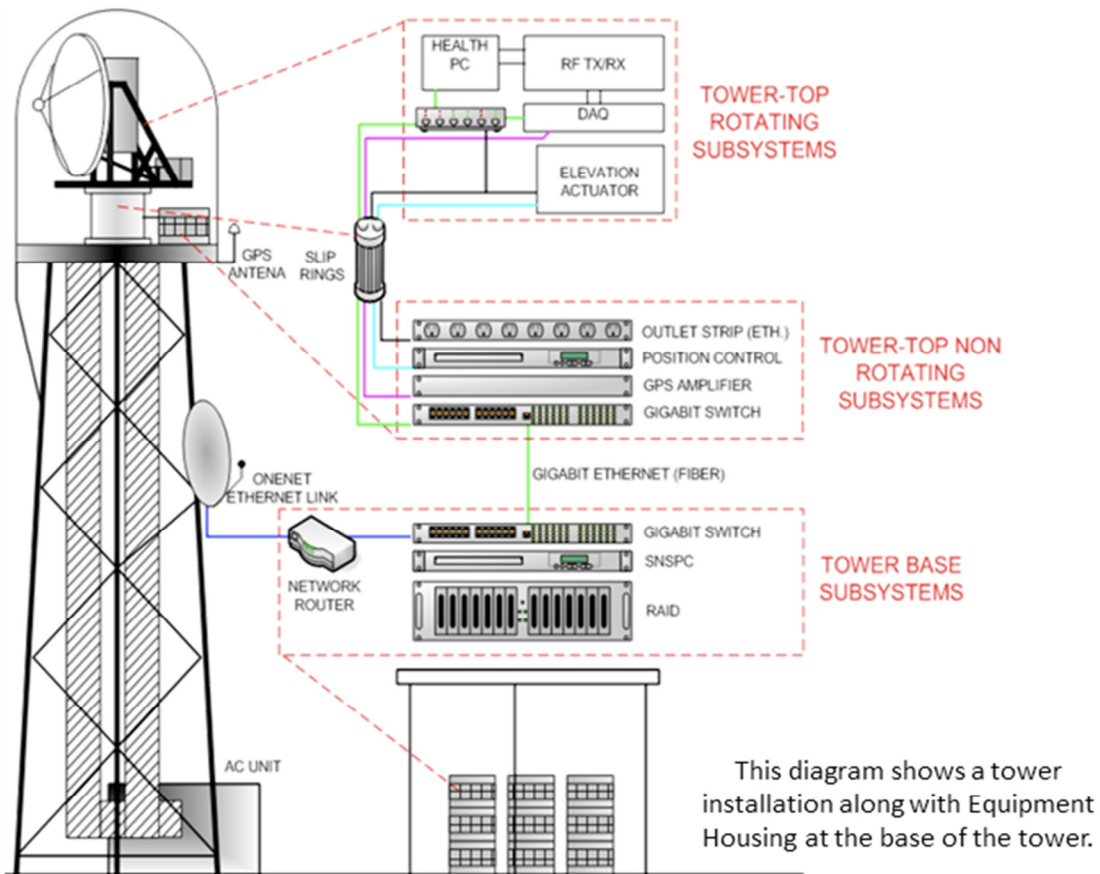


Figure 2

2. SITE REQUIREMENTS

2.1 Dimensions

The proposed site(s) shall provide enough space to house an 8ft x 8ft x 8ft small Radar Unit structure.

2.2 Field of view

The proposed site(s) shall provide a unobstructed 360 degree view out to the horizon and the full hemispherical view. Alternatively, it shall at least have the potential to achieve the unobstructed field of view through the use of a tower structure of no more than 25 ft in height and 10 ft by 10 ft in base area.

2.3 Weight

The proposed site(s) shall be able to support a 1200 lb small Radar Unit structure.

2.4 Main power

The proposed site(s) shall have access to a minimum of 20 A at 110 VAC and 30 A at 220 VAC.

2.5 Communications

Required: The proposed site(s) shall have an Internet access with a minimum outbound bandwidth of 10 Mbps and inbound bandwidth of 5 Mbps.

Desirable: Additional outbound bandwidth is desirable, but not required.

2.6 Equipment housing

The proposed site(s) shall be capable of accommodating computing equipment with appropriate climate control for a rack mounted server and ancillary equipment in 8U rack space.

2.7 Space requirements

The proposed site(s) shall be able to nearly collocate the Radar Unit equipment and the Computing Equipment to minimize cable runs between the two.

2.8 Security

The proposed site(s) shall be secured as to prevent unauthorized personnel gaining access to the radar unit structure and computing equipment.

2.9 Accessibility

The proposed site(s) shall be accessible by road. There should be 24/7 access for authorized CASA personnel to service equipment.

2.10 Installation

The proposed site(s) shall have one time access to installation equipment such as cranes or fork lifts.

2.11 Zoning

It is the responsibility of the site host to verify compliance with zoning regulations

2.12 Lightning protection

Radar deployment at the proposed site(s) shall require lightning protection.

2.13 Site spacing

The proposed site(s) shall be appropriately spaced to achieve optimal system performance. The average spacing should be approximately 30 km between sites.

2.14 Climate Control

The site(s) shall provide space for HVAC installations, including ductwork, to climate control the Radar Unit structure.

3. SITING OPTIONS

A candidate site may take several forms provided the requirements listed in section 2 are met. The radar may be mounted on a short tower structure (20'), a tall tower structure (70-100'), or on a rooftop. The computing equipment housing may be located within

fabricated shed, a trailer, in an existing building, or in a large, secured, weatherized box. The computing equipment housing should be nearly collocated with the radar enclosure, as they will be connected by fiber optic cable.

Below are photographic examples of varied installations, including requisite site preparation that may be necessary, depending on existing infrastructure.

3.1 Short Tower Field Installation

A) Ground preparation

Conduit installation for electrical (110V and 220V) and communications cables. May require digging of trenches to accommodate conduit.

Ground leveled and compacted as needed to support a poured reinforced concrete foundation, 9' x 9' x 5' with anchor bolts and grounding for lightning protection.



Figure 3 - Poured foundation, anchor bolts, trenched-in conduit

B) Short tower installation

Tower should be craned into position, anchored, and grounded.

Radar craned to tower top and anchored. Site must be accessible to crane.

Radar entry ladder bolted to tower and radar enclosure.



Figure 4 - Tower lifted into place



Figure 5 - Side view tower anchoring and conduit



Figure 6 - Top view tower anchoring with grounding cable visible



Figure 7 - Radar lifted to tower top and bolted in



Figure 8 - Angled ladder attached to radar and tower for trapdoor entry

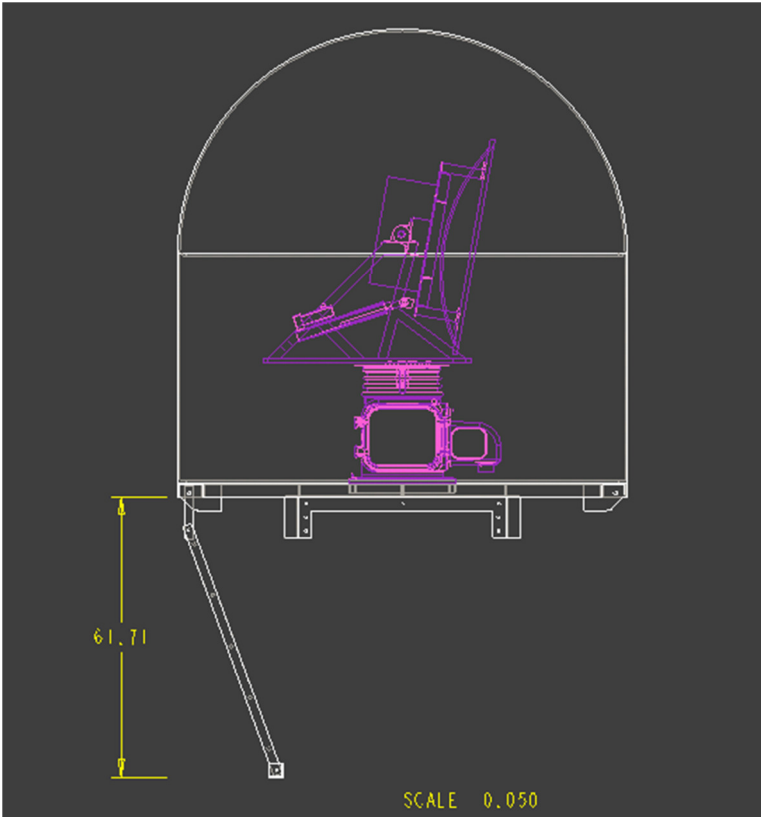


Figure 9 - Ladder and trapdoor model

C) Auxiliary infrastructure

Poured or prefabricated slab installed for HVAC unit.

Outgoing and Return ductwork installed.

Electrical breaker boxes and metering (if necessary).

8-10' chain link fence with razor wire to surround installation (if necessary).



Figure 10 - HVAC unit, Ductwork, Security fence



Figure 11 - Breaker box, Meter, Ductwork

3.2 Tall Tower Field Installation

In order to meet line of sight or communications requirements, a tall tower may be necessary. We have 3 existing examples of tall tower installations. Tower may be square or triangular. It may have a platform at the top or not. HVAC may be mounted on the ground or on a platform on the tower. A communications antenna may be mounted on the tower. Tall tower installations are not recommended unless a suitable tower already exists and is available or it is necessary to meet requirements. Many of the same steps are necessary as for the short tower.

A) Ground preparation

Conduit installation for electrical (110V and 220V) and communications cables.
May require digging of trenches to accommodate conduit.

Sunken cylindrical reinforced concrete pillars at least 2' in diameter and 7' deep.



Figure 12 - Ground preparation for Tall Tower Installation

B) Tall tower installation

Tower should be craned into position, anchored, and grounded.

Radar craned to tower top and anchored. Site must be accessible to larger crane.

Access ladder bolted to tower and entry ladder to radar enclosure if necessary



Figure 13 - Tower feet anchored to reinforced concrete cylinders.



Figure 14 - Triangular tower mounts, with cable conduit and grounding



Figure 15 - Tower top with small platform



Figure 16 - Tower top craned into place



Figure 17 - A square pyramid tower adjacent to an existing building with a microwave antenna mounted alongside for communications.



Figure 18 - A square tower is craned into place



Figure 19 - Radar is craned onto a platform constructed at the top of the square tower



Figure 20 - Radar mount elevated off the platform

C) Auxiliary Infrastructure

Poured or prefabricated slab installed for HVAC unit if on ground.

HVAC may also be mounted at tower top if a platform is present.

Outgoing and Return ductwork installed.

Electrical breaker boxes and metering (if necessary).

8-10' chain link fence with razor wire to surround installation (if necessary).

Wireless radio antenna installed on tower (if necessary)



Figure 21 - HVAC unit craned up to tower top platform



Figure 22 - Outgoing and return insulated metal duct with booster fans strapped to tower for ground HVAC installation



Figure 23 - Wireless radio antennas mounted to tower

3.3 Rooftop Installation

A rooftop installation can be a convenient option when requirements can be met. The exact site specifications may be highly variable depending on the roof, the surroundings, and the available infrastructure. In general, the use of a building will allow avoiding excessively tall towers, and provide ready access to most of the infrastructure needed (power, communications, and equipment housing). The platform-based tall tower installation shown in figures 19-21 may also be used for guidance.

- A) Ground preparation
 - Electrical (110V and 220V) and communications cables provided at rooftop
 - Platform constructed to elevate radar off surface of roof (if needed).
 - Lightning protection cabling installed

- B) Auxiliary Infrastructure
 - HVAC mounted on rooftop or platform
 - Outgoing and Return ductwork installed
 - Electrical breaker boxes and metering (if necessary).
 - Wireless radio antenna installed if no high speed internet cabling is present



Figure 24 - Radar mounted on a small platform, elevated off a rooftop. Weatherized computer equipment housing box seen below



Figure 25 – Radar mounted on roof platform to clear surrounding structures. Rest of radar computing and networking equipment is housed inside the building.

3.4 Computer Equipment Housing

As described in the requirements, in addition to the radar and associated infrastructure, space must be provided for computer equipment including servers, data storage arrays, network routers and switches, and rack mounted UPS. This may be housed in a shed, trailer, existing building (fig. 17 & 30), or weatherized box (fig. 24, except larger). An installation in an existing building will be similar to a standard server room, with equivalent HVAC and electricity requirements.

A) Ground preparation (if needed)

A concrete slab is poured to set housing on (shown in Figure 12)

Conduit installation for electrical (110V and 220V) and communications cables.

B) Shed requirements

HVAC for temperature and humidity control

Locking door

Internal and external lighting

Pass through for cabling to radar tower base

Space to hold a 20U server rack
NEMA 5-15 and L5-30 Receptacles



Figure 26 - A prefabricated shed is craned onto concrete slab



Figure 27 - Cable pass-through to tower base and equipment shed

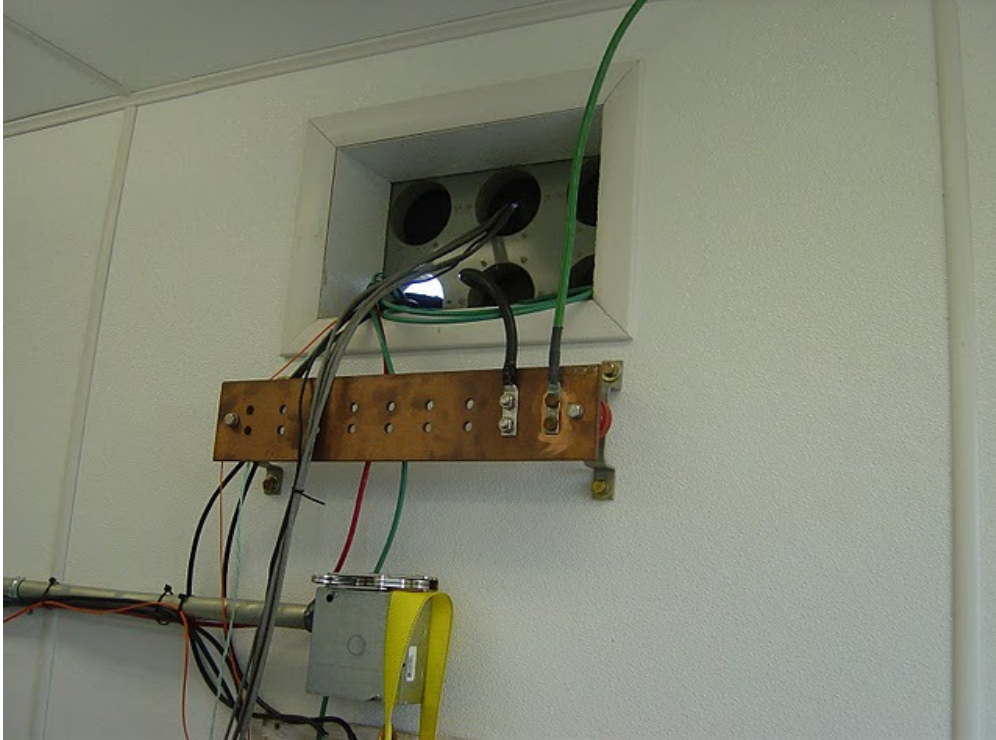


Figure 28 - Cable pass-through as seen from the inside



Figure 29 - Computer equipment housing installation



Figure 30 - Complete tall tower installation with prefabricated shed



Figure 31 - Complete short tower installation with collocated existing structure for computer equipment



Figure 32 - Complete building rooftop installation with indoor housing for computer equipment

APPENDIX B

SITE PREPARATION & RADAR INSTALLATION

A candidate site may take several forms provided the requirements listed in site requirements document are met (Appendix A). The radar may be mounted on a short tower structure, a tall tower structure, or on a rooftop. The computing equipment housing may be located within fabricated shed, a trailer, in an existing building, or in a large, secured, weatherized box. Based on the particulars of the selected site, the cost of installation can vary.

Radar installation will take place with the assistance of licensed, bonded and insured contractors identified by NCTCOG. CASA will help NCTCOG develop the work statements for the RFPs that may need to be issued. These contractors will be tasked with:

1. Determination of best installation structure (short or tall tower vs. rooftop).
2. Design and fabrication of mating structure (if needed).
3. Design and preparation of structure foundation (as needed)
4. Move of radars from workshop to sites and installation on structure.
5. Fencing, lightning protection, grounding, ductwork, electrical, HVAC, communication cabling (as needed).

SAMPLE QUOTE

Please note: These numbers are based on a previous radar installation, and may vary from your site's price.

SPECIFICATION AND PRICE

200' electric and fiber	\$4,700.00
Installation of tower foundations	\$6,000.00
Crane and labor	\$2,000.00
Ground rods and lightning rods	\$ 500.00
Installation of 140' 9 gauge strands of barbed wire	\$4,300.00
TOTAL	\$17,500.00
Additional one time design and engineering costs	\$7,500.00
GRAND TOTAL	\$~25,000.00

Based on site location and current infrastructure this cost potentially could go up to \$35,000.

APPENDIX C

Name of Radar System:

CASA IP1 Refurbished Radar System

Brief Description:

1. 1.2 m parabolic dish antenna operated at X-band
2. Low power magnetron transmitter (10 Kw peak, 13 W avg)
3. Dual polarized waveguide/antenna feed horn assembly
4. Dual channel coherent-on-receive receiver/ data acquisition system
5. High performance pedestal assembly
6. 8 foot radome
7. Networking, computing and storage hardware
8. UPS with battery pack

Ownership:

University of Massachusetts, Amherst

Host's Name: City of Fort Worth

Designation / Affiliation: Office of Emergency Management

Name of proposed site: City of Fort Worth

Address: 5801 Boat Club Road, Fort Worth, Texas.