Final Report

Phase I - Development of a Road Weather Information System (RWIS) for Florida's Intelligent Transportation System

CONTRACT # BD-160

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1.0 Executive Summary

The University of North Florida, in cooperation with the Florida State University and the National Weather Service, has completed Phase I of a research program aimed at developing a state-of-the-art Road Weather Information System (RWIS) for the State of Florida's Interstate Highway System (FIHS). The research was conducted in close coordination with the FDOT Office of Intelligent Transportation Systems and with considerable technical assistance from the consulting firms of PB Farradyne, Inc. and RCC Consultants, Inc. who operated under a separate contract with the FDOT-ITS Office.

The development of a Road Weather Information System for the State of Florida specifically addresses two of the FDOT Intelligent Transportation System Strategic Plan goals: "to reduce weather related traffic accidents by using road-weather information systems", and to "improve emergency management communications while providing real-time traveler information systems for evacuation". The primary motivating goal of this research program is for the State of Florida to have a system that will provide timely and useful ***early warning*** weather information to travelers, transportation managers, law enforcement, and emergency managers in order to ensure safe transportation in both normal and evacuation conditions for residents, visitors, and commerce.

The primary objective of the research program is to develop design recommendations for a Statewide FIHS RWIS. The primary accomplishment of Phase I of the research program was the development of a RWIS prototype research facility that provides the opportunity for the FDOT Office of Intelligent Transportation Systems to evaluate alternative designs and configurations for the data network, software, and sensors that could be incorporated into the statewide RWIS. Another significant accomplishment was the assembly and coordination an interdisciplinary team that is able to address the wide range of issues and the technical complexities associated with implementation of a RWIS.

The communications backbone for the RWIS research facility is the FDOT microwave system. These towers are spaced approximately 20 miles apart—an ideal spacing for the installation of the tower-mounted RWIS weather stations since reliable road weather forecasting requires a relatively high spatial resolution of weather observations.

A major feature of the team's system design concept includes the development of the capability for adding wireless weather sensors *between or near* the 20-mile spaced primary weather stations. This design feature anticipates the need for specialized stations at fixed locations to address site specific potential hazards such as high wind on high evacuation bridges or locations that are prone to fog. The proposed feature could also support the deployment of portable units to support wildfire or hazardous material spill response operations that occur between or near the tower locations.

As a component of the RWIS project, investigators from the Florida State University Departments of Electrical Engineering, Geography, and Meteorology also conducted research related to atmospheric effects on microwave transmissions and on improving road weather forecasting by using the data provided by the new RWIS.

An easy-to-remember URL was registered for the project website: **FloridaRoadWeather.ORG** (or .Com, or .Net). The Phase I website was designed to facilitate system testing, weather data access, data quality verification, and system/project management. As a result of close coordination with the National Weather Service, the basic weather data collected by the RWIS research facility weather stations (temperature, humidity, rainfall, wind speed, wind direction, and barometric pressure) is also now available via the website in a national standard data format to any forecaster. A public website is being developed in Phase II that will provide easy-to-understand road weather forecasts and warnings to the traveler.

Many technical lessons have been learned by both the research team and the staff of the FDOT-ITS Office (including the ITS contractors working with the researchers) about how to successfully integrate other IT systems with the existing microwave communications system. And the ongoing challenges associated with keeping the research facility operational continue to provide technical insight and understanding that will contribute to the final recommendations for statewide implementation of the system.

2.0 Introduction

2.1 Background

In the summer of 2001, the University of North Florida (UNF), in cooperation with the Florida State University (FSU) and the National Weather Service (NWS), entered into a contract with the FDOT Office of Research and Development to develop a research program aimed at developing a state-of-the-art Road Weather Information System (RWIS) for the State of Florida's Interstate Highway System (FIHS). The research was conducted in close coordination with the FDOT Office of Intelligent Transportation Systems (FDOT-ITS) and with considerable technical assistance from the consulting firms of PB Farradyne, Inc. and RCC Consultants, Inc. who operated under a separate contract with the FDOT-ITS Office. This report documents the progress made in Phase I of the research program.

2.2 Statement of Need

The development of a Road Weather Information System for the State of Florida specifically addresses two of the FDOT Intelligent Transportation System Strategic Plan goals: "to reduce weather related traffic accidents by using road-weather information systems", and to "improve emergency management communications while providing real-time traveler information systems for evacuation".

2.3 Primary Goal

The primary motivating goal of this research program is for the State of Florida to have a system that will provide timely and useful ***early warning*** weather information to travelers, transportation managers, law enforcement, and emergency managers in order to ensure safe transportation in both normal and evacuation conditions for residents, visitors, and commerce.

2.4 Primary Objective

The primary objective of the research program is to develop design recommendations for a Statewide FIHS RWIS that fulfills the program's ultimate goal of providing early warning weather information to travelers and managers. The central focus of this phase of the research program was on the development of a RWIS prototype research facility that would provide the opportunity for the FDOT Office of Intelligent Transportation Systems to evaluate alternative designs and configurations for the data network, software, and sensors that could be incorporated into the RWIS. A secondary focus for Phase I was to assemble and coordinate an interdisciplinary research team that could address the wide range of issues and the technical complexities associated with implementation that would require multi-agency coordination.

The main challenges for the research team were to design a state-of-the-art ***Florida-centric*** RWIS that 1) would address Florida's unique weather patterns, 2) would take into consideration existing FIHS infrastructure, 3) could be built and maintained within planned ITS budget constraints, and 4) would be closely integrated with existing weather forecasting systems.

3.0 Methods

3.1 Interdisciplinary Team

In addition to constructing the RWIS Research Facility, a most significant result of the Phase I effort was the establishment of an interdisciplinary, multi-university, multi-agency, private/public team to work on the issue of developing an innovative and successful RWIS for the State of Florida. The core research team includes engineers, meteorologists, geographers, computer scientists, and urban planners. The team includes both research-oriented and operations-oriented members that help balance the perspective of the research and development.

Also, it is important to point out that the research team has received enthusiastic cooperation, comments, and recommendations from other State and Federal agencies and private industry (e.g., Florida Highway Patrol (FHP), Florida Division of Emergency Management (FDEM), National Weather Service NWS), several manufacturers of relevant equipment, etc.). These "adjunct research team members" are representative of the stakeholders in the future system, and have played an important role as advisors on the design and operation of the system. In particular, the Science and Operations Officers at the Florida NWS Forecast Offices in Jacksonville, Tallahassee, and Melbourne have been playing a major role as advisors and cooperators. Additionally, the FHP and the FDEM will be playing a major role in the third phase of the project that is aimed at implementation issues.

3.2 Design Concept

The system design concept for the prototype RWIS anticipates weather situations that could be important to traveler safety including low visibility from fog or heavy rain, strong winds, and freezing temperatures. As envisioned, the RWIS will provide several methods of access to current and forecasted road weather information. The RWIS will allow travelers to get travel weather via a *FloridaRoadWeather.org* website. A fully implemented version of the RWIS *could* also include information kiosks at rest areas and other appropriate locations, integration with the 511 system, and, using the FDOT dynamic messaging system, road weather advisories could be posted for in-transit travelers

The communications backbone for the proposed RWIS is the FDOT microwave communications system (Figure 1). The FDOT maintains 92 microwave communications towers that are located along the Interstate and Turnpike system. These microwave towers have been designed to support mission-critical communications and data transmission for the FDOT and the Florida Highway Patrol. The towers will also support data transmission for some components of the FDOT's new Intelligent Transportation System (ITS). Hence, it is logical to begin development of a statewide RWIS by equipping these towers with weather stations that are connected to the existing data network. Additionally, the microwave towers are spaced approximately 20 miles apart. According to the research team's meteorologists, this is ideal spacing for the installation of these weather stations because reliable road weather forecasting requires a relatively high spatial resolution of weather observations.

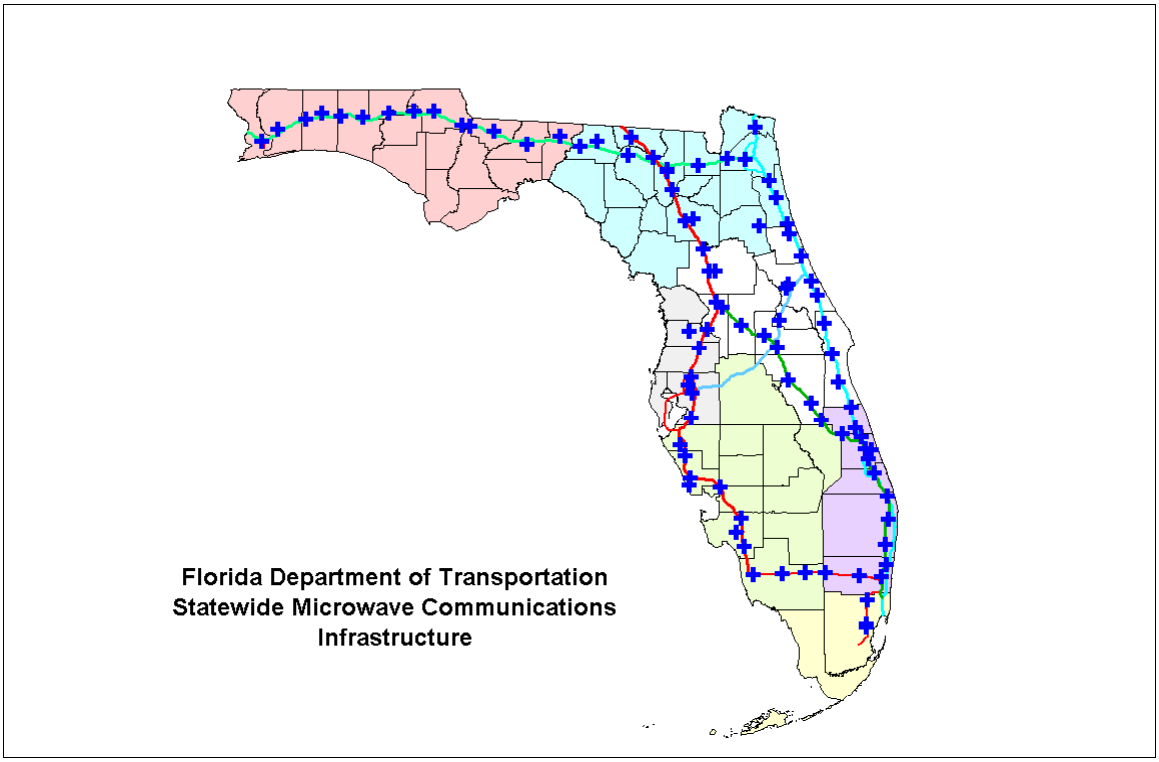

Figure 1: The communications backbone for the proposed RWIS is the FDOT microwave communications system. In year one, the prototype RWIS was installed on the towers in FDOT District 2 (shown in blue).

A major feature of the team's system design concept includes the development of the capability for adding wireless weather sensors *between or near* the 20-mile spaced primary weather stations. These secondary stations may not be equipped with a complete weather sensor array; rather they may just include a wind or visibility sensor. A generalized system design concept diagram is shown below in Figure 2.

This system design feature anticipates the need for specialized stations at fixed locations to address site specific potential hazards such as high wind on high evacuation bridges or locations that are prone to fog. The proposed feature could also support the deployment of portable units to support wildfire or hazardous material spill response operations that occur between or near the tower locations.

In order to evaluate the potential of using *between/near-tower* weather sensors to augment the fixed-tower network, the prototype research facility design includes two microwave towers with specialized radio communications systems that will enable portable, solar-powered, wireless weather sensors to be deployed between the fixed-location microwave tower weather stations and will include wind-sensor-equipped stations on two high evacuation bridges.

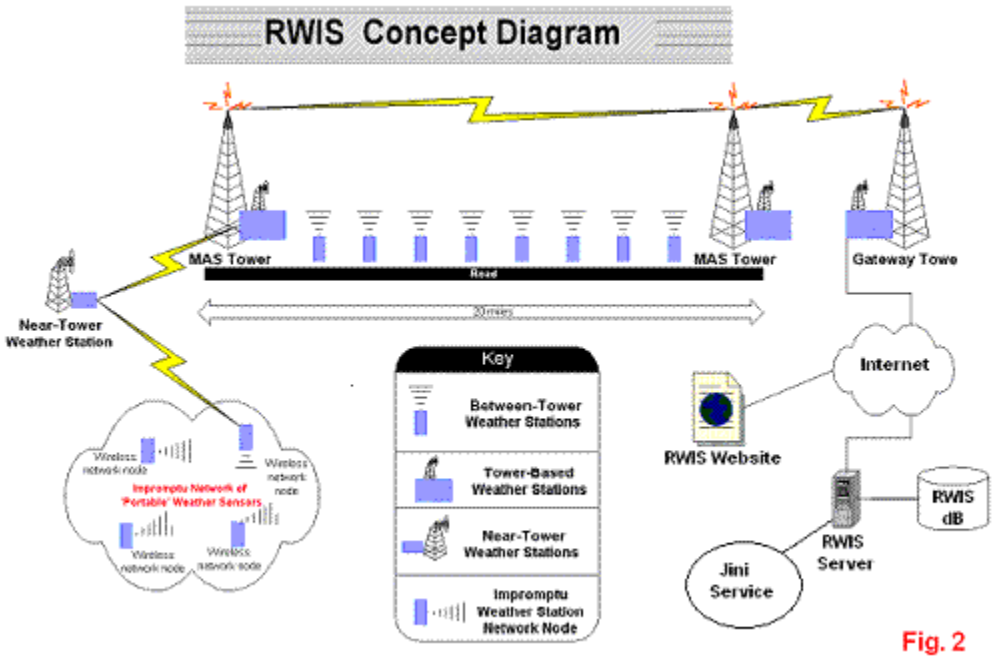

Fig. 2

3.3 FSU Subcontract - Atmospheric Effects on Microwave Transmissions And Road Weather Forecasting

As a component of the RWIS project, investigators from the Florida State University Departments of Electrical Engineering, Geography, and Meteorology conducted research related to atmospheric effects on microwave transmissions and on improving road weather forecasting by using the data provided by the new RWIS. The UNF investigators also worked very closely with the FSU investigators to determine the design requirements for the RWIS weather stations, the web site, and the weather data archive.

The major objectives of the FSU portion of this research are to:

- Characterize the effects of local weather on radio wave transmissions in real time.
- Characterize refractive layers and reflection points.
- Study the correlation of atmospheric effects with fades experienced by microwave paths.
- Derive and develop new guidelines to design and maintain microwave paths in this area.
- Collect, evaluate, and quality control the meteorological data collected at the prototype RWIS microwave tower sites.
- Develop procedures to infer the presence of fog at locations where direct sensors are not available.
- Develop new adaptive microwave link design methodologies, i.e., data acquisition systems with “intelligent” functions, e.g., to record only “interesting” events.
- Develop procedures to better-forecast hazardous travel weather utilizing data collected by the meteorological sensors on the microwave towers.

4.0 Results

4.1 Challenges

The research team made significant progress toward the primary goal and objective of the research program in Phase I despite significant technological and budgetary challenges. The completion of Phase I required several "no-cost extensions" for the project as a result of significant delays due to the underestimation of the complications associated with integrating the RWIS network hardware and software into the existing FDOT microwave communication system AND the underestimation of the costs associated with accomplishing that particular task.

It is important to point out that the original proposal did, in fact, anticipate that there could be unknown challenges associated with the networking component of this project since the FDOT microwave system is not a typical off-the-shelf networking solution. For example, in the original proposal the following two statements were included: *"It is expected that the FDOT-ITS staff and/or contractors will work with UNF to provide industry standard network connections to the microwave communications system hardware that the weather stations can be connected to."*, and *"Although not anticipated, this task may affect the schedule if unanticipated development is required. It is expected that the FDOT-ITS staff and/or their contractors will provide an Internet access point for the microwave communications system to allow the weather data to be transmitted (using TCP/IP) to a server at the UNF AGSLab."*

Although admittedly vague statements, the team's original understanding was that we would be able to connect our equipment to a network router provided by FDOT. When it became clear that this assumption was in error, the team was forced to reassess their anticipated design with the added challenge of building the system within budget while having to purchase several unanticipated hardware components. The primary components at issue included, but were not limited to, the network routers and CSU/DSU units required to provide network interfacing with the microwave system.

This single issue was at the core of the project delays and posed a considerable budgetary challenge for the design team. Not to be discouraged, the team was eventually able to work with several vendors to obtain substantial discounts on the hardware required (including some refurbished and used equipment) and was able to purchase all of the required equipment within the budget allotted for the project. And, with substantial help from the FDOT-ITS telecommunications contractor RCC Consultants, Inc., the design team was finally able to successfully develop and test a network design that integrated the RWIS system into the microwave communications system. This effort required several alternative design efforts to come up with a solution that would accomplish the objectives within the budget constraints.

There were also several unanticipated steps that required substantial effort, and several months to accomplish, on the part of the FDOT telecommunications contractors. For instance, a complete survey of all sites was required to determine the availability of space for our equipment racks, etc. In addition to the on-site surveys, other FDOT-ITS contractors were required to pre-wire and test each tower to provide the dedicated T1 circuits required for the RWIS system.
It should be noted that, as a result, the hardware components installed for the prototype research facility represent some compromises that had to be made as a result of these constraints. For

instance, we were forced to deploy some used and refurbished network hardware, and to select a weather sensor package that, while being fully sufficient for our research purposes, is not the package that we would recommend for a permanent, fully operational system.

Because of the delays in getting the network component of the RWIS system installed, several other objectives of the project were consequently delayed as well. The most significantly affected objectives were obviously those that were dependent on the operation of the system. For instance, the microwave signal fading research has had to focus on modeling without the benefit of real received signal level data collected by an operational system.

4.2 Tasks Accomplished by Objective

The following summary of accomplishments is organized according to the objectives and related tasks as stated in the original research proposal.

4.2.1 Objective #1

To design, build, and evaluate a prototype web-enabled real-time road-weather information system (RWIS) for the Interstate Highway System in Northeast Florida (FDOT District 2) by installing "basic" weather stations on 15 of the FDOT microwave communication towers.

Tasks

1.1 Evaluate alternative "basic" weather sensor arrays and determine hardware and software requirements for installation on towers and microwave communications network.
STATUS: Completed.

1.2 Purchase and assemble the "basic" weather station, networking, and installation hardware components for 15 towers.
STATUS: Completed.
Important Note:
One of the towers originally planned for the system became unavailable during the course of the project—the Palatka FHP tower. Consequently, with FDOT approval, only ***14*** *"basic station" towers were included in the Research Facility design.*

1.3 Develop any required specialized networking software or hardware solutions.
STATUS: Completed.

1.4 Install and test the "basic" weather stations on 15 microwave towers.
STATUS: Completed.

1.5 Evaluate the "basic" weather station sensor arrays and make recommendations related to which sensor arrays should be used for the statewide implementation of the RWIS.
STATUS: Completed.

Note:
The Phase 2 report will contain detailed recommendations, developed in cooperation with FSU and NWS meteorologists (as described in the FSU proposal), for weather sensor arrays that meet the standards and requirements deemed necessary for an accurate and reliable RWIS. As explained previously, the current "basic weather station" sensor packages chosen for this prototype system were a compromise based on budgetary constraints. The team believes that, although the current sensors meet the minimum needs of the project, other sensor packages will be more appropriate for future systems.

Figure 3 illustrates the locations of the 14 towers included in the prototype facility and the 3 specially equipped towers (to be described in section 4.2.3) that support the FSU microwave signal fading research. As stated earlier, one of the towers originally planned for inclusion in the prototype facility became unavailable during the project period—the Palatka FHP tower.

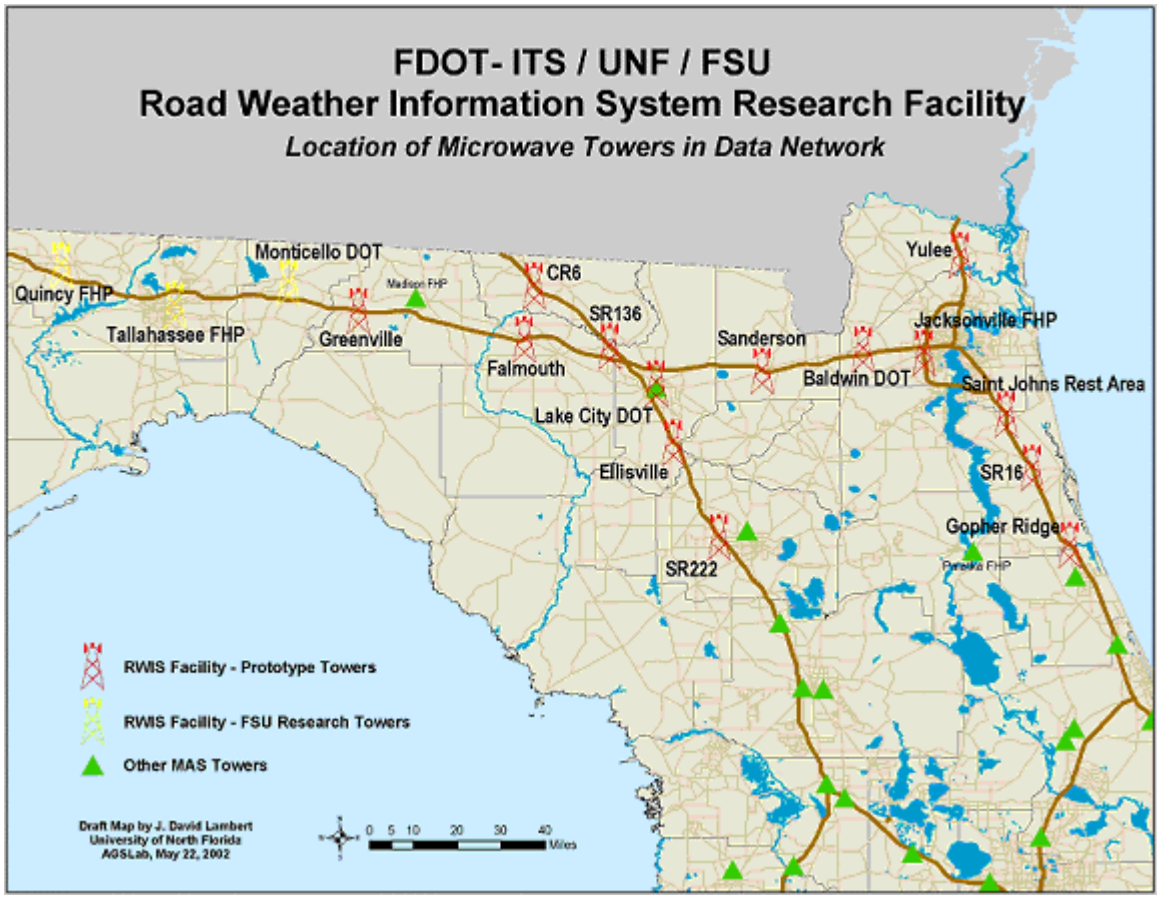

Figure 3: Location of Microwave Towers incorporated into the RWIS Research Facility

Working closely with the FDOT-ITS Office telecommunications contractor, RCC Consultants, Inc., the UNF design team developed the general design requirements and equipment specifications for the data network (Figure 4), data acquisition (see Figure 5 for typicals), and weather sensor components of the research facility. Due to stringent technical requirements and various physical limitations imposed upon the integration of the RWIS equipment into the existing microwave network infrastructure, a cooperative design and installation process was necessary.

The general process adopted for the project was for the design team to submit a preliminary design document to the FDOT-ITS Office for each phase of the installation. After FDOT approval, staff working for RCC Consultants would prepare a Technical Statement of Work (TSW). The TSW formed the basis for approval for the purchase of specialized hardware, equipment, and weather sensors, and dictated the methods of installation to be used to safely integrate the RWIS system into the existing microwave system infrastructure. Lightning and surge protection were major considerations in the design and installation process. Additionally, because of safety requirements and considerations associated with tower climbing, and research project budget constraints, the existing FDOT-ITS Office Microwave Maintenance contract was amended accomplish the installation of the weather sensor packages on the towers (see Figure 6).

This cooperative design and installation process resulted in the creation of three documents that record the detailed design of the research facility components and the installation requirements that were followed to build the RWIS research facility. The three documents created are:

Part 1: Installation of Data Network Equipment to Statewide Microwave Infrastructure,
Part 2: Installation of Data Acquisition Equipment to Statewide Microwave Infrastructure, Part 3: Weather Sensor Installations on Motorist Aid System Towers.

These documents represent and record the majority of the research team's time and efforts expended in Phase I. As such, they are attached to this report as **Appendix 1**.

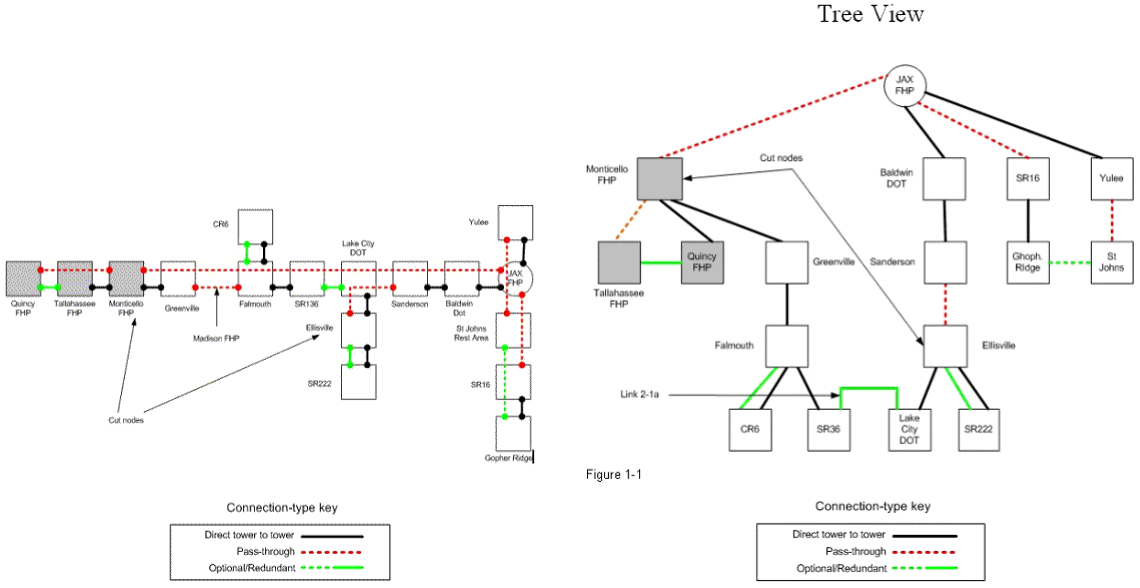

Figure 4: Generalized views of the RWIS research facility network design.

Figure 5: Typical installations of data network and acquisition equipment for the RWIS prototype facility.

Figure 6: Typical installation of the "basic weather station" sensors for the prototype facility.

4.2.2 Objective #2

To develop a web-based interface to the road-weather data collected by the RWIS that will make this information available in real-time and in a user-friendly and useful format to the traveling public through the "MyFlorida.Com" state agency web site.

Tasks

2.1 Conduct workshops to determine the requirements of FDOT, FSU investigators, and other potential stakeholders and to get feedback about successive versions.
STATUS: Completed and Ongoing in Phase II.

2.2 Develop a preliminary version of the web-site to be hosted on a UNF server computer.
STATUS: Completed.

2.3 Incorporate feedback from workshops, etc. to develop a final prototype RWIS website.
STATUS: Completed Version 1 Prototype site—Version 2 being developed as part of Phase II of the research project.

2.4 Develop recommendations and a plan for long-term maintenance, operation, and updating of the RWIS website.
STATUS: Completed.

A major objective of the project was aimed at the development of a prototype web-based interface to the road-weather data collected by the RWIS research facility. An easy-to-remember URL was registered for the project website: **FloridaRoadWeather.ORG** (or .Com, or .Net).

In Phase I of the project, the team concentrated on creating a website that would facilitate system testing, data access and quality verification, and system/project management. Figure 7 illustrates several methods by which the website provides access to the current and historical weather data generated by the system stations. Figure 8 illustrates a few of the facility and project management features of the website. All installation documents are accessible through the website and a 'trouble ticket' system facilitates efficient tracking of problems and maintenance efforts.

Development of the facility and project management features of the website will continue in Phase II; however, the emphasis for website development in Phase II is on creating a companion site that will make this information available in real-time and in a user-friendly and useful format to the traveling public through the MyFlorida.Com state agency web site. The preliminary design requirements for the public website were established in Phase I through a series of focused workshops.

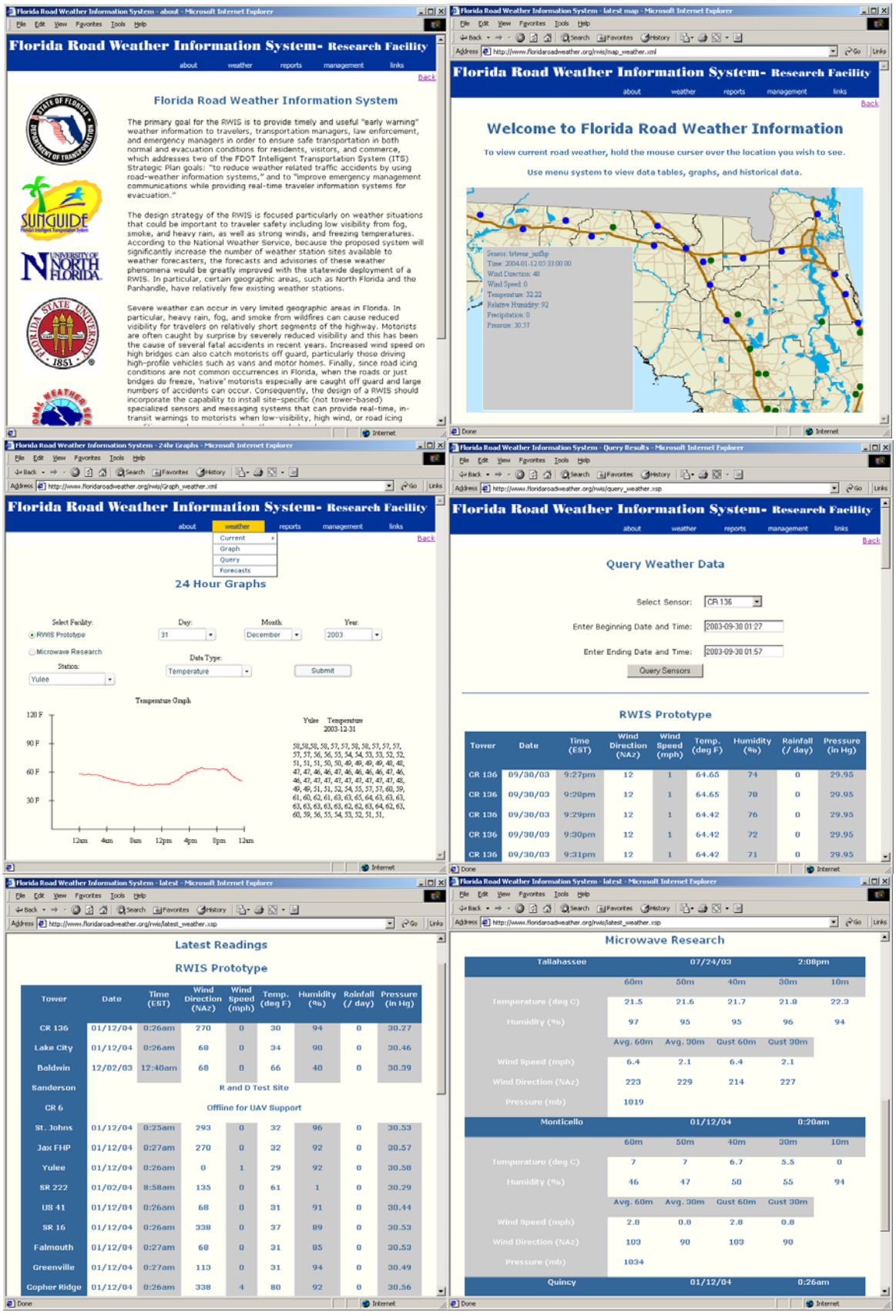

Figure 7: The RWIS website provides different manners of access to current and historical weather data.

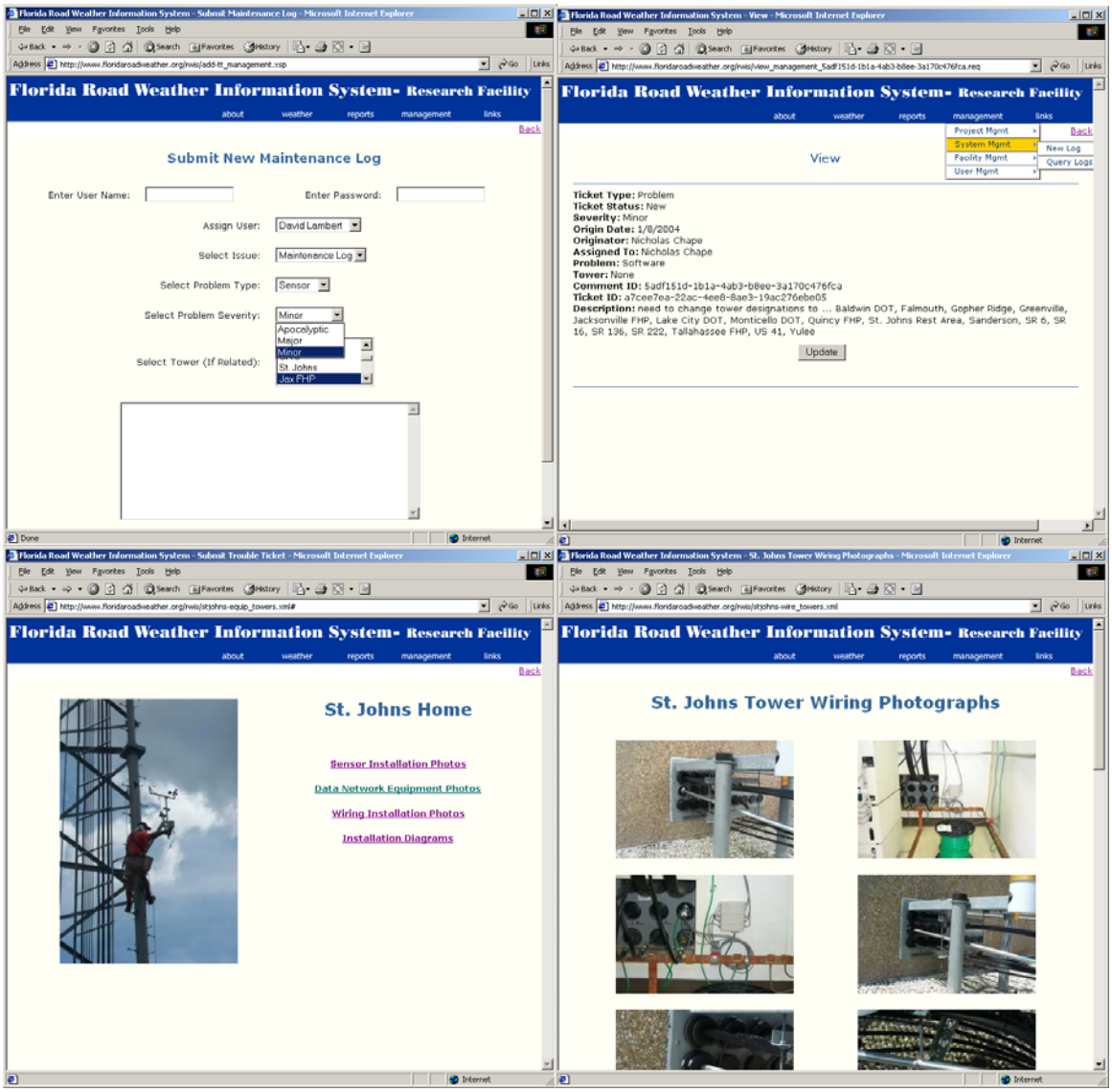

Figure 8: The RWIS Research Facility website includes project and facility management features such as a 'trouble ticket system' and access to installation documents.

4.2.3 Objective # 3

To specially outfit at least 3 microwave towers in the prototype RWIS with specialized multi-height weather sensors in support of the study of atmospheric effects on microwave transmission paths being conducted by FSU Electrical Engineering investigators.

Tasks

3.1 In cooperation with FSU investigators, evaluate alternative "specialized" weather sensor arrays and determine hardware and software requirements for installation on towers and microwave communications network.
STATUS: Completed.

3.2 Purchase and assemble the "microwave research" weather station, networking, and installation hardware components for at least 3 towers.
STATUS: Completed.

3.3 Develop any required specialized software or hardware solutions.
STATUS: Completed.

3.4 Install and test the "microwave research" weather station system.
STATUS: Completed.

3.5 Evaluate "microwave research" weather station sensor arrays.
STATUS: Completed.

A generalized diagram of this facility is shown in Figure 9.

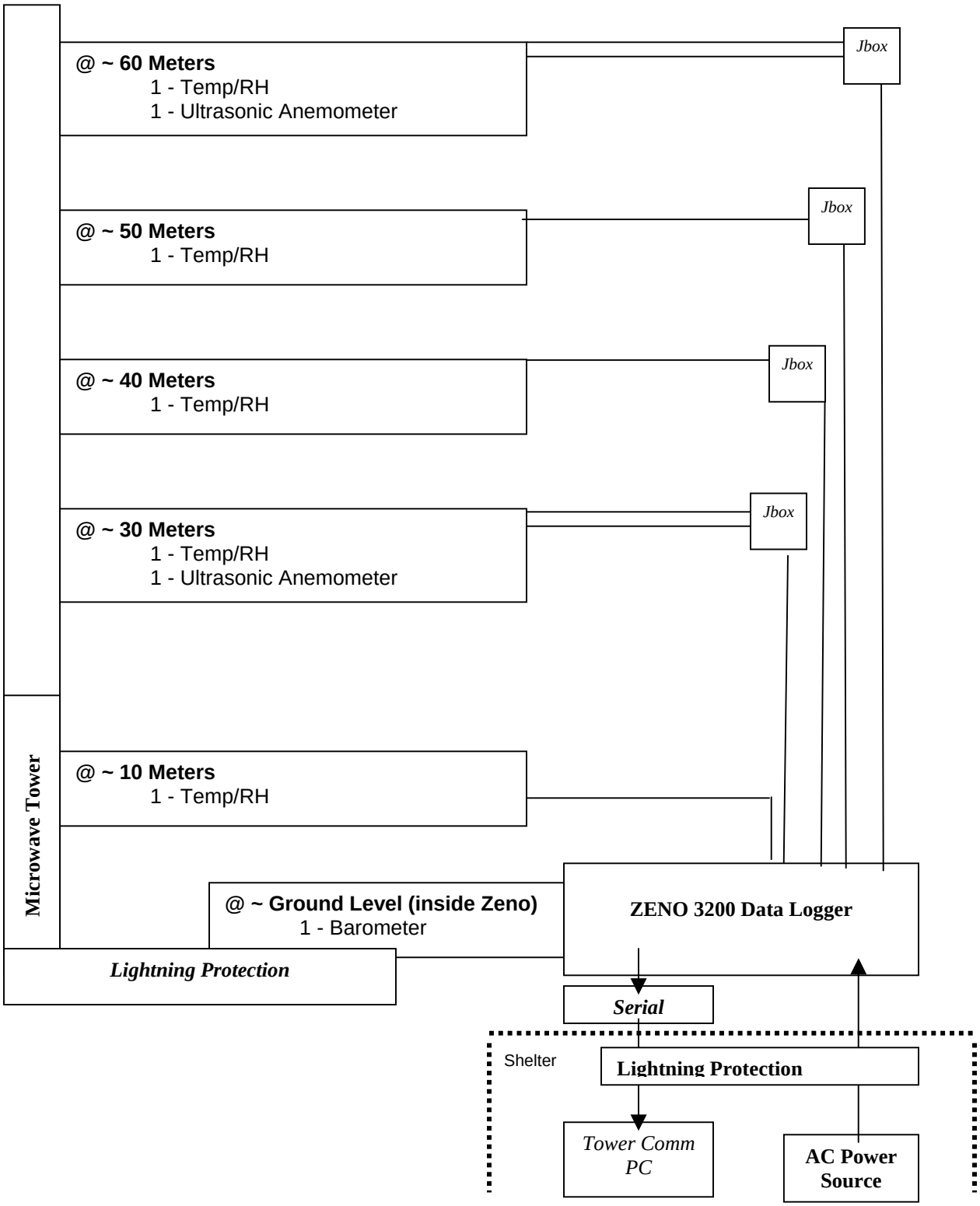

Figure 9: Generalized Configuration of the specialized FSU Microwave Research Towers

4.2.4 Objective # 4

To specially outfit 2 of the microwave towers in the prototype RWIS with custom radio communications systems that will enable additional wireless between-tower and portable weather sensors to be deployed within radio range of the fixed towers.

Tasks

4.1 Evaluate alternative electronic and radio hardware and software and determine requirements for installation on towers and microwave communications network.

STATUS: Completed.

4.2 Develop, install, and evaluate a prototype system to include "portable" and "between tower" weather stations, custom software applications, custom wireless networking, solar power, and installation hardware components.

STATUS: 50% Complete. Remainder of the task delayed, with FDOT approval due to budgetary constraints, till Phase II.

NOTE:
This component of our research was severely limited due to budgetary constraints. The preliminary design work was completed, however, since the entire equipment budget was used to complete the prototype "basic weather station" system and the three "microwave research" towers, there was not enough money to install this system within the limitations of the Phase 1 budget. This objective is now a major element of the Phase II research project.

4.3 Evaluate the system configuration needed to support different spacing intervals (such as 1 mile, 2 miles, 5 miles) for the between-tower sensors and develop a preliminary GIS model for locating the between tower stations based on parameters such as land cover, soil type, elevation, and slope, etc. that could predict fog hazards.

STATUS: Delayed with FDOT approval till Phase II of the research.

A preliminary design for a new research facility component was completed in Phase I that is aimed at specially outfitting 2 of the microwave towers in the prototype RWIS with custom radio communications systems that will enable additional wireless between/near-tower and portable weather sensors to be deployed within radio range of the fixed towers.

Several prototype wireless units were built and evaluated, and custom ad hoc wireless network software was developed and tested to prove the concept. Due to severe budget limitations (previously discussed), this facility was not field-installed during Phase I. Development of the prototype hardware and software will continue in Phase II, and the system will be installed on at least two towers for field-testing of the system concept (see Figure 10). The design of the demonstration project will include the installation of wireless-enabled ultrasonic wind sensors on two evacuation bridges in St. Johns County.

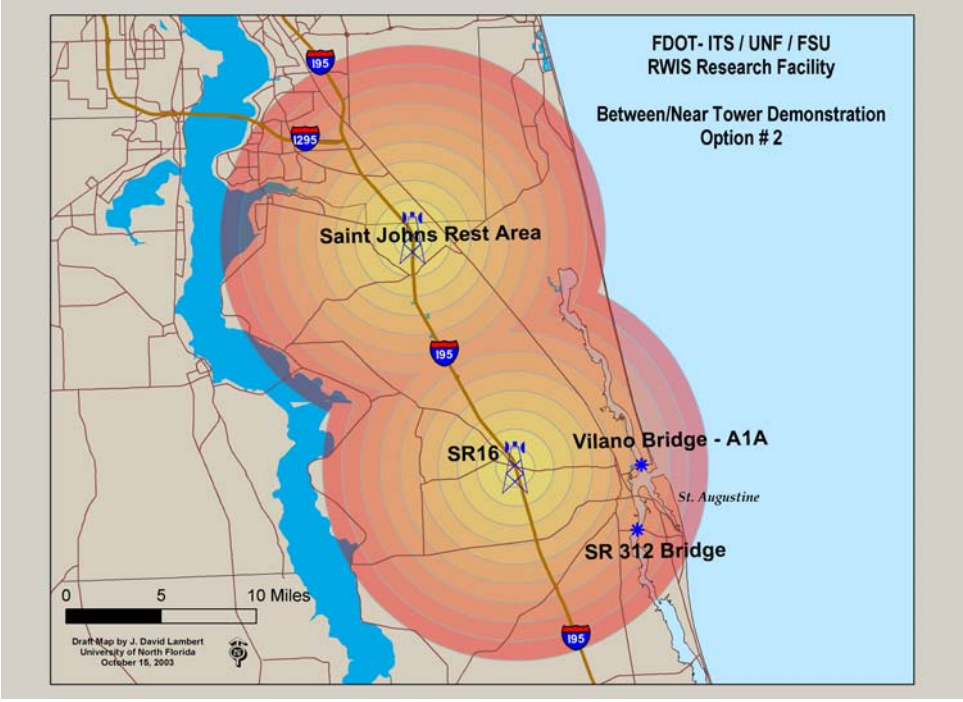

Figure 10: Preliminary design for between/near tower research facility.

4.2.5 Objective # 5

To archive weather data received from the RWIS on a server computer at UNF and make this data available to cooperating research meteorologists at FSU and the NWS through a simple web-based "historical weather database access system".

Tasks

5.1 Conduct workshop to determine the requirements of FDOT, FSU investigators, the NWS, and other potential stakeholders for access methods and database design.

STATUS: Completed with ongoing development in Phase II.

5.2 Develop the database access system and host it on a UNF server computer.

STATUS: Completed with ongoing development in Phase II.

5.3 Maintain and operate the data archive.

STATUS: Completed. Note: Future data will be provided to NWS archives.

5.4 Develop recommendations and a plan for long-term maintenance, operation, and updating of the "historical weather database access system" and website.

STATUS: Completed with ongoing development in Phase II.

As a result of the workshop, the research team recommends that, instead of maintaining a FDOT archive of historical weather data, that all 'raw' weather data collected by the RWIS stations be transferred to existing institutions, such as the Southeast Climate Center, for long-term archiving. Methods for transferring this data to the existing archives will be developed in Phase II.

4.2.6 Objective # 6

To provide project management to ensure that the efforts of the cooperating researchers are coordinated both in terms of complementary technical objectives and work schedules.

Tasks

6.1 Conduct quarterly project planning and management workshops and other meetings as required to provide coordination and management.

STATUS: Completed.

6.2 Coordinate and compile project reports by investigators to generate Interim and Final Reports to FDOT-ITS.

STATUS: Completed.

4.2.7 Objective # 7

To begin development of a proposal/plan for full-scale state-wide implementation of an operational RWIS.

STATUS: Completed and ongoing in Phase II (with FINAL plan to be completed in Phase III).

A component of this objective included preliminary research on the integration of dynamic in-transit messaging and traveler information kiosks---these elements of the system are being examined in more detail in Phase II.

4.2.8 Objective # 8 (FSU Subcontract)

To conduct preliminary research on atmospheric effects on microwave transmissions.

STATUS: Completed.

As a component of the RWIS project, investigators from the Florida State University Department of Electrical Engineering initiated research related to atmospheric effects on microwave transmissions. As stated previously, the microwave transmission research was obviously hampered by the lack of field data from an operational system. Despite this delay, significant modeling and simulation related to microwave signal attenuation was accomplished during Phase I. Several oral presentations of results were made to FDOT ITS Office staff during Phase I. *Digital copies of these PowerPoint presentations are included under separate cover.*

During Phase I, it was determined that microwave received-signal-level (RSL) monitoring devices would be needed in order to collect the data needed to correlate the weather variables to the signal fades experienced. Although the design and installation of these devices was NOT explicitly included in the original UNF task list, because of the identified need, the UNF team designed and built RSL devices and installed 3 custom-built devices on the 3 specially designed FSU research towers.

The electronic design and installation approval process for these devices took much longer than expected due to the fact that they would have to be attached directly to the microwave radio system and there was considerable concern about the potential for electrical surge through the devices that were connected to the RWIS data collection system.

As a result of adding these new devices to the research facility, in Phase II of the research program the team will be able to combine data sets of received signal levels with the multi-level weather variables to study the correlation of atmospheric effects with fades experienced by microwave paths based on real data.

Whereas, in Phase I of this project, the emphasis was placed on basic and background research, as well as the design and construction of an appropriate research facility, specific recommendations and guidelines to design and maintain microwave paths and the development of new adaptive microwave link design methodologies will be products of Phase II and III of the research project.

4.2.8 Objective # 8 (FSU Subcontract)

To conduct preliminary research on improving road weather forecasting by using the data provided by the RWIS.

STATUS: Completed.

A major effort has been initiated as a result of this project to coordinate the RWIS with existing NWS data and forecasting systems. The UNF investigators have also worked very closely with the FSU investigators to determine the design requirements for the RWIS weather station network, the website, and the weather data archive.

As a result of coordination with the National Weather Service, the basic weather data collected by the RWIS research facility weather stations (temperature, humidity, rainfall, wind speed, wind direction, and barometric pressure) is now available (by FTP download) in a national standard data format (FSL Mesonet) to any forecaster. Figure 11 lists the official NWS station identifiers that have been assigned to the RWIS stations.

The addition of the RWIS facility weather stations has filled several significant geographic gaps in weather data coverage for north Florida thus contributing to the potential for increased spatial resolution of weather forecasts for the region. This is an important accomplishment because the reliability of road segment forecasts depends on efforts aimed at increasing the spatial resolution of existing forecast models.

As a result of several focused workshops, the research team determined that the best approach for developing the public RWIS website would be to develop a software system that could incorporate a new NWS forecast product called the 'National Digital Forecast Database' (NDFD). However, this much-anticipated forecast product would only become available from the NWS in the fall of 2003.

Gopher Ridge	GFRF1
Lake City	LCYF1
Sanderson	SDRF1
Baldwin	BAWF1
St Johns Rest Area	RSTF1
SR 16	SOMF1
Yulee	YULF1
CR 6	HWJF1
Falmouth	SUFF1
SR 136	SUCF1
SR 222	GVNF1
US 41	ECSF1
JAX FHP	JHPF1

Figure 11: Official National Weather Service Station Identifiers assigned to the RWIS research facility weather stations that enable incorporation into weather forecast models.

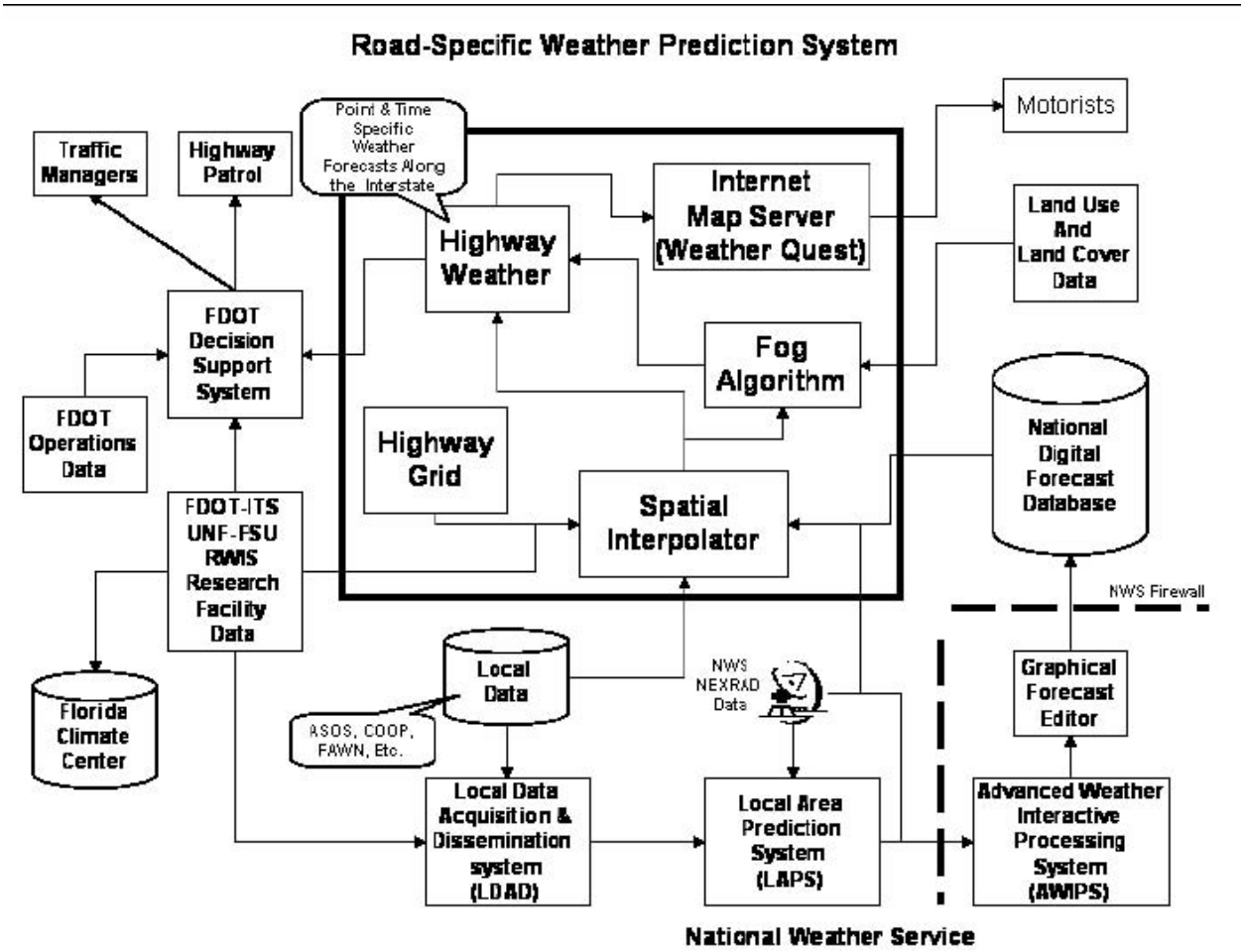

Figure 12: Preliminary design for the Road-specific weather prediction system.

It was determined that this approach will require much more software development work than originally anticipated, but will provide a more reliable and usable product to the public as a result. This has turned out to be a major unanticipated finding of this research and is due in large part to the close cooperation with the National Weather Service.

The preliminary design for the 'Road-Specific Weather Prediction System' that was developed during Phase I of the program is shown in Figure 12. A prototype implementation of the proposed system design is being developed in Phase II.

5.0 Conclusions and Recommendations

Despite the delays experienced because of unanticipated design and installation challenges noted earlier, it is important to emphasize that the RWIS research team is very optimistic and is excited about its accomplishments during Phase I of the research program. The most significant accomplishments of Phase I are certainly the completion of the operational RWIS research facility, and the establishment of an interdisciplinary, multi-university, multi-agency, private/public team to work on the development of an innovative and successful RWIS for the State of Florida.

National Weather Service participation in the initial design process has been particularly important. For instance, a challenge associated with generating accurate road-segment-specific weather forecasts is presented by the relatively coarse spatial resolution of current weather forecasts. It became evident early in the design process that the proposed state-wide deployment of a RWIS could significantly increase the number of weather station sites available to both public (NWS) and private weather forecasters which could significantly contribute to the development of higher spatial resolution forecast models (called 'Mesoscale' forecasting) for Florida.

By contributing much needed real-time, relatively high spatial resolution weather data to the NWS mesoscale models, the RWIS could benefit in turn by receiving more accurate, higher spatial resolution forecasts and advisories. This is especially important when forecasting the road segment locations of hazardous weather phenomena.

This realization became the basis for the preliminary design of the 'Road-specific weather prediction system' that is being further developed in Phase II of the research program. NWS coordination is also on going related to integrating other existing NWS weather products into the RWIS, such as radar, for tracking rainfall rates associated with particular road segments. Essentially, the concept is that the RWIS contributes data to the NWS forecast models which lead to better quality NWS forecast products that are subsequently incorporated into the more reliable RWIS—a mutually beneficial partnership.

As a result of interviews and workshops involving traffic managers, law enforcement, and emergency managers, it has become evident that there is a high priority need for additional wind sensor stations located on high coastal evacuation bridges. Managers have expressed the need for information about wind speeds at bridges in order to know when to close the bridges to high profile vehicle traffic during a hurricane evacuation.

The proposed between/near tower system may provide a solution. Thus, the development and testing of this proposed RWIS feature has become a major objective of the Phase II research effort.

Many small, but significant, technical lessons have been learned by both the research team and the staff of the FDOT-ITS Office (including the ITS contractors working with the researchers) about how to successfully integrate other IT systems with the existing microwave communications system.

The ongoing challenges associated with keeping the research facility operational continue to provide technical insight and understanding that will contribute to the final recommendations for statewide implementation of the system.

For example, the design team now has a deep appreciation for the need for robust lightning protection—several of the equipment failures experienced thus far have been associated with lightning strikes which, despite the design teams best efforts at providing protection, found weak spots in the design. Future design recommendations for lightning protection will certainly incorporate these lessons learned.

Similarly, as a result of experience with the operation of the research facility, the team has been able to identify long-term maintenance issues and has begun developing recommendations related to statewide implementation. For instance, the prototype system has had some maintenance problems associated with some of the budget-related compromises. Consequently, the team has learned that it is not economical in the long run to cut corners on the quality of the weather sensors installed because these components are relatively more difficult to maintain since they require a certified tower climber be employed for replacement or maintenance activities. Also, it is important to keep in mind that the prototype facility will eventually (2-3 years?) need to be upgraded to be consistent with the final recommended equipment and sensor configuration.

The design team recommends that the statewide maintenance of tower-mounted stations be accomplished by the employing the technicians already conducting other microwave tower maintenance tasks. In other words, field maintenance of the RWIS could become an additional task added to the on going maintenance contract for the microwave towers. In addition to the field-based maintenance requirements, there will also be a need for technical staff that have special skills related to maintaining the operational system software and web servers. The research team has been developing a software system that utilizes open-source code to ensure that there will be no proprietary software to hinder transition of the system between maintenance vendors, however, it must be pointed out that this is unavoidably a customized system that will require specially trained technicians to maintain and operate it. Thus, a major objective of the final phase of the research project will be to document the custom software in a manner that the system can be efficiently turned over to a system administration contractor.

APPENDIX 1 – Technical Statement of Work

Final Report
Phase I - Development of a Road Weather Information System (RWIS) for Florida's Intelligent Transportation System

CONTRACT # BD-160

ATMOSPHERIC RESEARCH PROJECT

TECHNICAL STATEMENT OF WORK

PART I

INSTALLATION OF DATA NETWORK EQUIPMENT

TO

STATEWIDE MICROWAVE INFRASTRUCTURE

Florida Department of Transportation

Development of a Road Weather Information System (RWIS) for

Florida's Intelligent Transportation System - Phase I

August 23, 2002

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1. GENERAL

The work specified herein consists of installation tasks that are required to implement the first phase of a research project to develop a Road Weather Information System (RWIS) carried over the Florida Department of Transportation's (FDOT) digital microwave system. The intent is to provide timely and useful "early warning" weather information to travelers, transportation managers, law enforcement, and emergency managers in order to ensure safe transportation in both normal and evacuation conditions for residents, visitors, and commerce. Weather data that is detected and generated by equipment installed at several sites along I-10, I-75, and I-95 will be carried over the digital microwave circuit and delivered to a network server at Jacksonville FHP. The data will then be collected by the University of North Florida's network server located at the university via a DSL connection.

As a component to the RWIS project, investigators from the Florida State University Departments of Electrical Engineering, Geography, and Meteorology will conduct research related to atmospheric effects on microwave transmissions and on improving road weather forecasting through the use of data provided by the new RWIS. The microwave transmission paths that will be studied are between the Quincy FHP and Tallahassee FHP towers, and between the Tallahassee FHP and Monticello DOT towers. These paths were chosen due to their geographic locations and the distances between the towers. Both paths are more than 20 miles in length and have displayed signal fading problems in the past, therefore, making them ideal candidates for this research project.

Central to this project's design is the provision of transient voltage surge suppression (TVSS) devices that integrate with the communications site's existing grounding systems to afford maximum lightning and surge protection to the network's sensitive computer and communications equipment. Where possible, additions to the grounding system's electrical circuit configuration shall be accomplished by connecting to the existing grounding system components.

The University of North Florida (UNF), along with Florida State University (FSU), collectively known as the Universities, shall provide all equipment, connecting/mounting hardware, expendable installation supplies, and the installation work necessary to accomplish the entire communications and road weather information system described herein. Figure 1-1 on page A1 of 35 is a system diagram that illustrates the IP router

data network and digital microwave equipment elements that are the subject of this installation Technical Statement of Work.

The installation work shall be of high quality and of the type and quantity prescribed by this specification. In all cases, the routing of the wiring and its dressing shall be neat, secure, and free of sharp bends. All cables and wiring shall be cut to appropriate lengths without being too taunt or too slack. The Universities are responsible for the removal of any surplus materials and all other debris from the site at the conclusion of the work activities.

2. INSTALLATION

This pilot project is being undertaken through a joint effort of the FDOT Intelligent Transportation Systems (ITS) Office and the Universities, utilizing their respective general staff, consultants, and contractors for requisition of the materials and execution of the installation work.

The FDOT's Telecommunications General Consultant (FDOT TGC) is responsible for the T-1 transport system integration and the development of this Installation Technical Statement of Work. The Universities' staff and contractors will perform installation tasks up to the microwave system T-1 circuit demarcation. The FDOT's Microwave Maintenance Contractor has performed the digital microwave T-1 system's wiring cross-connects and software reconfiguration.

Additionally, the FDOT TGC will coordinate the commissioning, testing, and installation activities with the Universities and any other parties. The major equipment items and materials are listed in Table 2-1.

Table 2-1: Equipment Items and Materials

The following equipment, or approved equivalents, shall be installed in accordance with the site-specific installations as part of this project:

Item	Description	Manufacturer	Part Number	Qty
1	T-1 RJ-48/45 TVSS Unit	Atlantic Scientific	90700	34
2	DIN Rail 32 TVSS Unit Module for EIA Rack Mount and Bracket	Atlantic Scientific	24500	17

3	Open Aluminum Relay Rack 84"H x 19"W	Bud Industries, Inc. (Tessco)	ARR-1272-NATURAL	14
4	Relay Rack Anchor Kit	B-Line Systems (Tessco)	SB-588-A	14

3. TERMS

CAT-V:	Category 5
CSU:	Channel Service Unit
DSL:	Digital Subscriber Line
DSU:	Data Service Unit
EIA:	Electronic Industries Association
FCC:	Federal Communications Commission
FDOT:	Florida Department of Transportation
FDOT Microwave Maintenance Contractor:	TransCore 5744 S. Semoran Blvd. Orlando, FL 32822 Contact: Bill Eatley Telephone: (407) 382-1301
FDOT TGC:	FDOT Telecommunications General Consultant. PB Farradyne, Inc. and RCC Consultants, Inc. 605 Swannee St. MS 90 Tallahassee, FL 32399-0450 Contact: Russell Allen Telephone: 850-410-5626

FSU:	Florida State University 2525 Pottsdamer Street Tallahassee, FL 32310 Contact: Simon Y. Foo, Ph.D. Telephone: 850-410-6474
ITS:	Intelligent Transportation Systems
NEC:	National Electric Code
RWIS:	Road Weather Information System
UNF:	University of North Florida 4567 St. Johns Bluff Road, South Jacksonville, FL 32224-2645 Contact: J. David Lambert, Ph.D. Telephone: 904-620-3881
Universities:	UNF and FSU Staff/Contractors
UPS:	Uninterrupted Power Supply
VAC:	AC Volts
TVSS	Transient Voltage Surge Suppression

4. SITES OF WORK

The installation materials shall be delivered and installed as outlined in these specifications at the following FDOT communications sites:

1. Quincy FHP
   2 Miles West of Quincy on US90
   Quincy, FL
   Lat: 30-35-10.2N Lon: 84-37-13.6W NAD83

2. Tallahassee FHP
   2100 Mahan Drive
   Tallahassee, FL
   Lat: 30-27-18.9N Lon: 84-14-43.2W NAD83

3. Monticello DOT
   FDOT Maintenance Yard on US19
   Monticello, FL
   Lat: 30-31-45.9N Lon: 83-52-7.5W NAD83

4. Greenville
   0.6 Miles West of US-221 on I-10
   Greenville, FL
   Lat: 30-26-8N Lon: 83-38-17W NAD27

5. Falmouth
   NW Quadrant of US90 & I-10 Intersection (Old Exit 39 / New Exit 275)
   Falmouth, FL
   Lat: 30-20-33.0N Lon: 83-05-25.0W NAD83

6. SR6
   NW Quadrant of SR6 & I-75 intersection
   Jennings, FL
   Lat: 30-31-04.8N Lon: 83-03-27.5W NAD83

7. SR136
   NE Quadrant of SR136 & I-75 Intersection (Old Exit 84 / New Exit 439)
   White Springs, FL
   Lat: 30-19-09.0N Lon: 82-48-29.0W NAD83

8. Lake City DOT
   1650 Lake Jeffery Road
   Lake City, FL
   Lat: 30-11-42.0N Lon: 82-39-11.0W NAD83

9. US41
   NE Quadrant of US41 & I-75 Intersection (Old Exit 80 / New Exit 414)
   Ellisville, FL
   Lat: 25-59-59.0N Lon: 82-35-54.0W NAD83

10. SR222
    SW Quadrant of SR222 & I-75 Intersection (Old Exit 77 / New Exit 390)
    Gainesville, FL
    Lat: 29-41-16.0N Lon: 82-26-46.0W NAD83

11. Sanderson
    SE Quadrant of US90 & I-10 Intersection (Old Exit 45 / New Exit 324)
    Sanderson, FL
    Lat: 30-14-16.0N Lon: 82-18-14.0W NAD83

12. Baldwin DOT
    FDOT Maintenance Yard on US301
    Baldwin, FL
    Lat: 30-18-27.0N Lon: 81-58-19.0W NAD83

13. Jacksonville FHP
    Normandy Blvd & I-295 Intersection (Old Exit 7 / New Exit 19)
    Jacksonville, FL
    Lat: 30-17-50.0N Lon: 81-41-11.0W NAD83

14. Yulee
    NE Quadrant of SR200/A1A & I-95 Intersection (Old Exit 129 / New Exit 373)
    Italia, FL
    Lat: 30-37-13.0N Lon: 81-38-59.0W NAD83

15. St. Johns Rest Area
    SW Corner of Southbound Rest Area on I-95
    Durbin, FL
    Lat: 30-05-34.0N Lon: 81-30-00.0W NAD83

16. SR16
    SW Quadrant of SR16 & I-95 Intersection (Old Exit 95 / New Exit 318)
    St. Augustine, FL
    Lat: 29-55-01.0N Lon: 81-24-45.0W NAD83

17. Gopher Ridge
SE Quadrant of US1/SR5 & I-95 Intersection (Old Exit 92 / New Exit 298)
Marineville, FL
Lat: 29-39-45.0N Lon: 81-17-12.0W NAD83

5. EXAMINATION OF SITES AND SPECIFICATIONS

The Universities are required to carefully examine the specifications contained herein and inform themselves thoroughly regarding any and all site conditions and requirements that may in any manner affect the work to be performed under this installation Technical Statement of Work.

Notwithstanding the details presented in this specification, it is the responsibility of the Universities to verify the completeness of the materials required and suitability of devices to meet this specification. Any additional equipment required for operation in accordance with these specifications shall be provided and installed by the Universities.

6. UNIVERSITIES' QUALIFICATIONS

The Universities shall possess the qualifications, skills, and experience necessary to accomplish the work required by this specification without adversely impacting the critical operations of the FDOT's microwave network.

7. EQUIPMENT INSTALLATION

7.1 General

The equipment installations required by this specification include all of the previously described equipment and services (Figure 1-1 and Table 2-1) and associated ancillary hardware. All installations shall be accomplished in accordance with good engineering practices. The end result will be a completely integrated and operating IP router data network.

The FDOT shall provide space for the equipment within the communications facilities. The Universities shall install equipment racks and data communications equipment in accordance with this installation Technical Statement of Work in the various

communications facilities. The Universities shall install the equipment and wiring within these spaces and connect the data communications equipment to the overhead 120 VAC receptacle and associated T-1 circuit demarcation point on the 66 punch block located on the cross-connect backboard at each site.

The Universities are required to adhere to FCC Rules, NEC, all local codes, and building regulations. Additionally, the Universities must perform all work in a manner consistent with good engineering practices. The Universities are required to coordinate with the FDOT ITS Office and the microwave maintenance contractor prior to the commencement of any installation work at any FDOT microwave communications site.

7.2 Digital Microwave Transmission Plan

Figure 1-1 illustrates the overall digital microwave transmission plan across several of the Motorist Aid System (MAS) microwave sites along Interstate, northern Interstate 75, and northern Interstate 95. The diagram delineates the T1 transmission paths allocated for this project. In essence, meteorological data is transported from a CrystalPC CS1000 server located at each site to a network server located at the Jacksonville FHP site over allocated T1 circuits on the digital microwave system. All microwave and channel bank equipment are in place.

TransCore has installed cross-connects and jumpers to the channel bank ports, installed M12 cards, and provided demarcation points on the 66 punch blocks located on the Telco back board at each site, as specified in the Microwave Maintenance Contractor Statement of Work.

7.3 Site Specific Installations

The work specified in this section includes equipment and hardware installation parameters. These parameters include, but are not limited to, new rack placement, new and existing rack installation, equipment installation, rack and equipment grounding, T-1 circuit termination, and power hook up.

New RWIS equipment racks shall be installed in accordance with the site specific requirements. New racks must be mounted to the floor using relay rack anchor kits as specified in Table 2-1 in APPENDIX B. New racks must be connected to the grounding system at the floor using #6 copper strand wire with green insulation. All connections between rack, ground wire, and grounding system must be mechanical, and must not

cause a trip hazard. The RWIS equipment shall be connected to the T-1 circuit demarcations as delineated in Table 7.3-1.

All equipment and network cabling must be secured to the equipment racks. All cabling shall be directed to the overhead cable trays and positioned such that no empty rack units that may be used in the future are blocked. Positioning of equipment is shown in the site specific figures in APPENDIX A.

7.3.1 Quincy FHP Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Quincy FHP Shelter Floor Plan (Figure 7.3.1-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.1-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.1.1 Quincy FHP – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply shall be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.1-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Quincy FHP communications shelter.

7.3.2 Tallahassee FHP Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Tallahassee FHP Shelter Floor Plan (Figure 7.3.2-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.2-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect

backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.2.1 Tallahassee FHP – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.2-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Tallahassee FHP communications shelter.

7.3.3 Monticello DOT Equipment

The Universities shall use existing rack "AR-7" as shown in the Monticello DOT Shelter Floor Plan (Figure 7.3.3-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.3-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.3.1 Monticello DOT – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.3-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Monticello DOT communications shelter.

7.3.4 Greenville Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Greenville Shelter Floor Plan (Figure 7.3.4-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.4-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.4.1 Greenville – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.4-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Greenville communications shelter.

7.3.5 Falmouth Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Falmouth Shelter Floor Plan (Figure 7.3.5-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.5-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.5.1 Falmouth – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.5-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Falmouth communications shelter.

7.3.6 SR6 Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the SR6 Shelter Floor Plan (Figure 7.3.6-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.6-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.6.1 SR6 – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.6-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the SR6 communications shelter.

7.3.7 SR136 Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the SR136 Shelter Floor Plan (Figure 7.3.7-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.7-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.7.1 SR136 – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment

rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.7-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the SR136 communications shelter

7.3.8 Lake City DOT Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Lake City DOT Shelter Floor Plan (Figure 7.3.8-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.8-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.8.1 Lake City DOT – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.8-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Lake City DOT communications shelter.

7.3.9 US41 Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the US41 Shelter Floor Plan (Figure 7.3.9-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.9-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.9.1 US41 – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.9-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the US41 communications shelter.

7.3.10 SR222 Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the SR222 Shelter Floor Plan (Figure 7.3.10-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.10-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.10.1 SR222 – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.10-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the SR222 communications shelter.

7.3.11 Sanderson Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Sanderson Shelter Floor Plan (Figure 7.3.11-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.11-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.11.1 Sanderson – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.11-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Sanderson communications shelter.

7.3.12 Baldwin DOT Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Baldwin DOT Shelter Floor Plan (Figure 7.3.12-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.12-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.12.1 Baldwin DOT – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.12-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Baldwin DOT communications shelter.

7.3.13 Jacksonville FHP Equipment

The Universities use existing rack "MAS Call Box Base Station" as shown in the Jacksonville FHP Equipment Room Floor Plan (Figure 7.3.13-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.13-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.13.1 Jacksonville FHP – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.13-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Jacksonville FHP communications shelter.

7.3.14 Yulee Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Yulee Shelter Floor Plan (Figure 7.3.14-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.14-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.14.1 Yulee – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment

rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.14-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Yulee communications shelter.

7.3.15 St. Johns Rest Area Equipment

The Universities shall use existing rack "MAS Call Box Base Station North" as shown in the St. Johns Rest Area Shelter Floor Plan (Figure 7.3.15-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.15-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.15.1 St. Johns Rest Area – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.15-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the St. Johns Rest Area communications shelter.

7.3.16 SR16 Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the SR16 Shelter Floor Plan (Figure 7.3.16-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.16-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.16.1 SR16 – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.16-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the SR16 communications shelter.

7.3.17 Gopher Ridge Equipment

The Universities shall install a standard EIA 19-inch X 7-foot aluminum equipment rack as shown in the Gopher Ridge Shelter Floor Plan (Figure 7.3.17-1). The Universities shall also install network equipment and TVSS devices as shown in the rack elevation diagram (Figure 7.3.17-2).

The RWIS CSU/DSU units shall be connected to T-1 TVSS devices using CAT-V cable or approved equivalent. The T-1 TVSS devices shall be connected to the cross-connect backboard using CAT-V cable or approved equivalent. Refer to Table 7.3-1 for the position on the 66 punch blocks.

7.3.17.1 Gopher Ridge – Power Hook Up

The RWIS data network equipment 120 VAC UPS power supply must be connected to the nearest twist-lock receptacle located on the cable tray. If no 120 VAC twist-lock receptacle exists on the cable tray the power cable must be routed along the equipment rack cable tray to the nearest 120 VAC wall outlet. Figure 7.3.17-2 is the RWIS rack elevation diagram that shows the 120 VAC UPS power supply location for the Gopher Ridge communications shelter.

7.4 Testing and Commissioning

7.4.1 General

At the conclusion of the data network equipment installation, the Universities will have the opportunity to evaluate the system performance by conducting equipment/system tests. The TGC will perform inspections and note any discrepancies for correction by the Universities.

APPENDIX A

Figures

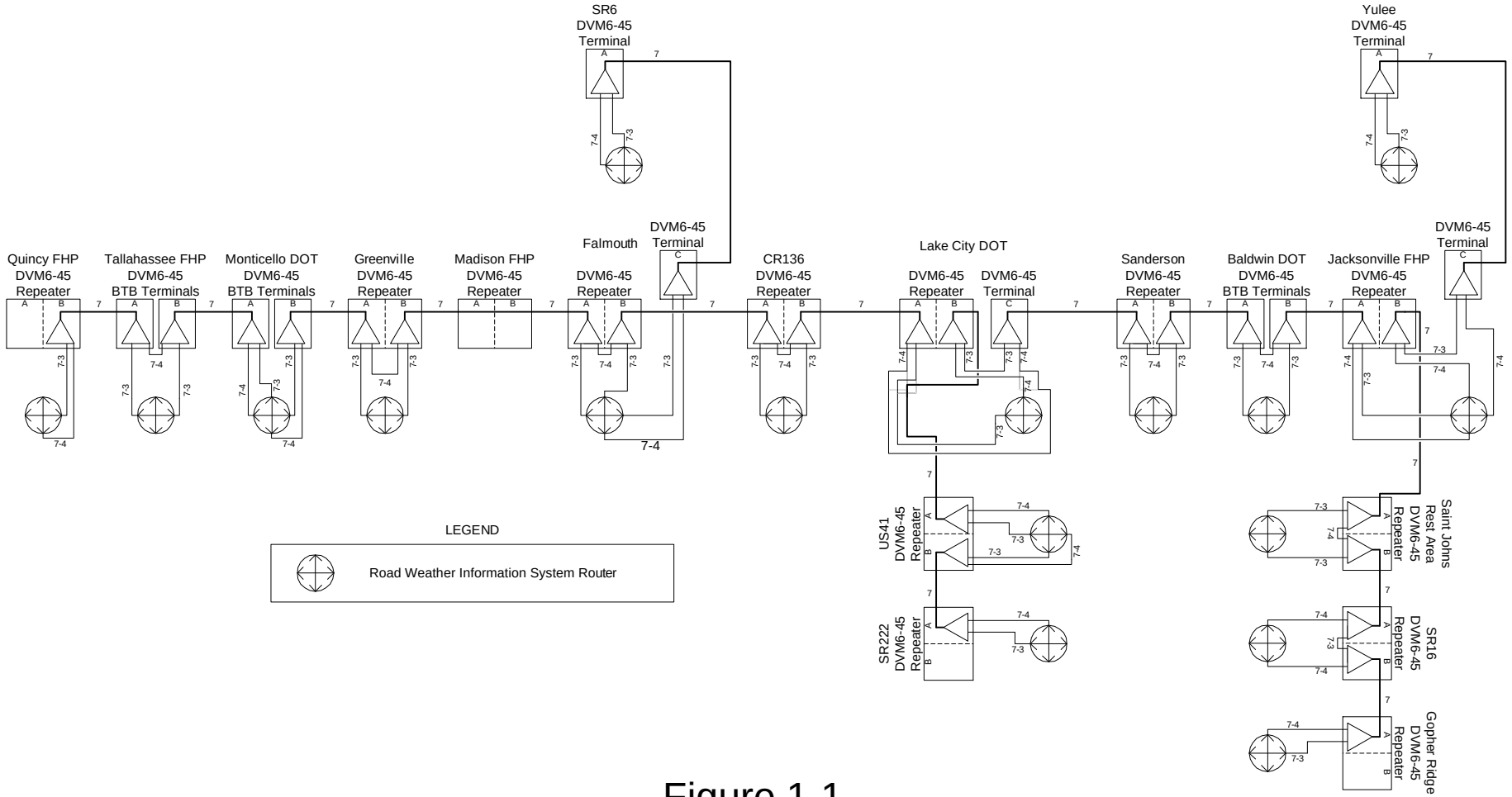


Figure 1-1
Road Weather Information System
T1 and Router Configuration

Scale: 3/8" = 1'-0"

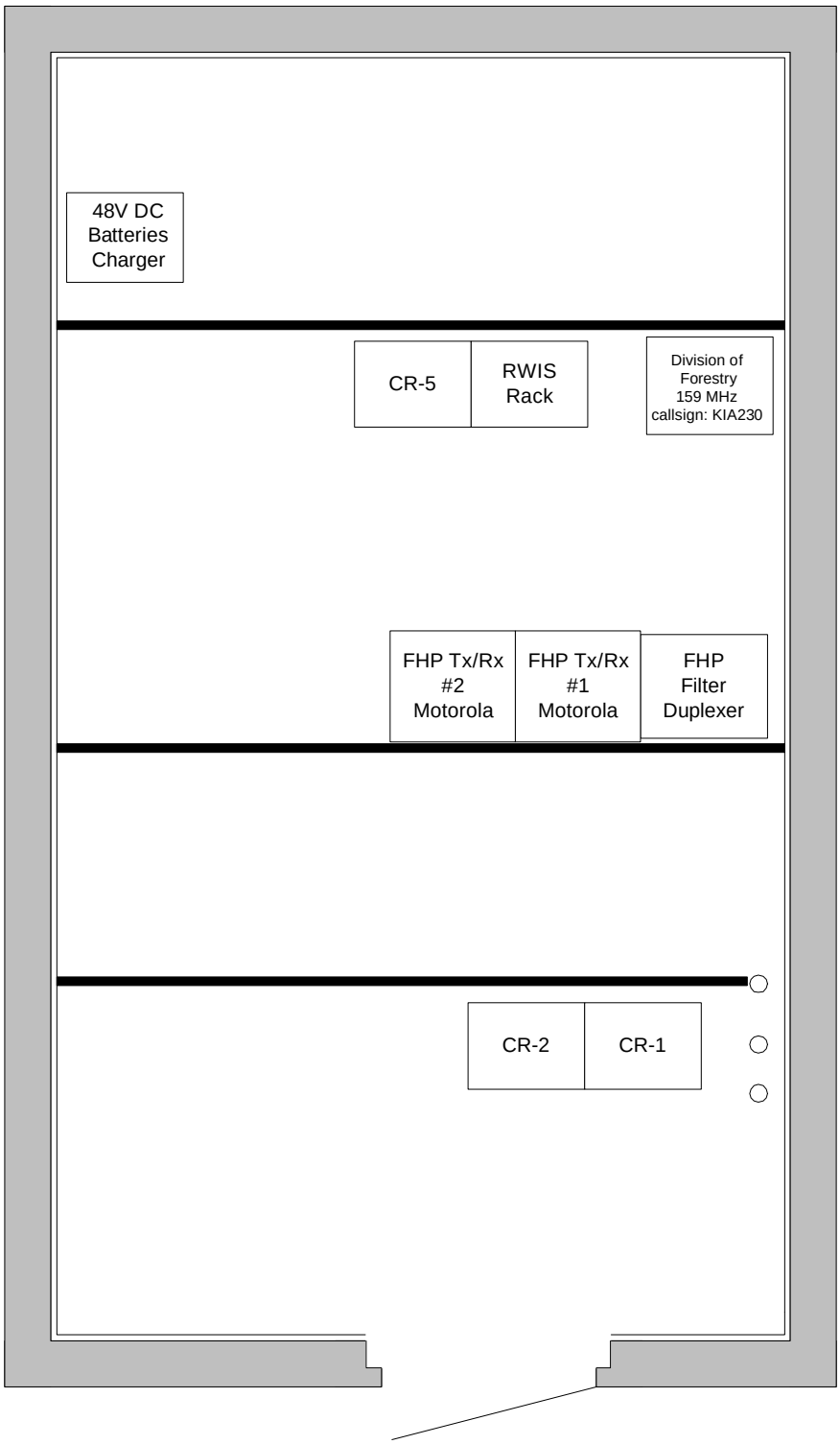


Figure 7.3.1-1
Quincy FHP Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

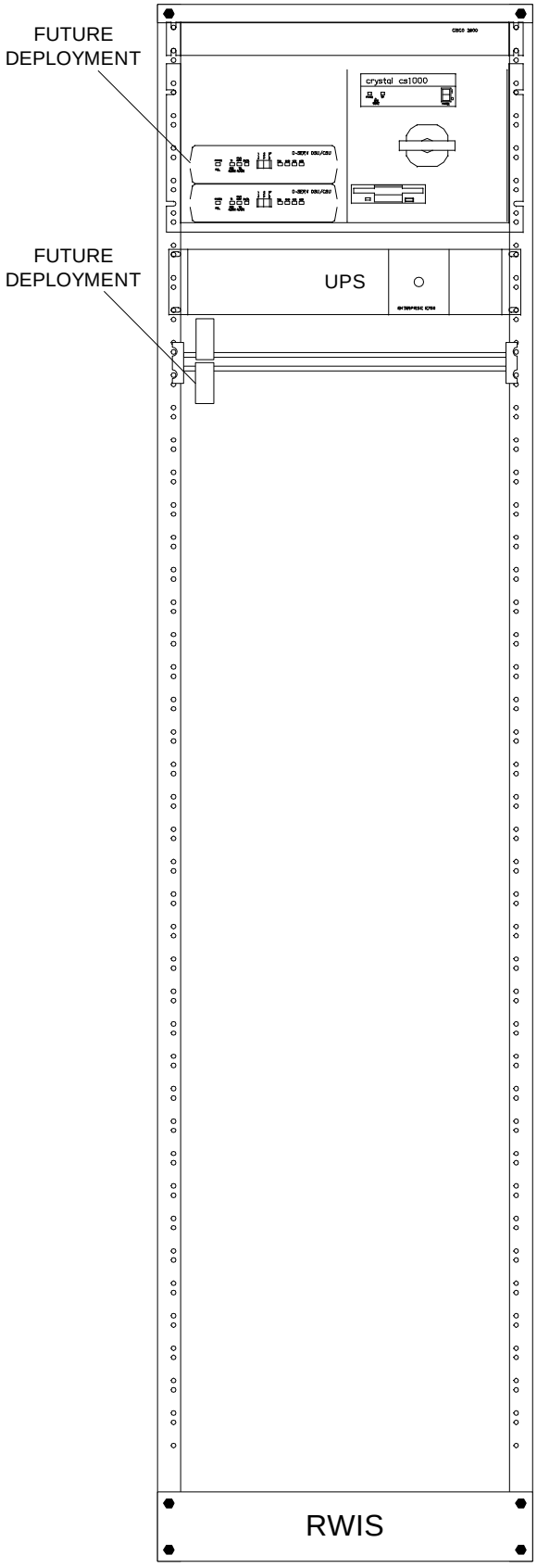


Figure 7.3.1-2
Quincy FHP
RWIS Rack Elevation
Front View

Scale: 3/8" = 1'-0"

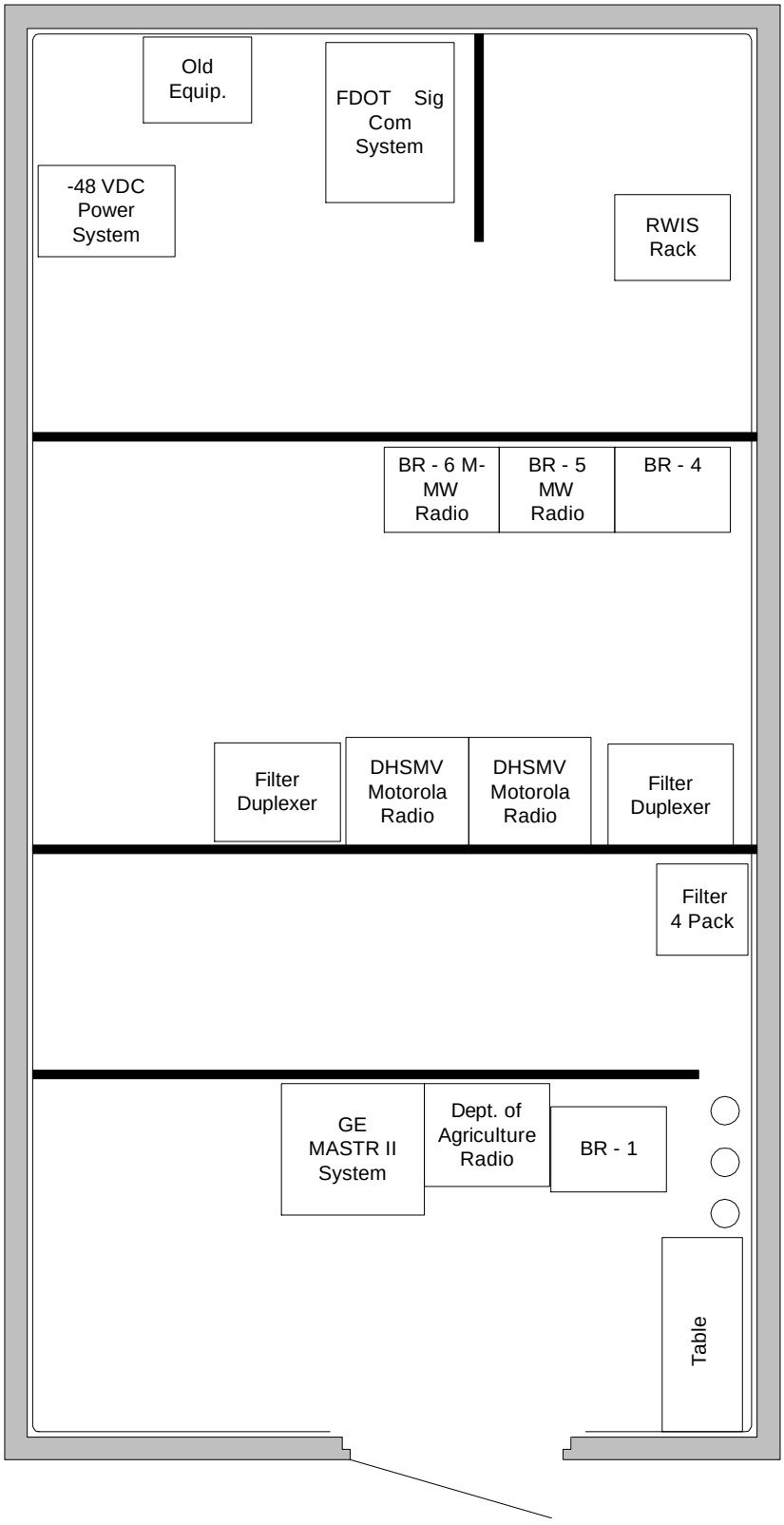


Figure 7.3.2-1
Tallahassee FHP Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

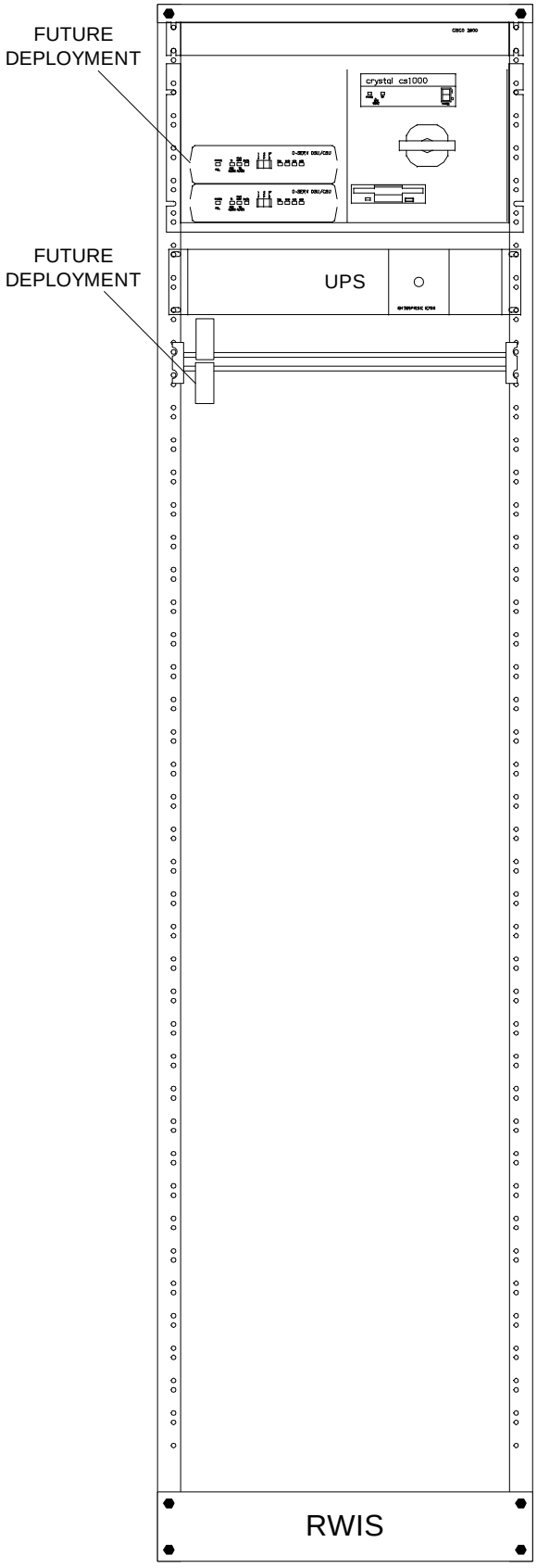


Figure 7.3.2-2
Tallahassee FHP
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'0"

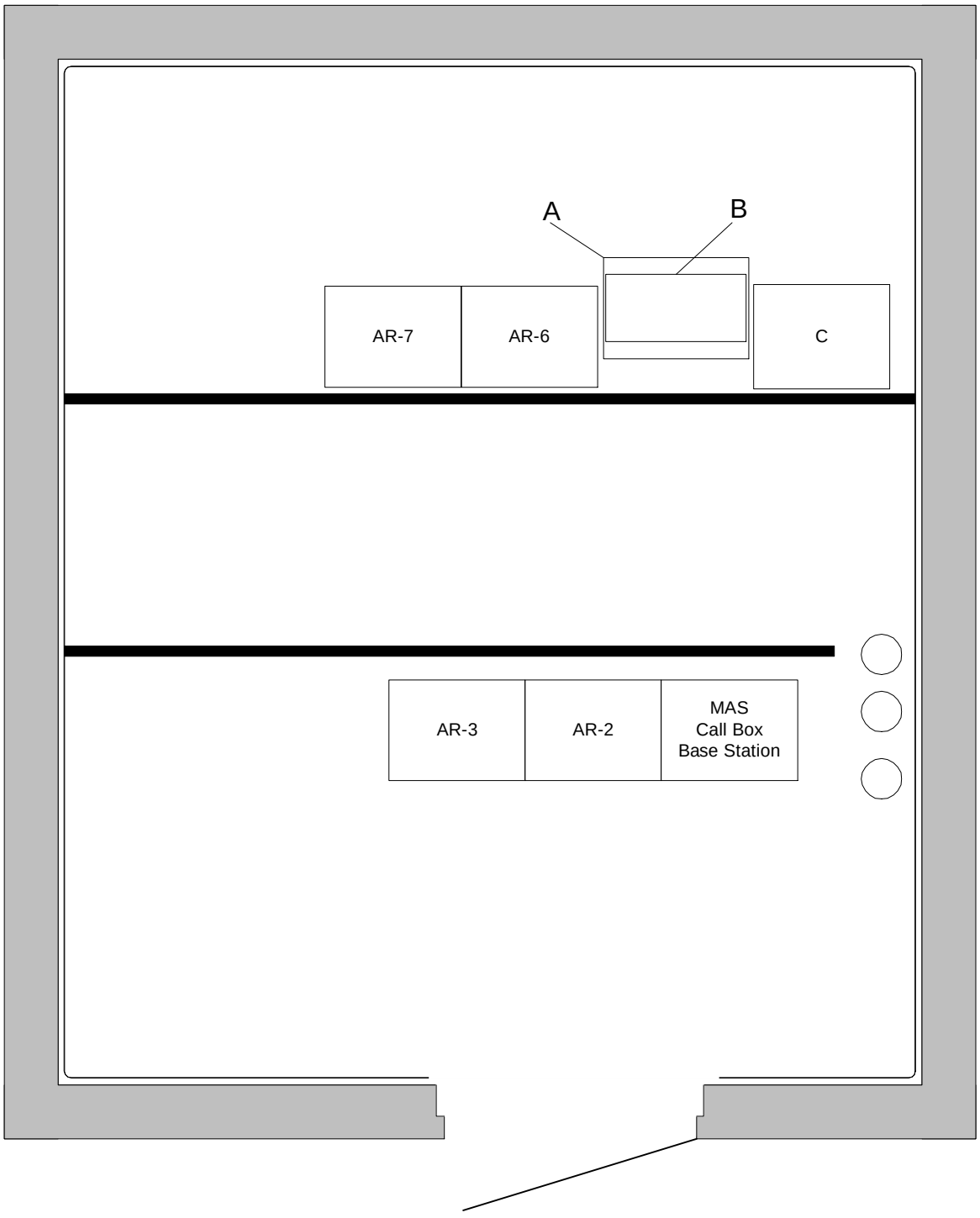


Figure 7.3.3-1
Monticello DOT Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

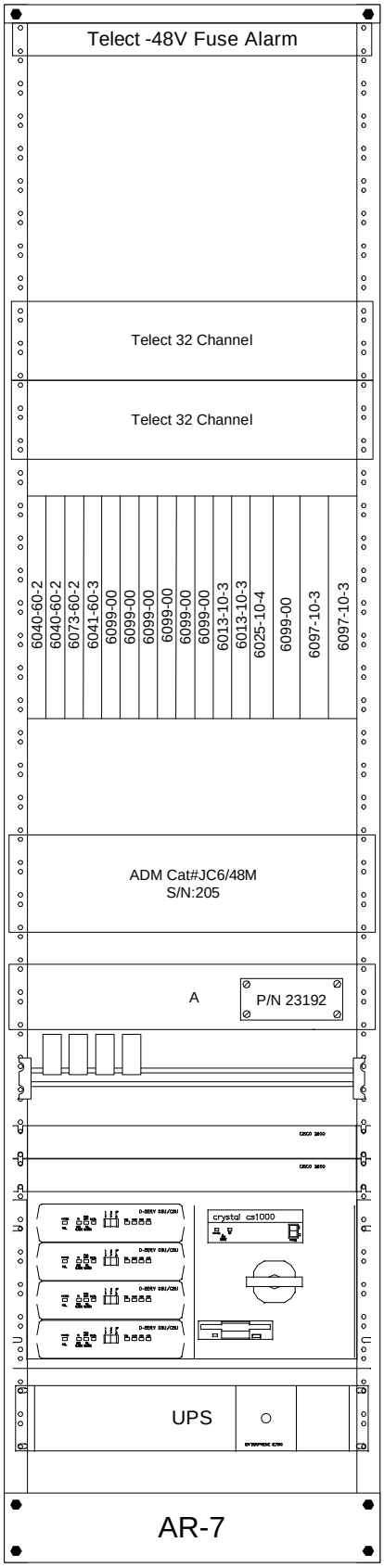


Figure 7.3.3-2
Monticello DOT
AR-7 Rack Elevation
Front View

Scale: 1/2" = 1'-0"

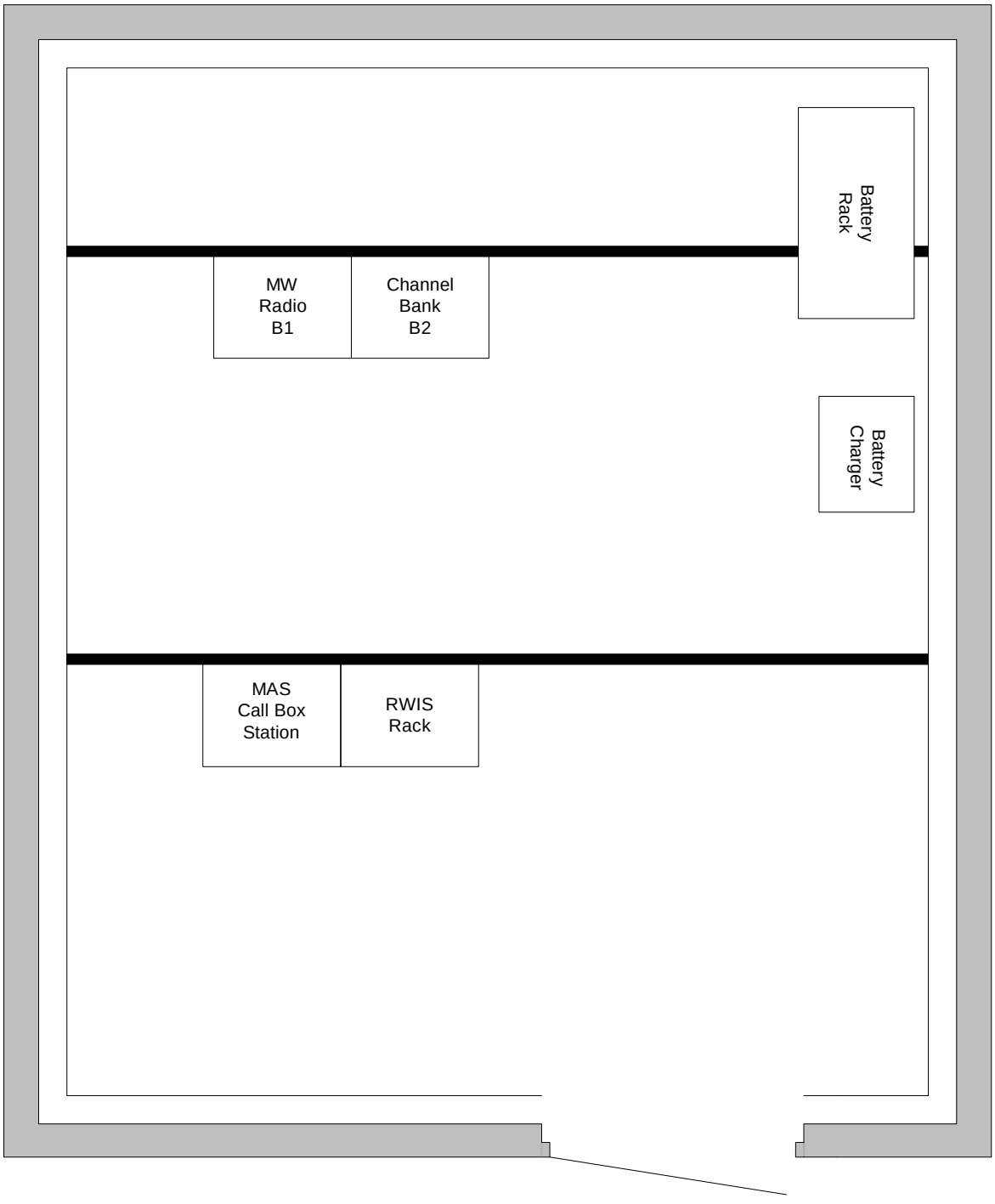


Figure 7.3.4-1
Greenville Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

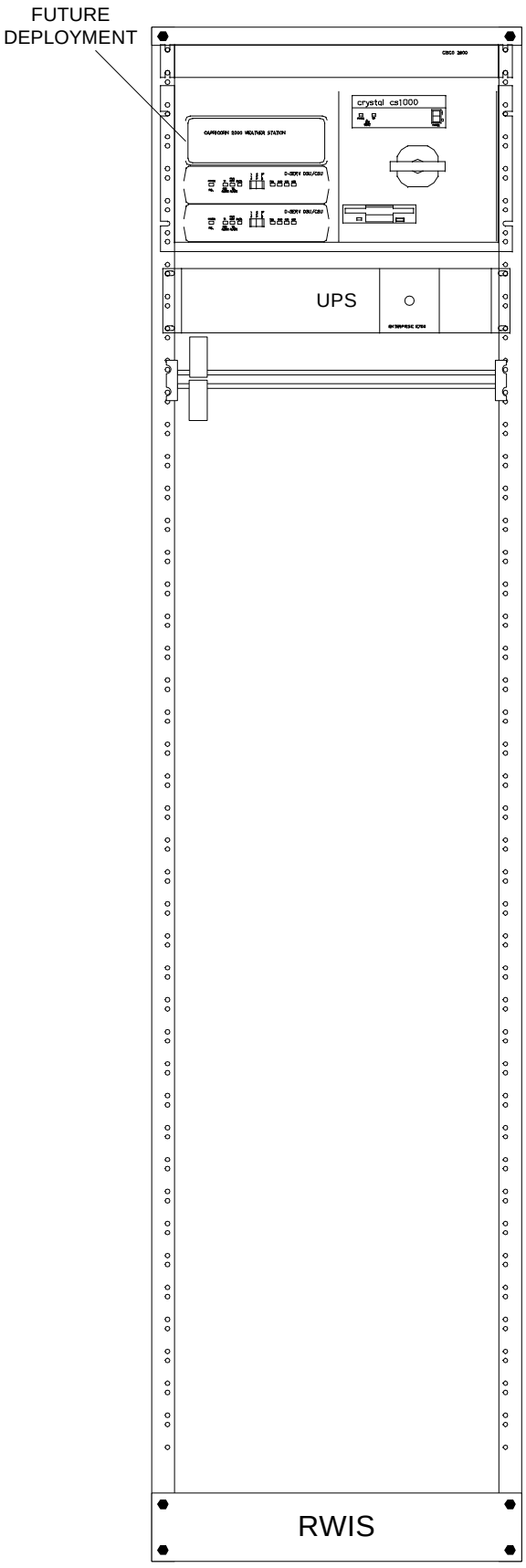


Figure 7.3.4-2
Greenville
RWIS Rack Elevation
Front View

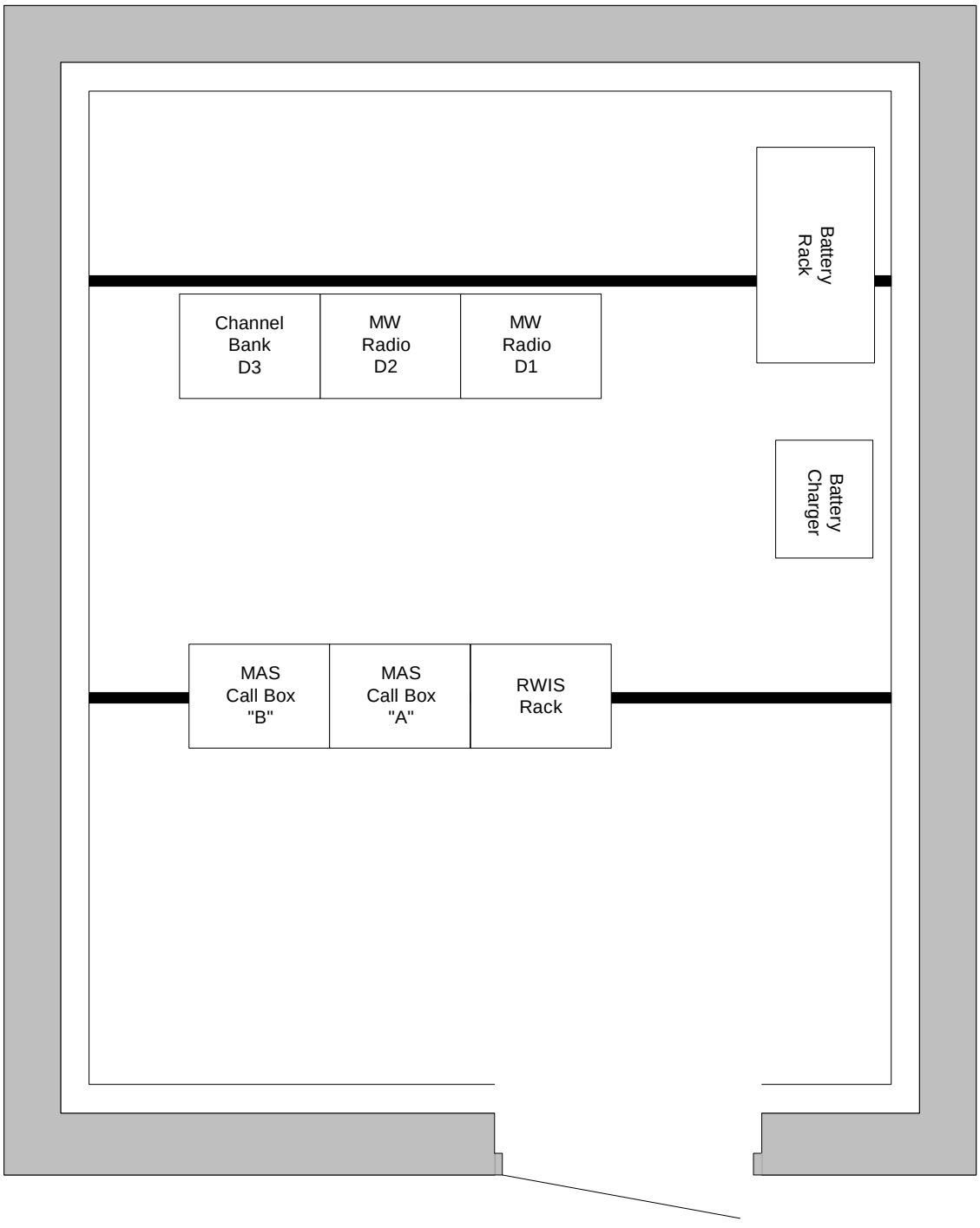


Figure 7.3.5-1
Falmouth Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

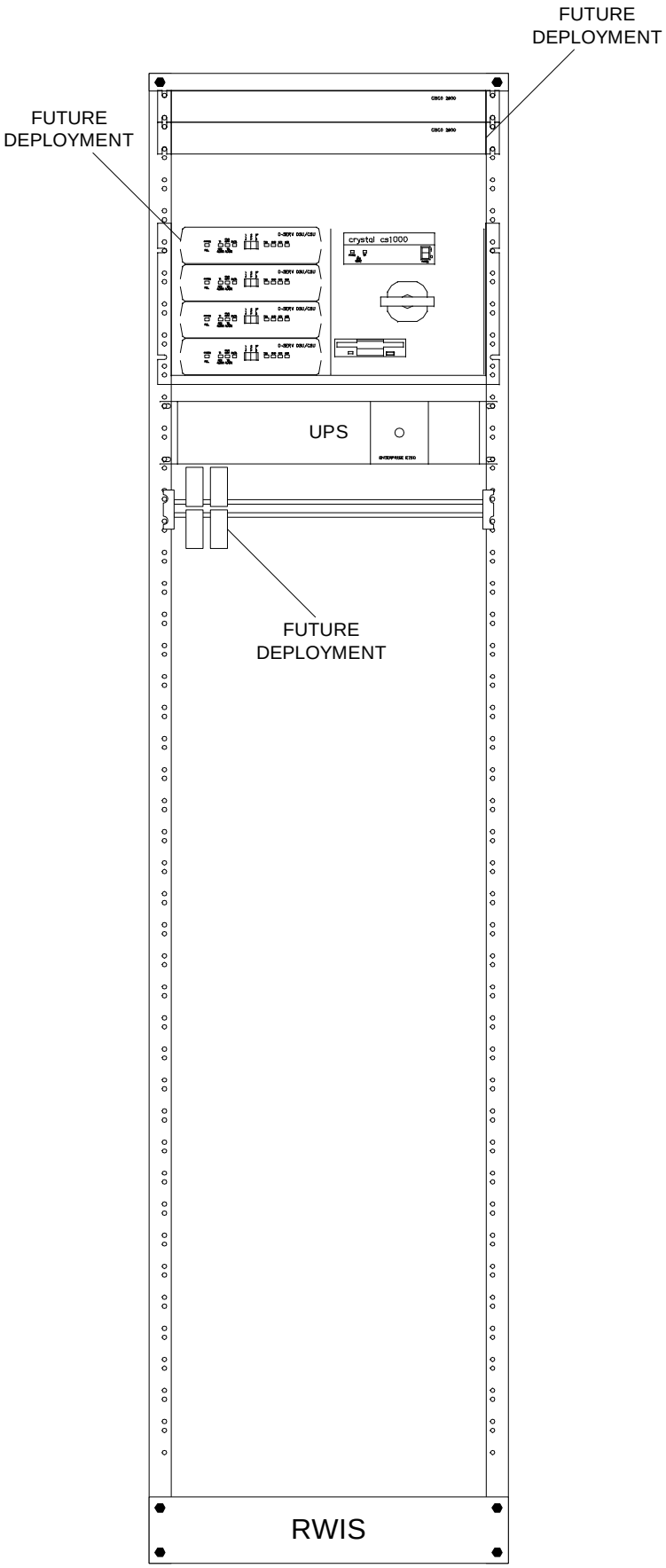


Figure 7.3.5-2
Falmouth
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

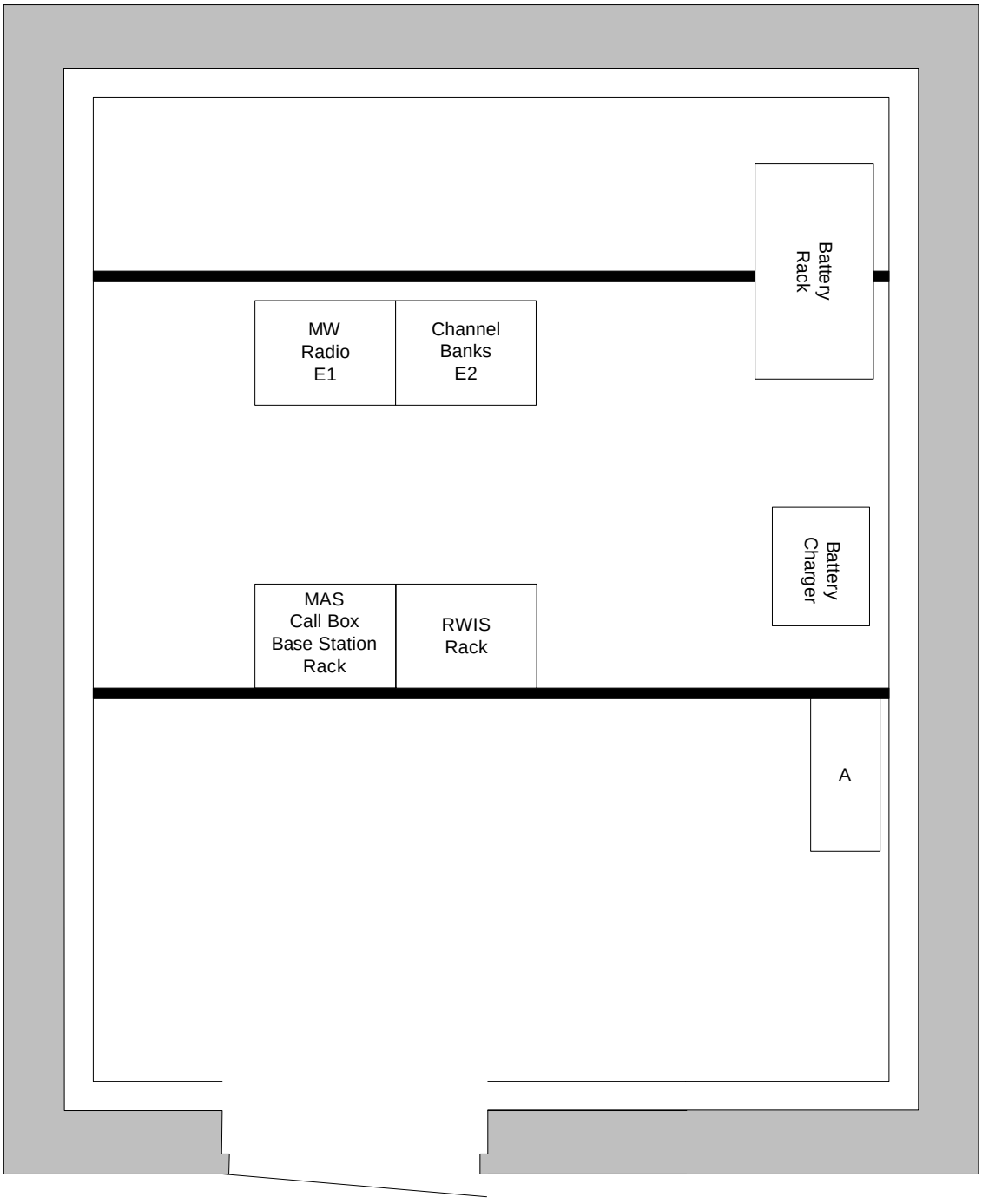


Figure 7.3.6-1
SR6 Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

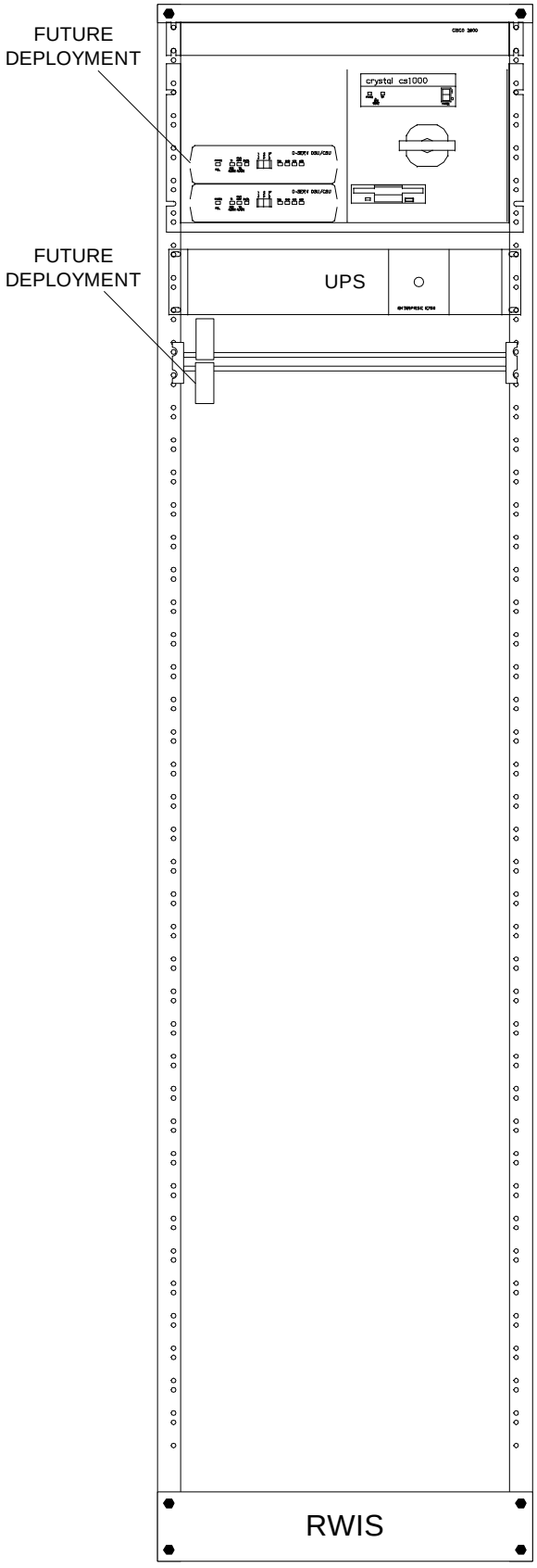


Figure 7.3.6-2
SR6
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

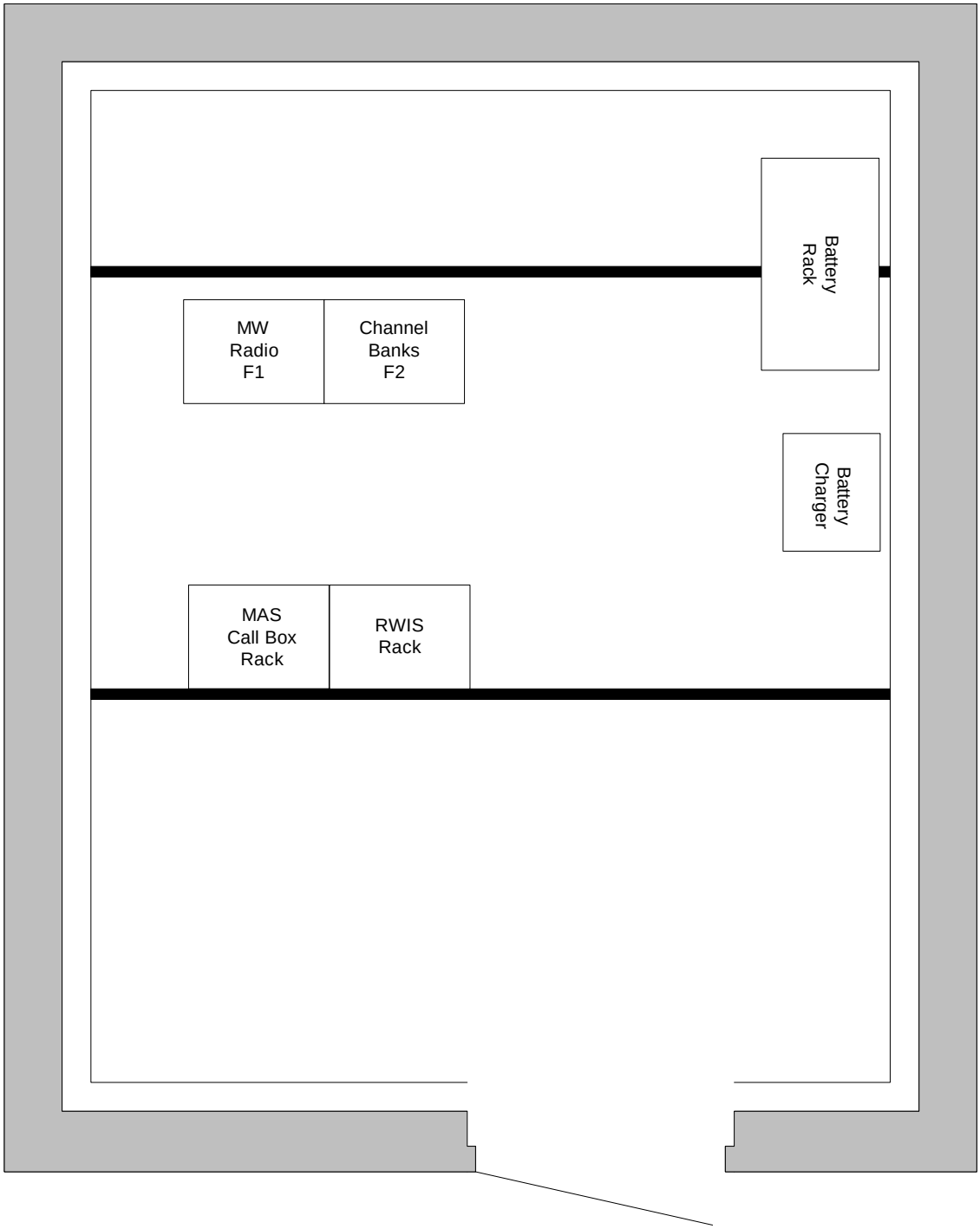


Figure 7.3.7-1
SR136 Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

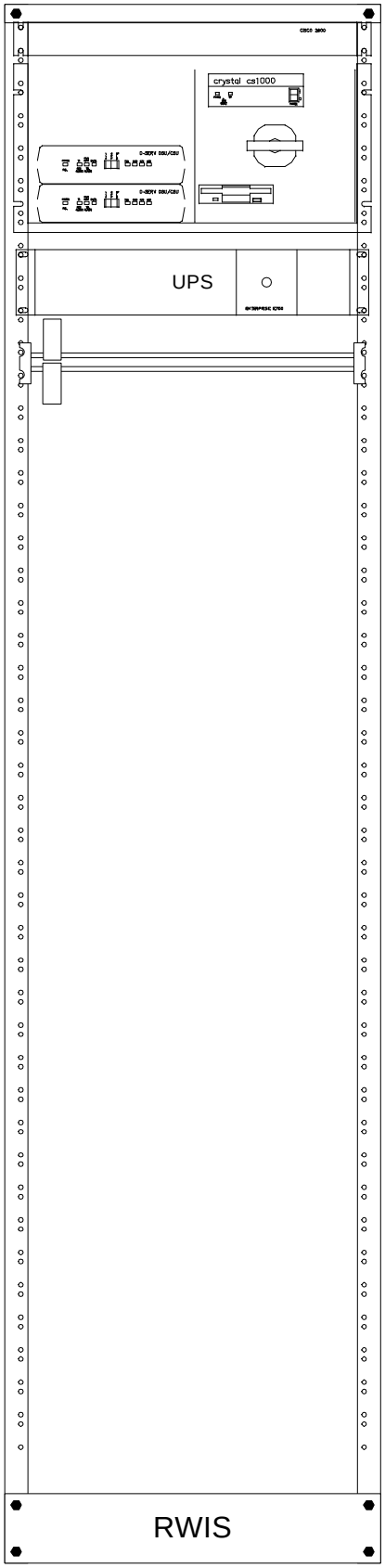


Figure 7.3.7-2
SR136
RWIS Rack Elevation
Front View

Scale: 3/8" = 1'-0"

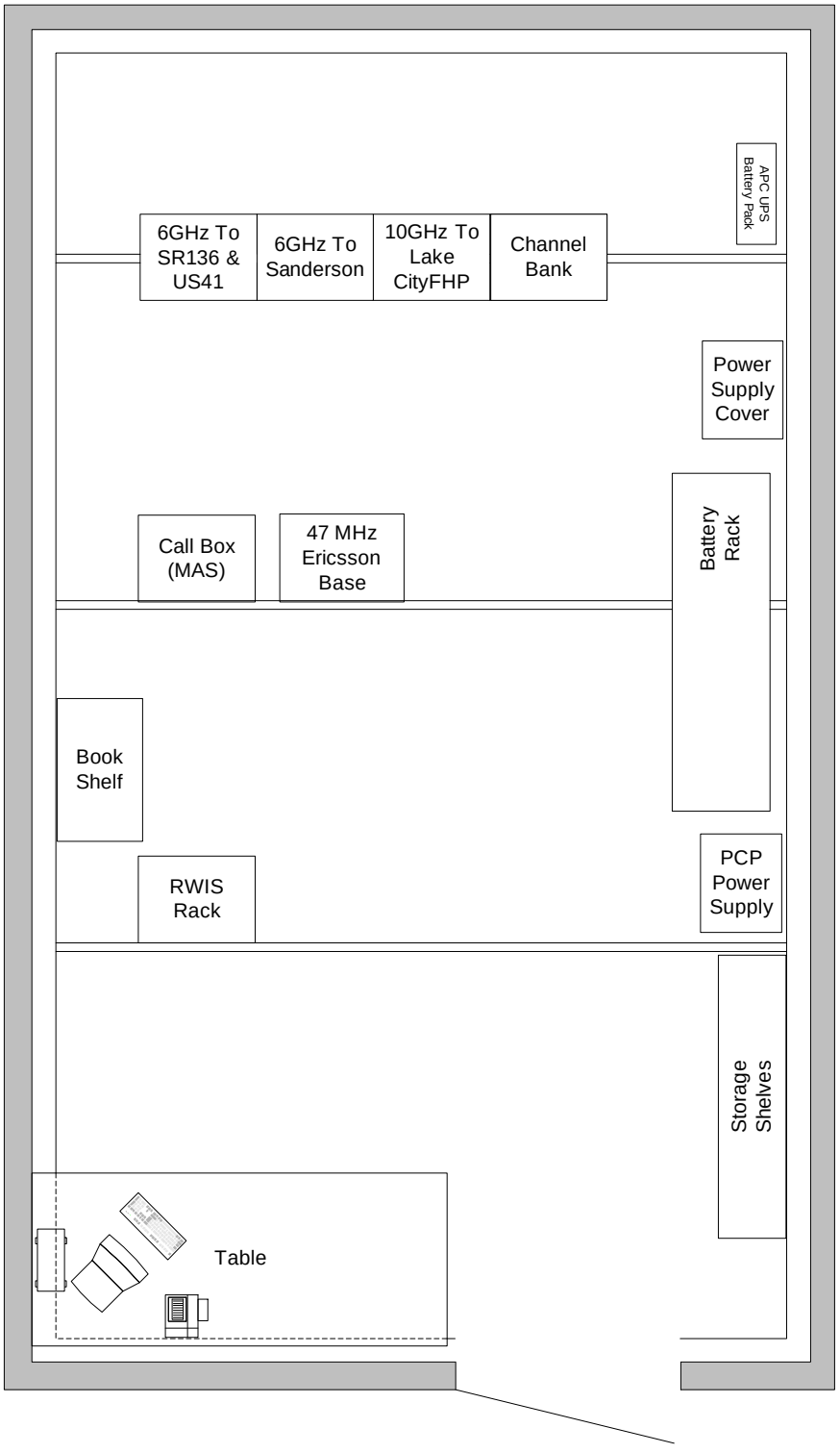


Figure 7.3.8-1
Lake City DOT Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

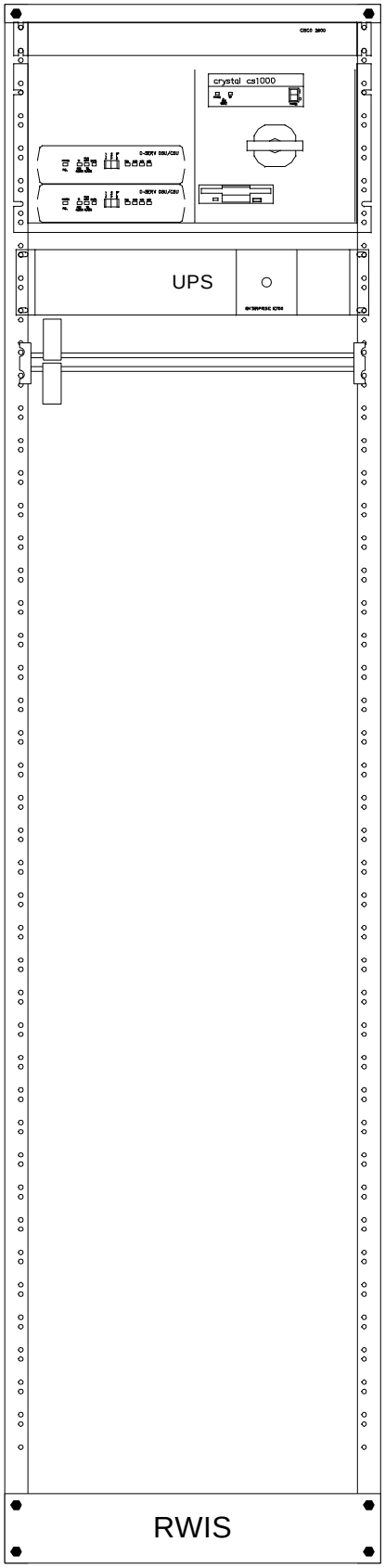


Figure 7.3.8-2
Lake City DOT
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

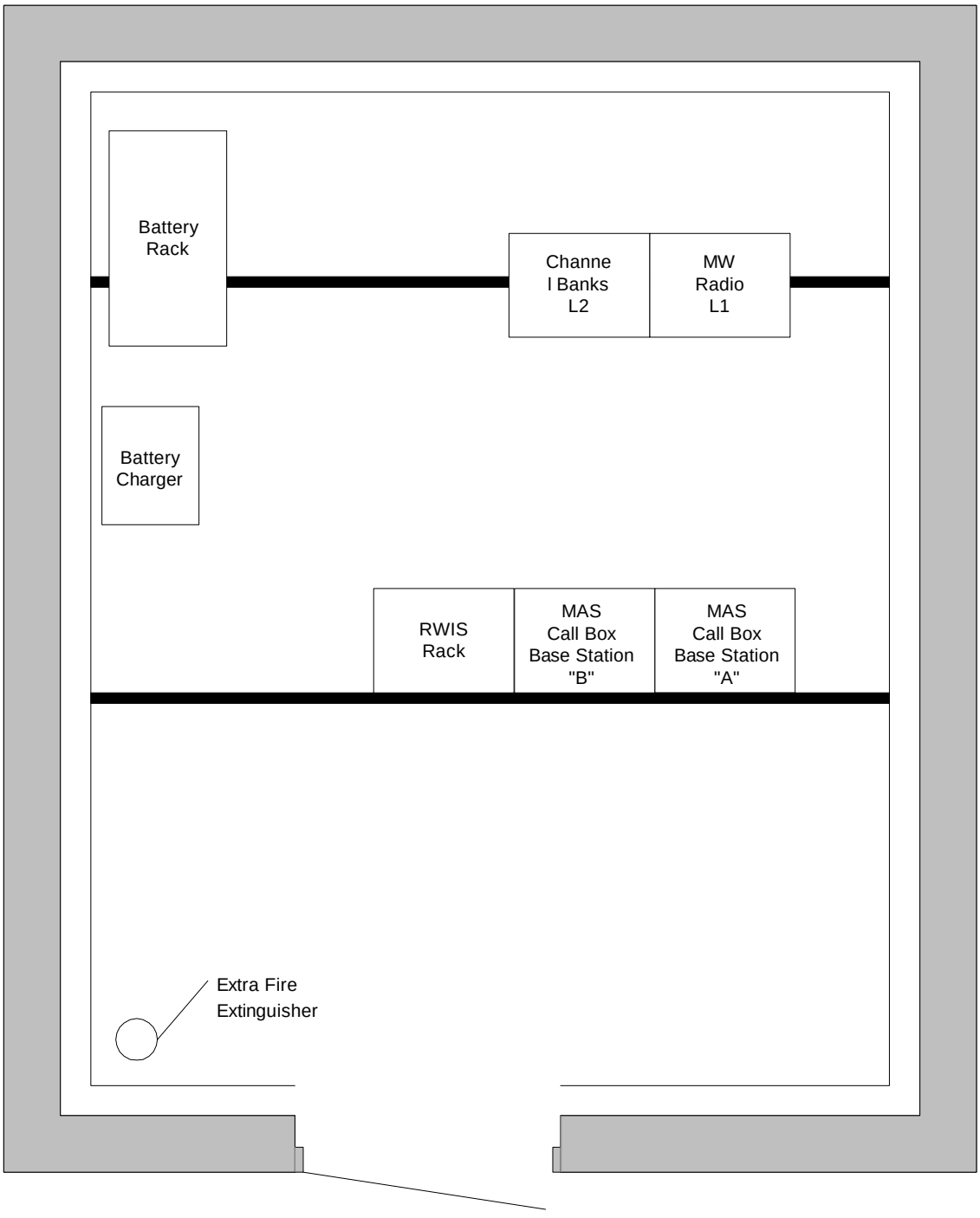


Figure 7.3.9-1
US41 Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

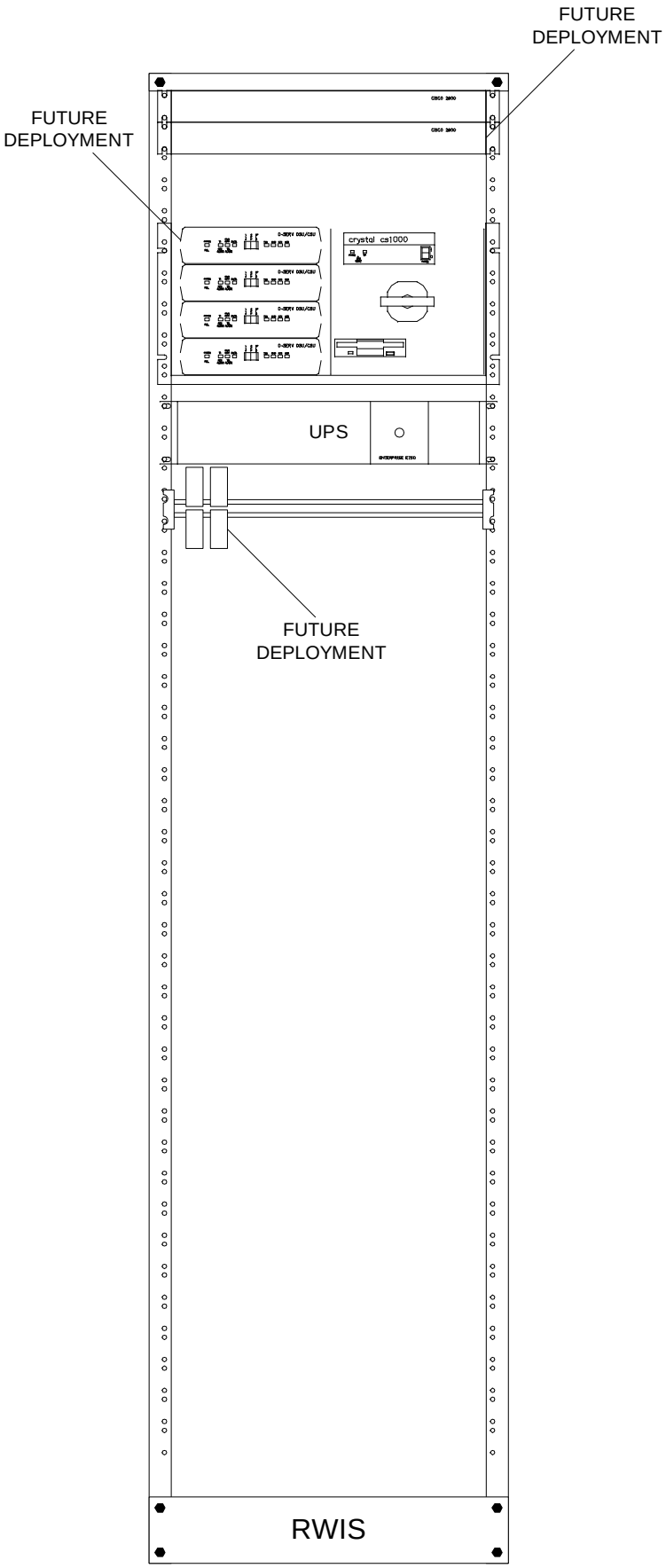


Figure 7.3.9-2
US41
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

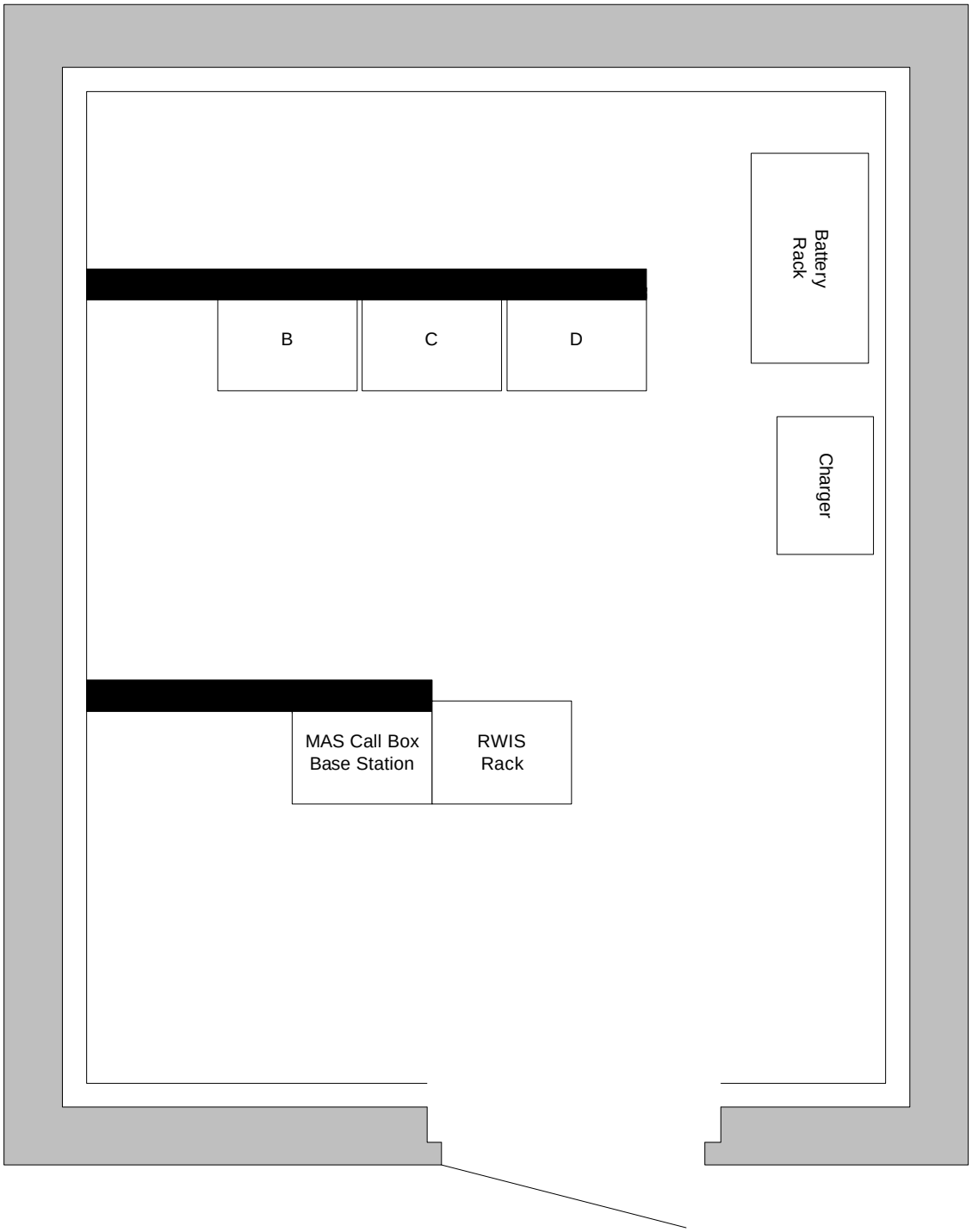


Figure 7.3.10-1
SR222 Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

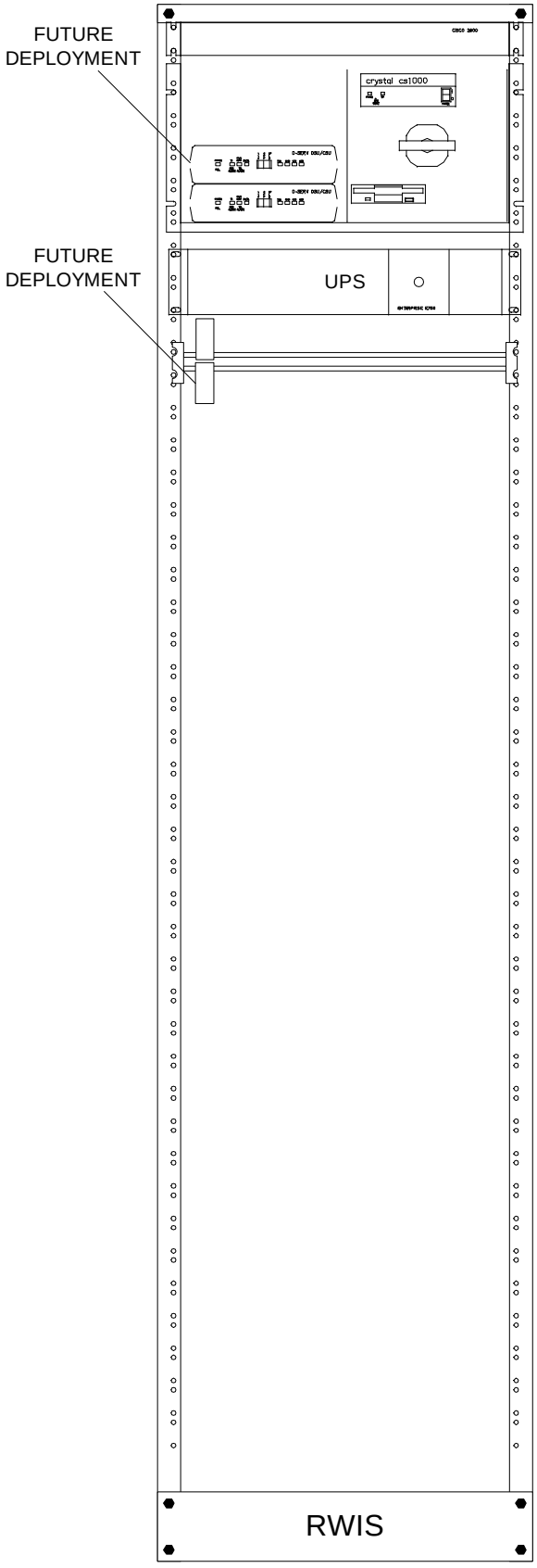


Figure 7.3.10-2
SR222
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

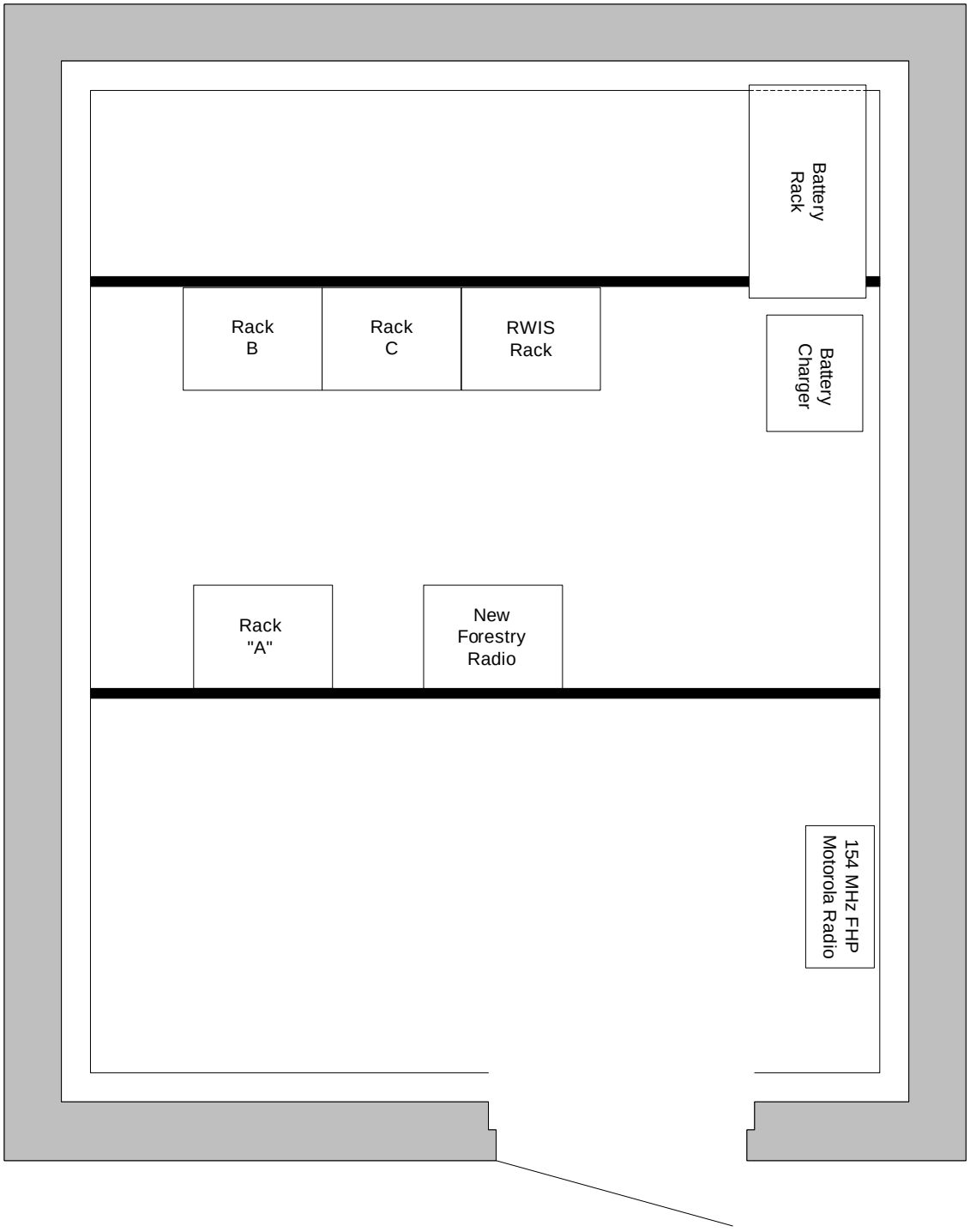


Figure 7.3.11-1
Sanderson Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

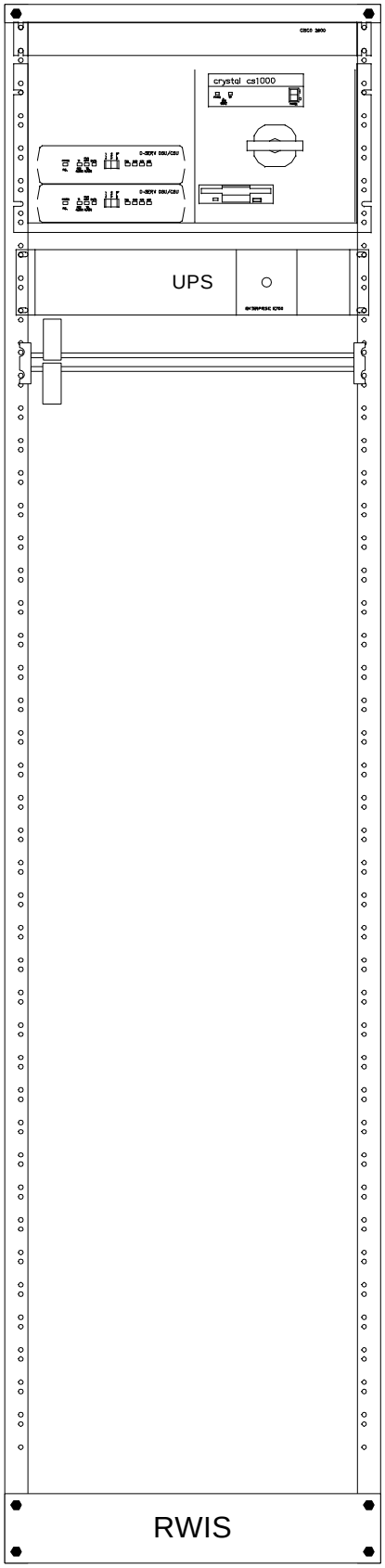


Figure 7.3.11-2
Sanderson
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

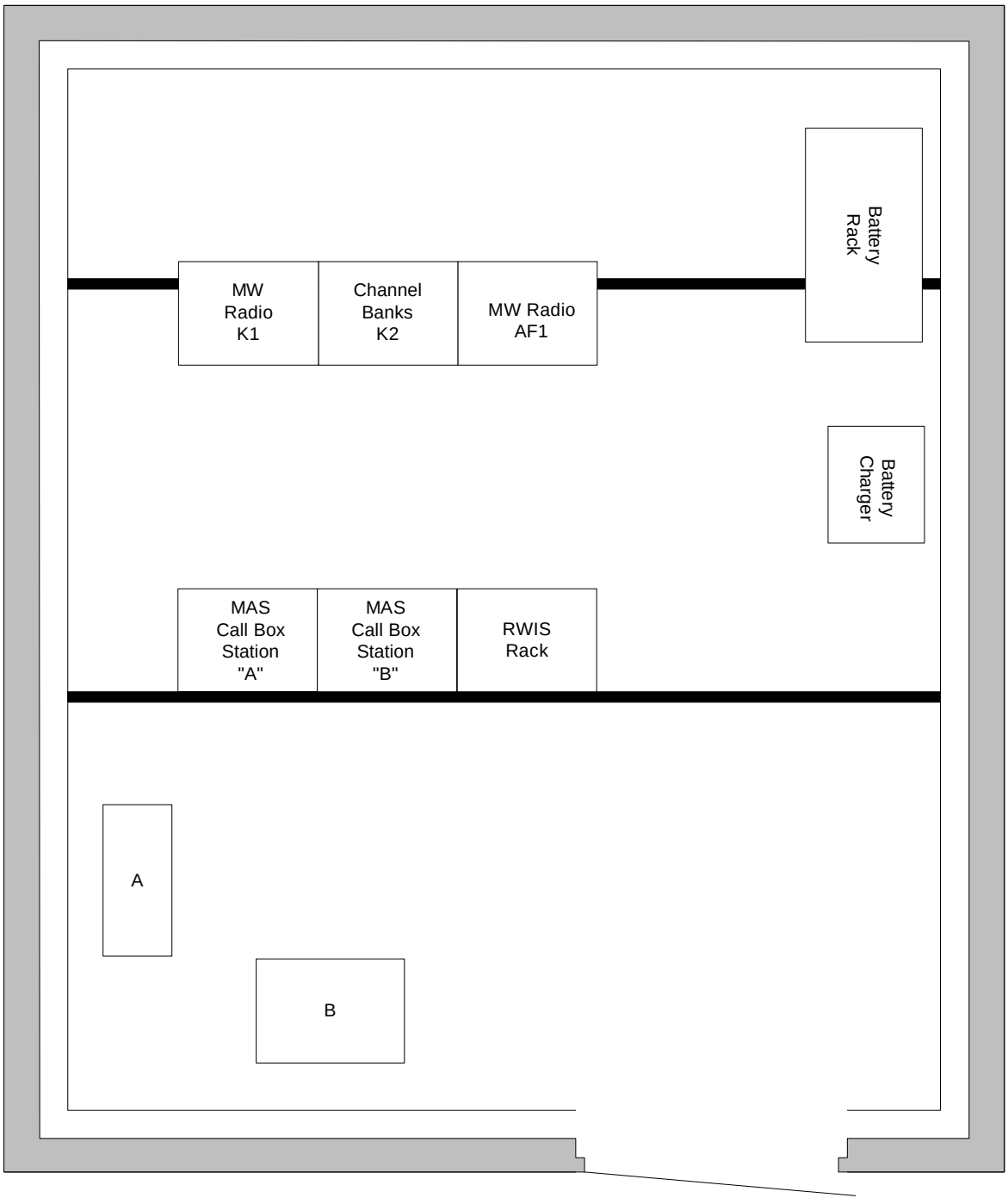


Figure 7.3.12-1
Baldwin DOT Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

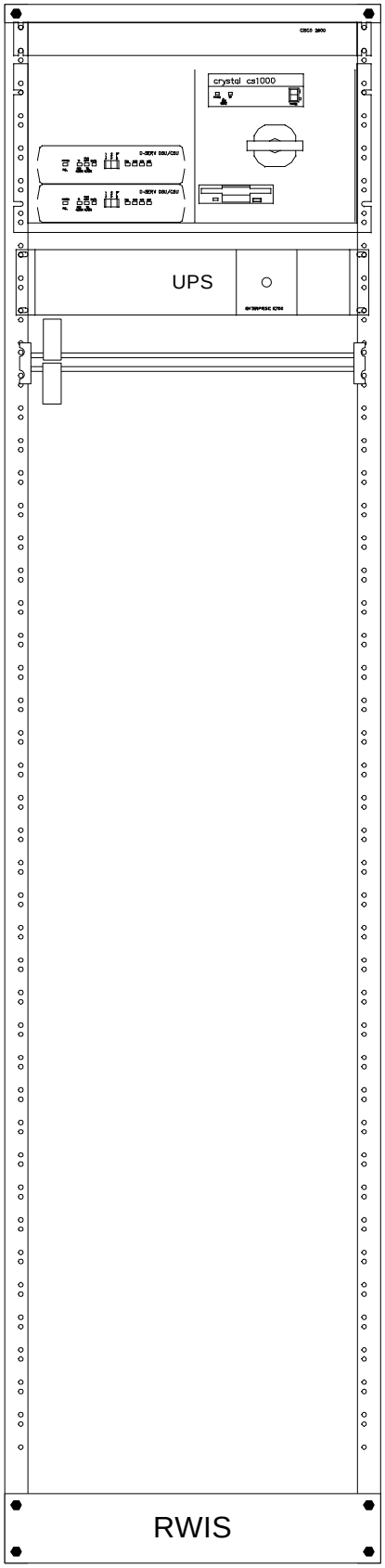
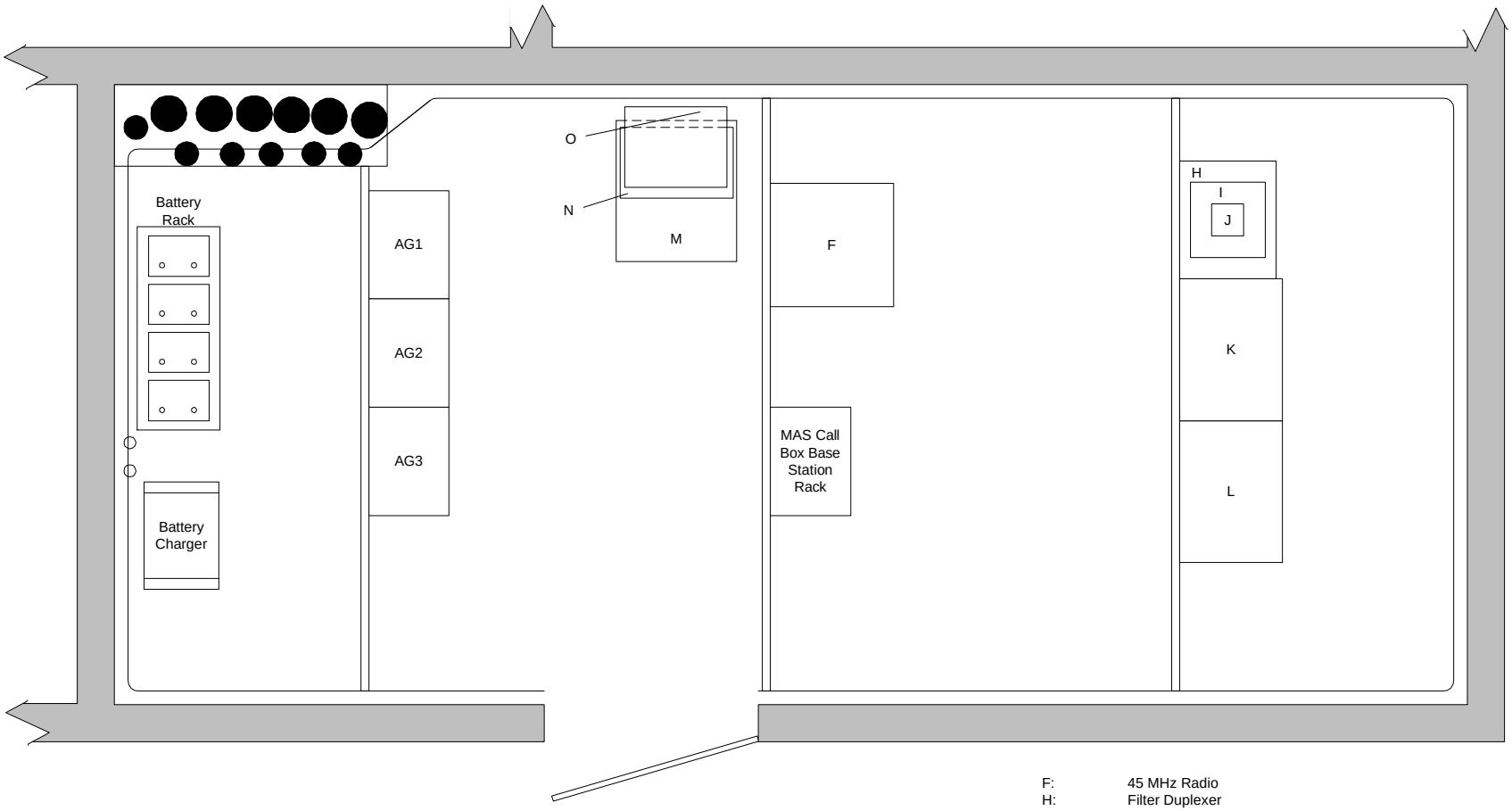


Figure 7.3.12-2
Baldwin DOT
RWIS Rack Elevation
Front View

Scale: 3/8" = 1'-0"



F:	45 MHz Radio
H:	Filter Duplexer
I:	Johnson Radio
J:	Johnson Radio
K:	155 MHz Motorola Radio
L:	900 Mhz Motorola Radio
M:	FDOT SigCom Motorist Aid Console (Disconnected) NH# 965448 Serial # 8804046
N:	SigCom Equipment (Disconnected) model # 990-0571 SN: 024723 O/M
O:	2- MRI Units (Disconnected)

Figure 7.3.13-1
Jacksonville FHP Equipment Room Floor Plan

Scale: 1 1/4" = 1'-0"

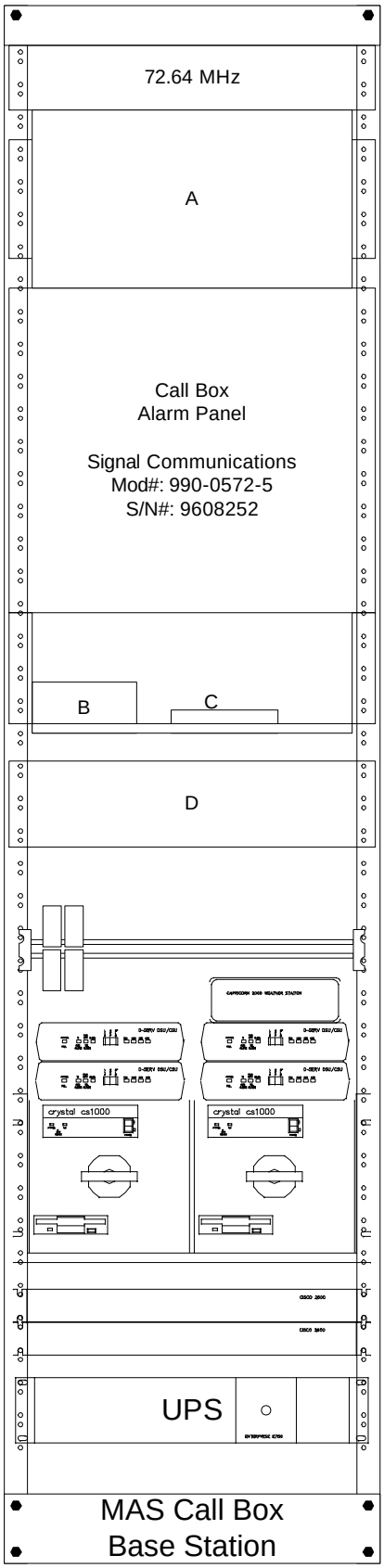


Figure 7.3.13-2
Jacksonville FHP
MAS Call Box Base Station
Rack Elevation
Front View

Scale: 1/2" = 1'-0"

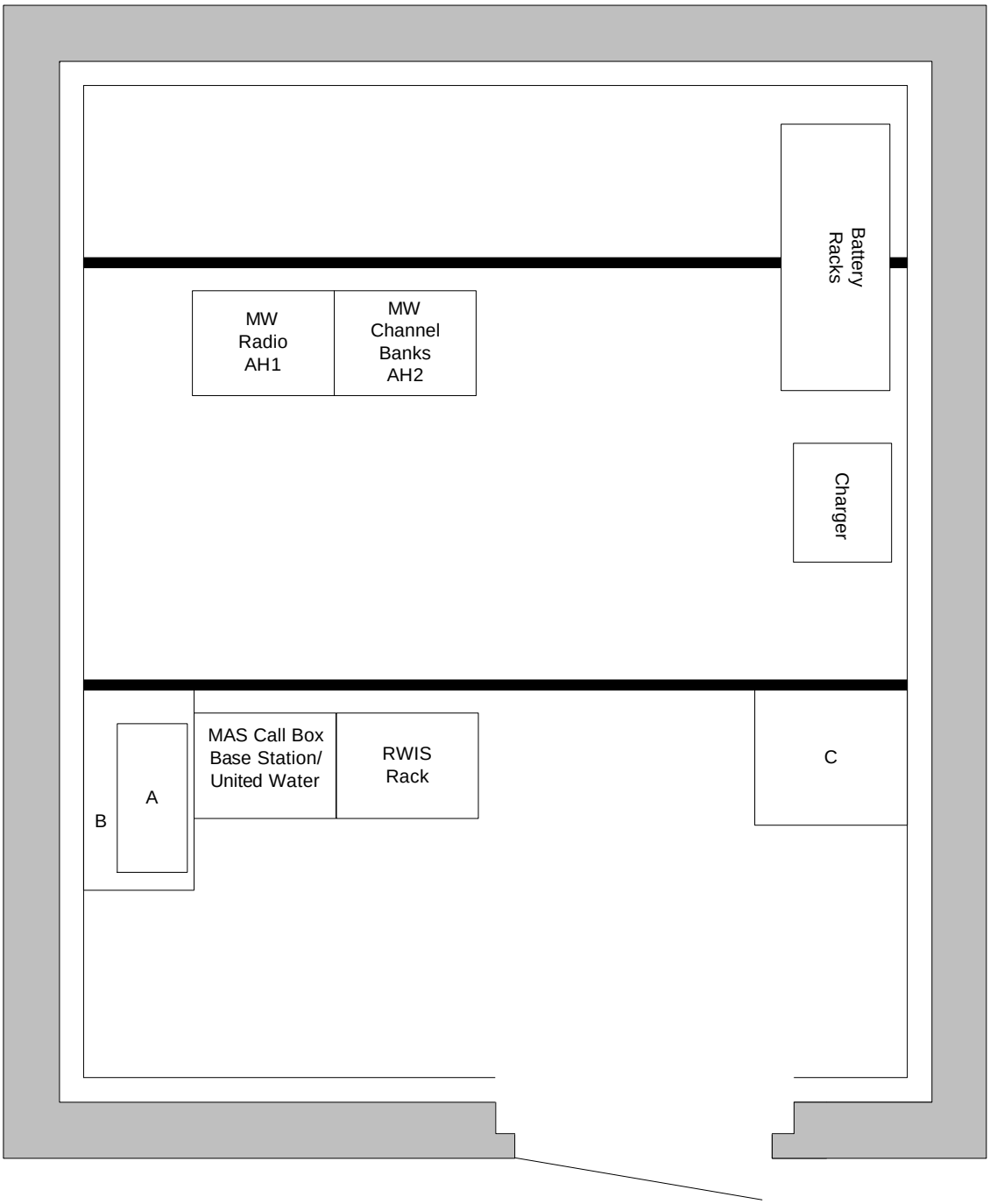


Figure 7.3.14-1
Yulee Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

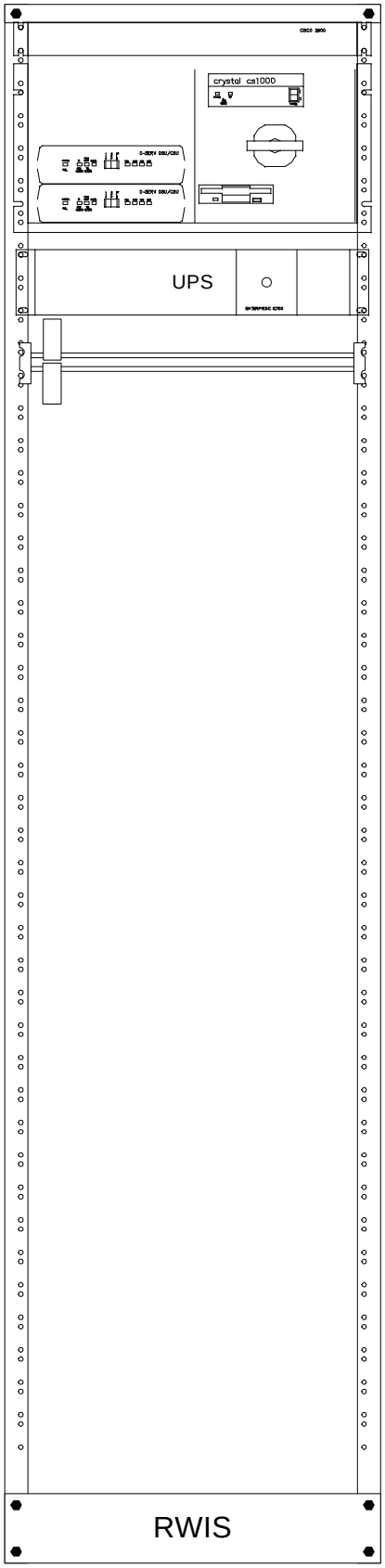


Figure 7.3.14-2
Yulee
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

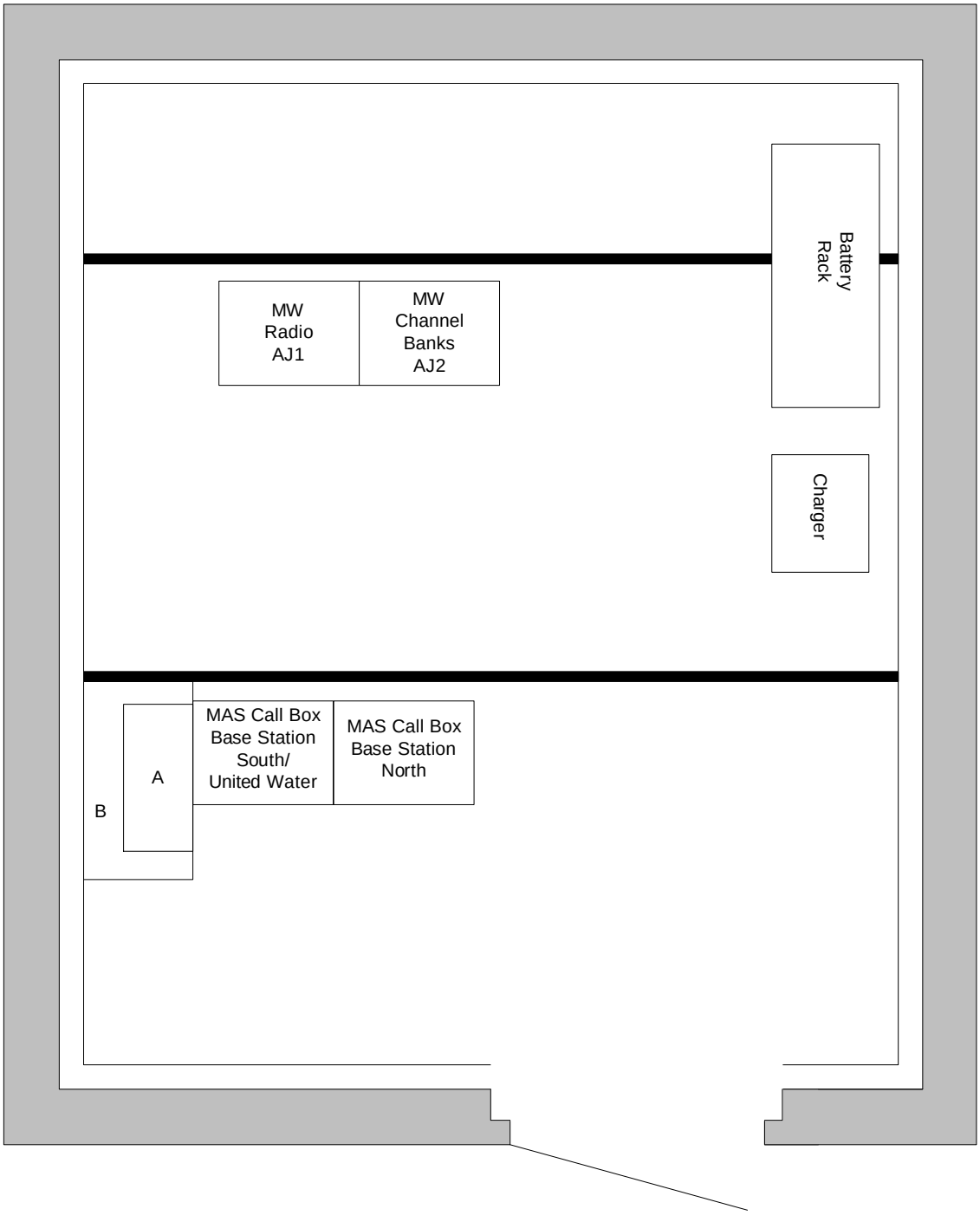


Figure 7.3.15-1
St Johns Rest Area Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

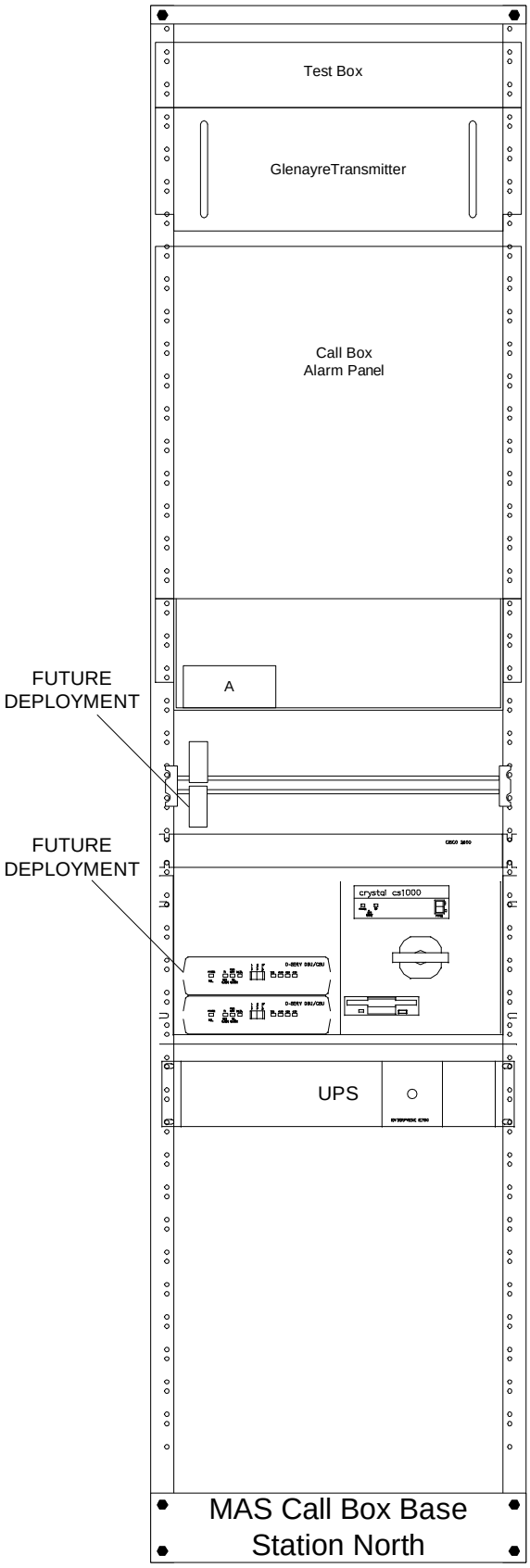


Figure 7.3.15-2
St. Johns Rest Area
MAS Call Box Base Station North
Rack Elevation
Front View

Scale: 1/2" = 1'-0"

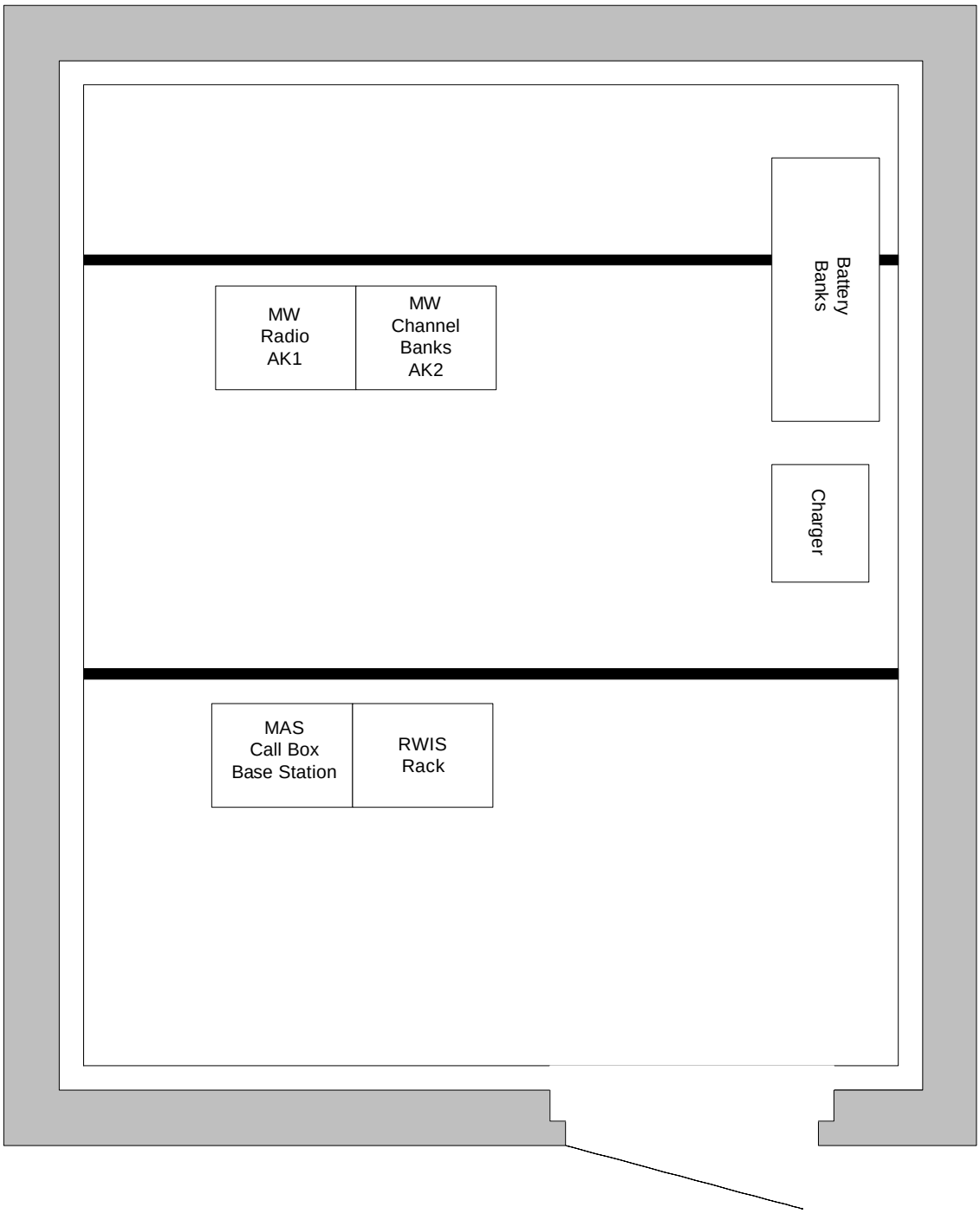


Figure 7.3.16-1
SR 16 Shelter Floor Plan

Scale: 1 1/4" = 1'-0"

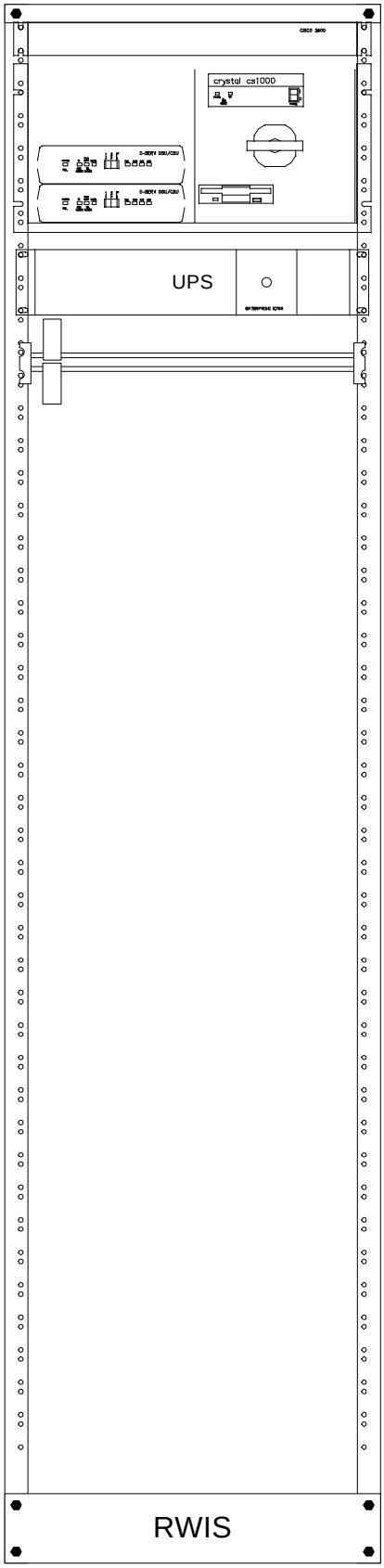


Figure 7.3.16-2
SR16
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"

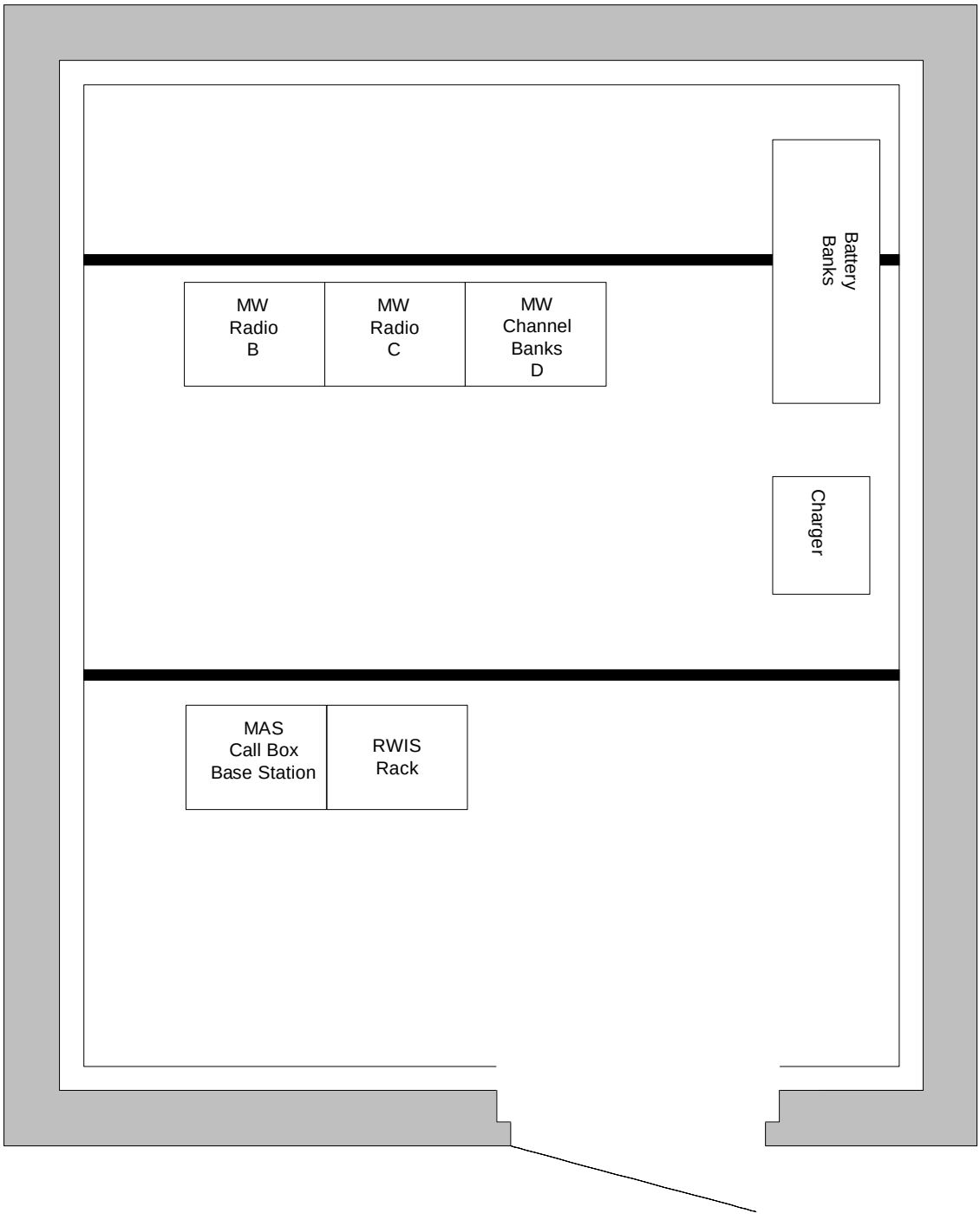


Figure 7.3.17-1
Gopher Ridge Shelter Floor Plan

TLITSSERVER:\Public\Weather Research\RWISInstallationSpecs\DataNetworkInstallation\Figure7.3.17-1_GopherRidgeShelterFloorPlan.vsd
7/26/02

Scale: 1 1/4" = 1'-0"

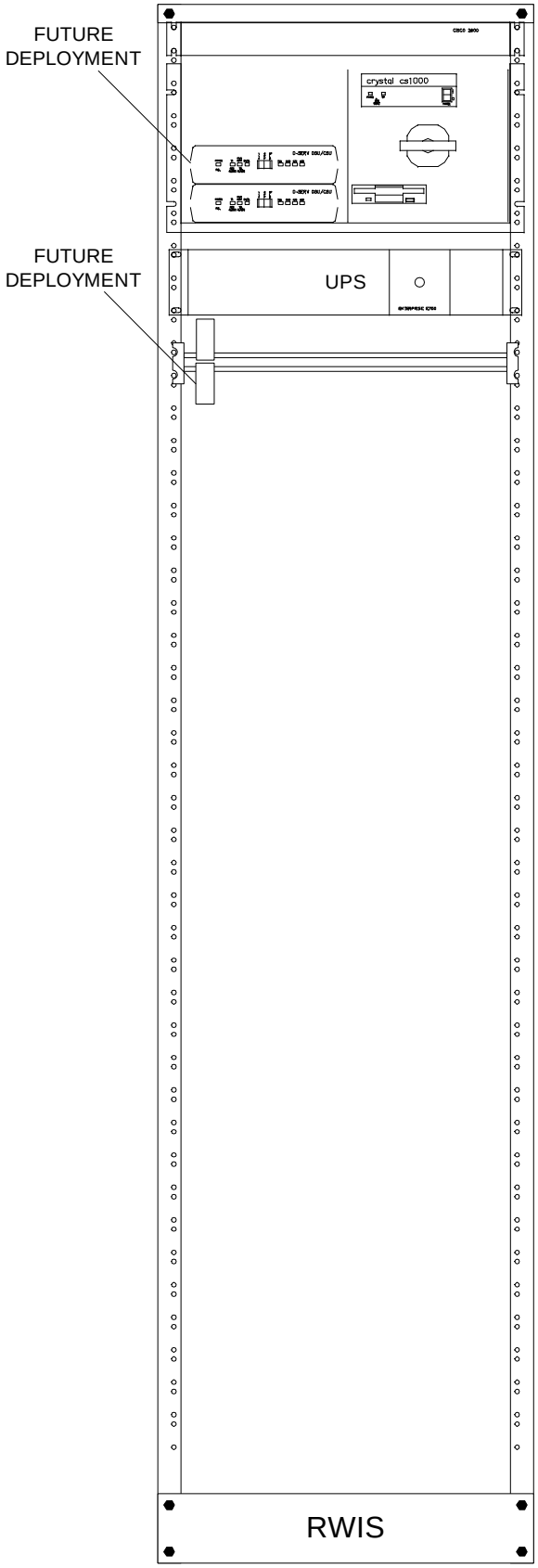


Figure 7.3.17-2
Gopher Ridge
RWIS Rack Elevation
Front View

APPENDIX B

Tables

Table 7.3-1: T-1 Circuit Demarcation Punch Block Schedule

Table 7.3-1 denotes the punch blocks and positions that are used for the RWIS circuits. The positions of the T-1 circuits are listed as transmit (TX in) and receive (RX out). This denotation is with respect to transmit and receive of the RWIS equipment (i.e., "TX in" denotes the transmission from the RWIS equipment into the MW radio).

Site Name	Punch Block	Position	Description
Quincy FHP	B0	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East)
Tallahassee FHP	B0	19 (TX in) 20 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East)
Monticello DOT	A0	17 (TX in) 18 (RX out) 19 (TX in) 20 (RX out) 22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #A7-4 (West) T-1 #A7-4 (West) T-1 #B7-3 (East) T-1 #B7-3 (East) T-1 #B7-4 (East) T-1 #B7-4 (East)
Greenville	C1	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East)
Falmouth	B3	18 (TX in) 19 (RX out) 20 (TX in) 21 (RX out) 22 (TX in) 23 (RX out) 24 (TX in)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East) T-1 #C7-3 (North) T-1 #C7-3 (North) T-1 #C7-4 (North)

		25 (RX out)	T-1 #C7-4 (North)
SR6	A3	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (South) T-1 #A7-3 (South) T-1 #A7-4 (South) T-1 #A7-4 (South)
SR136	A3	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East)
Lake City DOT	B4	20 (TX in) 21 (RX out) 22 (TX in) 23 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-4 (South) T-1 #B7-4 (South)
US41	D2	18 (TX in) 19 (RX out) 20 (TX in) 21 (RX out) 22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (North) T-1 #A7-3 (North) T-1 #B7-3 (South) T-1 #B7-3 (South) T-1 #A7-4 (North) T-1 #A7-4 (North) T-1 #B7-4 (South) T-1 #B7-4 (South)
SR222	A4	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (North) T-1 #A7-3 (North) T-1 #A7-4 (North) T-1 #A7-4 (North)
Sanderson	A3	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East)
Baldwin DOT	A3	18 (TX in) 19 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (West) T-1 #A7-3 (West) T-1 #B7-3 (East) T-1 #B7-3 (East)

Jacksonville FHP	A1	9 (TX in) 10 (RX out) 11 (TX in) 12 (RX out) 13 (TX in) 14 (RX out) 15 (TX in) 15 (RX out)	T-1 #A7-3 (East) T-1 #A7-3 (East) T-1 #A7-4 (East) T-1 #A7-4 (East) T-1 #B7-4 (South) T-1 #B7-4 (South) T-1 #C7-4 (North) T-1 #C7-4 (North)
Yulee	A1	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (South) T-1 #A7-3 (South) T-1 #A7-4 (South) T-1 #A7-4 (South)
St. Johns Rest Area	A1	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (North) T-1 #A7-3 (North) T-1 #B7-3 (South) T-1 #B7-3 (South)
SR16	A1	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-4 (North) T-1 #A7-4 (North) T-1 #B7-4 (South) T-1 #B7-4 (South)
Gopher Ridge	A1	22 (TX in) 23 (RX out) 24 (TX in) 25 (RX out)	T-1 #A7-3 (North) T-1 #A7-3 (North) T-1 #A7-4 (North) T-1 #A7-4 (North)

Florida Department of Transportation

Development of a Road Weather Information System (RWIS) for

Florida's Intelligent Transportation System - Phase I

TECHNICAL STATEMENT OF WORK

PART 2

INSTALLATION OF DATA ACQUISITION EQUIPMENT

TO

STATEWIDE MICROWAVE INFRASTRUCTURE

March 14, 2003

RCC Consultants, Inc.
930 Thomasville Road, Suite 200
Tallahassee, Florida 32303
Florida Professional Engineering Business, No. 00006992
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File: K:\KN962WA\PROJECTS\UNF-ATMOSPHERICRESEARCH\RWISINSTALLATIONSPECS\DATAEQUIPMENTINSTALLATION\RWISDATAACQUISITIONEQUIPMENTINSTALLATION20030314FINAL.DOC

1. GENERAL

This Technical Statement of Work is the second part of a three-part installation for the first phase of a Road Weather Information System (RWIS) research project. The work specified herein consists of installation tasks that are required of the University of North Florida (UNF) to implement a road weather information system, which is carried over the Florida Department of Transportation's (FDOT) digital microwave system. The intent is to provide timely and useful "early warning" weather information to travelers, transportation managers, law enforcement, and emergency managers to ensure safe transportation in both normal and evacuation conditions for residents, visitors, and commerce. Weather data that is detected and generated by equipment installed at 17 sites along I-10, I-75, and I-95, will be carried over the digital microwave circuit and delivered to a network server at Jacksonville FHP. The data will then be collected by UNF's network server (located at the university) via a DSL connection.

As a component to the RWIS project, investigators from the Florida State University (FSU) Departments of Electrical Engineering, Geography, and Meteorology will conduct research related to atmospheric effects on microwave transmissions and on improving road weather forecasting through the use of data provided by the new RWIS. The microwave transmission paths to be studied are between the Quincy FHP and Tallahassee FHP towers, and between the Tallahassee FHP and Monticello DOT towers. These paths were chosen due to their geographic locations and the distances between the towers. Both paths are greater than 20 miles in length and have displayed signal fading problems in the past; therefore, making them ideal candidates for this research project.

Central to this project's design is the provision of transient voltage surge suppression (TVSS) devices that integrate with the communications sites' existing grounding systems to afford maximum lightning and surge protection to the network's sensitive computer and communications equipment. This Technical Statement of Work will cover the installation of the appropriate TVSS devices for the entrance of the weather sensor equipment into the communications facilities. Where possible, additions to the grounding system's electrical circuit configuration shall be accomplished by connecting to the existing grounding system components.

UNF and FSU, collectively known as the Universities, shall provide all equipment, connecting/mounting hardware, expendable installation supplies, and the installation work necessary to accomplish the entire communications and road weather information system described herein. Figure A-1 in Appendix A is a system diagram that illustrates

the location of all tower sites that require the installation of weather sensors, which are the subject of this installation Technical Statement of Work.

All installations must be neat, secure, and free of sharp bends. The installation must also be in accordance with good engineering practice.

The installation work shall be of high quality and of the type and quantity prescribed by this specification. In all cases, the routing of the wiring and its dressing shall be neat, secure, and free of sharp bends. All cables and wiring shall be cut to appropriate lengths without being too taut or too slack. The Universities are responsible for the removal of any surplus materials and all other debris from the site at the conclusion of the work activities.

2. APPLICABLE PUBLICATIONS AND STANDARDS

The latest issues of the following publications and standards, unless otherwise specified, shall be part of this installation Technical Statement of Work. In the event of inconsistencies between this Technical Statement of Work and these publications and standards, the requirements of this specification shall take precedence.

A. ASTM: Standard Specification for: Zinc (Hot Galvanized) coatings on products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip.

B. ASTM: Standard Specification for: Zinc coating (hot-dip) on iron or steel hardware.

C. NFPA 70 National Electric Code (NEC).

D. Applicable Manufacturer's Instructions and Standard Practices.

E. Applicable Occupational Safety and Health Administration

3. TERMS

AGC:	Automatic Gain Control
CE&I:	Construction Engineering and Inspection
CSU:	Channel Service Unit
DSL:	Digital Subscriber Line
DSU:	Data Service Unit
DSX:	Digital Signal Cross-connect
FCC:	Federal Communications Commission
FDOT:	Florida Department of Transportation
FDOT Microwave Maintenance Contractor:	TransCore 5744 S. Semoran Blvd. Orlando, FL 32822 Contact: Bill Eatley Telephone: (407) 382-1301

FDOT TGC:	FDOT Telecommunications General Consultant. PB Farradyne, Inc. and RCC Consultants, Inc. 605 Suwannee St. MS 90 Tallahassee, FL 32399-0450 Contact: Russell Allen Telephone: 850-410-5626
FSU:	Florida State University 2525 Pottsdamer Street Tallahassee, FL 32310 Contact: Simon Y. Foo, Ph.D. Telephone: 850-410-6474
ITS:	Intelligent Transportation Systems
NEC:	National Electric Code
RSL:	Receive Signal Level
RWIS:	Road Weather Information System
TTL:	Transistor-Transistor Logic
TVSS:	Transient Voltage Surge Suppression
UNF:	University of North Florida 4567 St. Johns Bluff Road, South Jacksonville, FL 32224-2645 Contact: J. David Lambert, Ph.D. Telephone: 904-620-3881
Universities:	UNF and FSU Staff/Contractors
UPS:	Uninterrupted Power Supply
UV:	Ultra Violet
VAC:	Volts Alternating Current

4. SITES OF WORK

The installation materials shall be delivered and installed as outlined in these specifications at the following FDOT communications sites:

1. Quincy FHP (Site #3-3425)
   2 Miles West of Quincy on US90
   Quincy, FL
   Lat: 30-35-10.2N Lon: 84-37-13.6W NAD83

2. Tallahassee FHP (Site #3-3424)
   2100 Mahan Drive
   Tallahassee, FL
   Lat: 30-27-18.9N Lon: 84-14-43.2W NAD83

3. Monticello DOT (site #3-3423)
   FDOT Maintenance Yard on US19
   Monticello, FL
   Lat: 30-31-45.9N Lon: 83-52-7.5W NAD83

4. Greenville (Site #2-2514)
   0.6 Miles West of US-221 on I-10
   Greenville, FL
   Lat: 30-26-8.7N Lon: 83-38-16.5W NAD83

5. Falmouth (Site #2-2510)
   NW Quadrant of US90 & I-10 Intersection (Old Exit 39 / New Exit 275)
   Falmouth, FL
   Lat: 30-20-33.0N Lon: 83-05-25.0W NAD83

6. SR6 (Site #2-2508)
   NW Quadrant of SR6 & I-75 Intersection
   Jennings, FL
   Lat: 30-31-04.8N Lon: 83-03-27.5W NAD83

7. SR136 (Site #2-2506)
   NE Quadrant of SR136 & I-75 Intersection (Old Exit 84 / New Exit 439)
   White Springs, FL
   Lat: 30-19-09.0N Lon: 82-48-29.0W NAD83

8. Lake City DOT (Site #2-2504)
   1650 Lake Jeffrey Road
   Lake City, FL
   Lat: 30-11-42.0N Lon: 82-39-11.0W NAD83

9. US41 (Site #2-2516)
   NE Quadrant of US41 & I-75 Intersection (Old Exit 80 / New Exit 414)
   Ellisville, FL
   Lat: 25-59-59.0N Lon: 82-35-54.0W NAD83

10. SR222 (Site #2-2518)
    SW Quadrant of SR222 & I-75 Intersection (Old Exit 77 / New Exit 390)
    Gainesville, FL
    Lat: 29-41-16.0N Lon: 82-26-46.0W NAD83

11. Sanderson (Site #2-2502)
    SE Quadrant of US90 & I-10 Intersection (Old Exit 45 / New Exit 324)
    Sanderson, FL
    Lat: 30-14-16.0N Lon: 82-18-14.0W NAD83

12. Baldwin DOT (Site #2-2500)
    FDOT Maintenance Yard on US301
    Baldwin, FL
    Lat: 30-18-27.0N Lon: 81-58-19.0W NAD83

13. Jacksonville FHP (Site #2-2524)
    Normandy Blvd & I-295 Intersection (Old Exit 7 / New Exit 19)
    Jacksonville, FL
    Lat: 30-17-50.0N Lon: 81-41-11.0W NAD83

14. Yulee (Site #2-2522)
    NE Quadrant of SR200/A1A & I-95 Intersection (Old Exit 129 / New Exit 373)
    Italia, FL
    Lat: 30-37-13.0N Lon: 81-38-59.0W NAD83

15. St. Johns Rest Area (Site #2-2526)
    SW Corner of Southbound Rest Area on I-95
    Durbin, FL
    Lat: 30-05-34.0N Lon: 81-30-00.0W NAD83

16. SR16 (Site #2-2528)
    SW Quadrant of SR16 & I-95 Intersection (Old Exit 95 / New Exit 318)
    St. Augustine, FL
    Lat: 29-55-01.0N Lon: 81-24-45.0W NAD83

17. Gopher Ridge (Site #2-2530)
    SE Quadrant of US1/SR5 & I-95 Intersection (Old Exit 92 / New Exit 298)
    Marineville, FL
    Lat: 29-39-45.0N Lon: 81-17-12.0W NAD83

5. EXAMINATION OF SITES AND SPECIFICATIONS

The Universities are required to carefully examine the specifications contained herein and inform themselves thoroughly regarding any and all site conditions and requirements that may, in any manner, affect the work to be performed under this installation Technical Statement of Work.

Notwithstanding the details presented in this specification, it is the responsibility of the Universities to verify the completeness of the materials required and suitability of the electrical devices to meet this specification. Any additional equipment required for operation in accordance with these specifications shall be provided and installed by the Universities.

6. UNIVERSITIES' QUALIFICATIONS

The Universities shall possess the qualifications, skills, and experience necessary to accomplish the work required by this specification without adversely impacting the critical operations of the FDOT's microwave network. These requirements are in addition to the normal contractor licensing requirements of the State of Florida.

7. EQUIPMENT INSTALLATION

7.1 General

The equipment installations required by this specification include, but are not limited to, all of the described equipment and materials (See Table 7.3), services and associated ancillary hardware. All installations shall be accomplished in accordance with good engineering practice. The end result will be a completely integrated and operating road weather information system and atmospheric data acquisition system.

The Universities shall install the equipment and wiring in accordance with this Technical Statement of Work.

The Universities are required to adhere to FCC Rules, NEC, all local codes, and building regulations. Additionally, the Universities must perform all work in a manner consistent with good engineering practice. The Universities are required to coordinate with the FDOT ITS Office and the microwave maintenance contractor prior to the commencement of any installation work at any FDOT microwave communications site.

7.2 Corrosion Protection

All steel (except for stainless steel) shall be hot-dip galvanized after fabrication per ASTM A123 with a minimum application of two ounces of zinc per square foot of surface area. All hardware and other attachments shall be galvanized per ASTM A153.

Table 7-3: Required Equipment and Materials List

Item		Description	Manufacturer	Part Number	Qty
	1	7.5VAC TVSS unit (TTL – 4 Terminal)	Atlantic Scientific	90745	56
	2	17VAC TVSS unit (Serial Data – 4 Terminal)	Atlantic Scientific	24509	17
	3	120VAC TVSS Unit (with neutral ground lead)	Atlantic Scientific	Zone Preserver®	3
	4	RSL Monitors	Custom		8
	5	Electrical Box			3
**	6	Flex Metallic Conduit, Terminals and Grounding Terminals			Lot
		Configuration 1			
*	7	Data Logger inside Weatherproof Box	Coastal Environmental	Zeno 3200	3
*	8	Aspirator (Temperature and Relative Humidity)	Coastal Environmental	S1276Z	15
*	9	Anemometer	Coastal Environmental	S5777	6
*	10	Junction Box	Custom	N/A	15
		Configuration 2			
*	11	Capricorn 2000 Kit	Columbia Weather	8150-D-1	14
*	12	Self Aspirating Radiation Shield	Columbia Weather	82103	14
*	13	Relative Humidity	Columbia Weather	82201	14
*	14	Precipitation Sensor	Columbia Weather	82300	14
		All Sites			
*	15	4” Boot Assembly w/ one 1-1/4” Cushion Port	Microflect (Tessco)	B1152A (22195)	14
*	16	4” Boot Assembly w/ four 1-1/4” Cushion Ports	Microflect (Tessco)	B1566 (92005)	1
*	17	1-1/4” Cushion Port Plug (5 pk.)	Wireless Solutions (Tessco)	WCP-114 (69346)	1
*	18	Roof Entry Boot Sealer	Microflect (Tessco)	B1177 (22919)	4
*	19	Sealing Tape	Microflect (Tessco)	B299	Lot

* UNF shall provide these materials to Transcore prior to beginning any installation.
** UNF to be determined.

7.3 Installation

This pilot project is being undertaken through a joint effort of the FDOT Intelligent Transportation Systems (ITS) Office and the Universities, utilizing their respective general staff, consultants, and sub-contractors for requisition of the materials and execution of the installation work.

The Universities will perform the tasks required to surge protect all data/power cabling entering the shelter. The TVSS device will serve as the installation demarcation point for the Universities. Additionally, the Universities will install any additional device necessary to interface the weather sensors to the RWIS communications equipment inside the shelter.

The FDOT TGC will perform the Construction Engineering and Inspection (CE&I) for all installation activities.

The major required equipment items and materials are listed in Table 7-3. These equipment/materials, or approved equivalents, shall be installed in accordance with the site-specific installations as part of this project.

7.4 Grounding and Surge Suppression

Lightning damage to equipment and structures and its prevention is a major consideration in the design of communications facilities in Florida. Installation practices for the FDOT sites must meet the requirements herein to ensure compliance with FDOT construction practices. The Universities must install all equipment and associated hardware in accordance with the design requirements delineated herein to ensure that adequate and consistent lightning protection is constructed at each site. THE UNIVERSITIES SHALL SUBMIT, IN WRITING, ANY REQUEST FOR VARIANCE FROM THE FDOT DESIGN. THE VARIANCE MUST BE PRE-APPROVED IN WRITING BY THE PROJECT MANAGER OR IT WILL NOT BE ACCEPTED.

CARE MUST BE TAKEN WHEN HANDLING ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES. THE UNIVERSITIES SHALL USE ESD-WRISTSTRAPS AND ESD-APPROVED TOOLS AT ALL TIMES WHEN IN CONTACT OR IN CLOSE PROXIMITY TO ESD SENSITIVE DEVICES. THE UNIVERSITIES SHALL READ AND BECOME FAMILIAR WITH THE ESD PREVENTION PROCEDURES PROVIDED BY THE MANUFACTURERS OF EACH PIECE OF EQUIPMENT.

The Universities shall install the grounding for the surge protection devices per the manufacturer's instructions and connect to the existing grounding system with no less than the minimum wire size specified herein or the manufacturer's recommended wire size, whichever is larger. Ground conductors shall be downward coursing and be as short and straight as practical. The minimum bending radius for interior shelter grounds shall be eight inches, wherever possible. Ninety-degree bends and multiple bends in

conductors will not be allowed. All bonding and grounding design drawings must be submitted to the Department and approved prior to installation.

The Atlantic Scientific *Zone Preserver*® 120VAC TVSS shall be housed inside a metallic electrical box as shown in Figure A-4. Both the metallic electrical box and the TVSS device shall be connected to the existing grounding system.

The Universities shall use lugs or clamps, appropriate to the size and the type of wire and provisions/requirements of the equipment being grounded, to connect the ground conductors to the equipment. To ensure good electrical connection, the Universities shall crimp and then solder the wires connected to lugs or clamps.

The Universities shall remove all non-conducting surface coatings before each connection is made. The Universities shall apply an anti-oxidant compound ("No-OX, or approved equivalent) to all connections. The Universities shall install star washers, or some other means appropriate to the fastener used, to ensure a continued good electrical connection. The objective is to provide a good, low-maintenance electrical and mechanical connection that will not deteriorate.

7.5 Site Specific Installations

The work specified in this section shall be done in accordance with the equipment and hardware installation parameters provided herein. These parameters include, but are not limited to, equipment grounding and surge protection, power hook up and interface of weather sensors to equipment rack.

All equipment shall be installed in accordance with the site specific requirements.

All equipment and cabling must be secured to shelter interior walls, ground bus bars, and cable trays in accordance with good engineering practices. All cabling shall be directed to the overhead cable trays and positioned such that no empty rack units are blocked. The positioning of equipment is shown in the site specific figures in Appendix A.

This section comprises two subsections. The first subsection lists the installation requirements for the three tower sites that FSU will be using for their research. These tower sites are Quincy FHP, Tallahassee FHP, and Monticello DOT, which will be referred to as "Configuration 1" sites. The second subsection lists the installation requirements for the remaining tower sites, which will be referred to as "Configuration 2" sites.

7.5.1 Configuration 1 (FSU Sensors)

The Universities shall install necessary surge protection at the Configuration 1 sites, in accordance with the site specific requirements, as shown in Appendix A.

The data/power cabling shall be connected to the appropriate Atlantic Scientific surge protection devices, or approved equivalents, using UV protected cables that are listed for outdoor use, in accordance with the site specific requirements as shown in Appendix A.

Additionally, the Universities shall install the Receive Signal Level (RSL) monitoring devices as shown in Figure A-3. The Universities shall provide to the Microwave Maintenance Contractor all necessary cabling to interface the monitoring devices to the Automatic Gain Control (AGC) on the microwave radios. UNDER NO CIRCUMSTANCES SHALL THE UNIVERSITIES PERFORM THESE CONNECTIONS.

7.5.1.1 Configuration 1 Power Hook Up

The RWIS data logger power supply shall be connected to the appropriate surge protection device (Atlantic Scientific *Zone Preserver*®, or approved equivalent) upon entry into the shelter, and then connected to the 120 VAC UPS power supply. Figure A-3 is the RWIS Rack Elevation diagram for the typical site communications facilities. The Atlantic Scientific *Zone Preserver*® TVSS device shall be housed inside a metallic electrical box, as shown in Figure A-4. All TVSS devices shall be mounted and grounded in accordance with he site specific requirements as shown in Appendix A. All 120 VAC power cables shall be routed to enter the communications facilities in accordance with the site specific requirements as shown in Appendix A. All 120 VAC power cables must be installed inside metallic conduit and routed away from all transmission communications lines and perpendicular to all communications cable crossings.

7.5.2 Configuration 2 (Integrated Sensors)

The Universities shall install the necessary surge protection for the Configuration 2 sites, in accordance with the site specific requirements, as shown in Appendix A.

The weather sensor cabling shall be connected to the appropriate surge protection devices (Atlantic Scientific Model Numbers 24509 and 90745, or approved equivalents), upon entry into the shelter, in accordance with the site specific requirements as shown in Appendix A.

7.5.2.1 Configuration 2 Power Hook Up

The RWIS data logger power supply shall be connected to the 120 VAC UPS power supply. Figure A-8 is the Typical Site RWIS Rack Elevation diagram that shows the location of the data logger and 120 VAC UPS power supply for the typical site communications facilities.

7.6 Installation Inspections

7.6.1 General

The FDOT's Telecommunications General Consultant (TGC) shall be present to oversee and inspect the installation of the weather sensor packages. The Universities shall notify the individuals listed below of the start of work a minimum of 10 working days in advance. The TGC has the authority to stop work at the site if the work is not being performed in a manner consistent with these specifications or is being performed in an unsafe manner.

Name	Organization	Telephone Number
Nick Adams	Florida Department of Transportation	(850) 410-5608
Terry Posey	RCC Consultants, Inc.	(850) 410-5611
Russell Allen	RCC Consultants, Inc.	(850) 410-5626

The Universities will have the opportunity to evaluate the system performance by conducting equipment/system tests at the conclusion of the weather sensor equipment installation. The FDOT TGC will perform inspections and note any discrepancies for correction by the Universities.

APPENDIX A

FIGURES

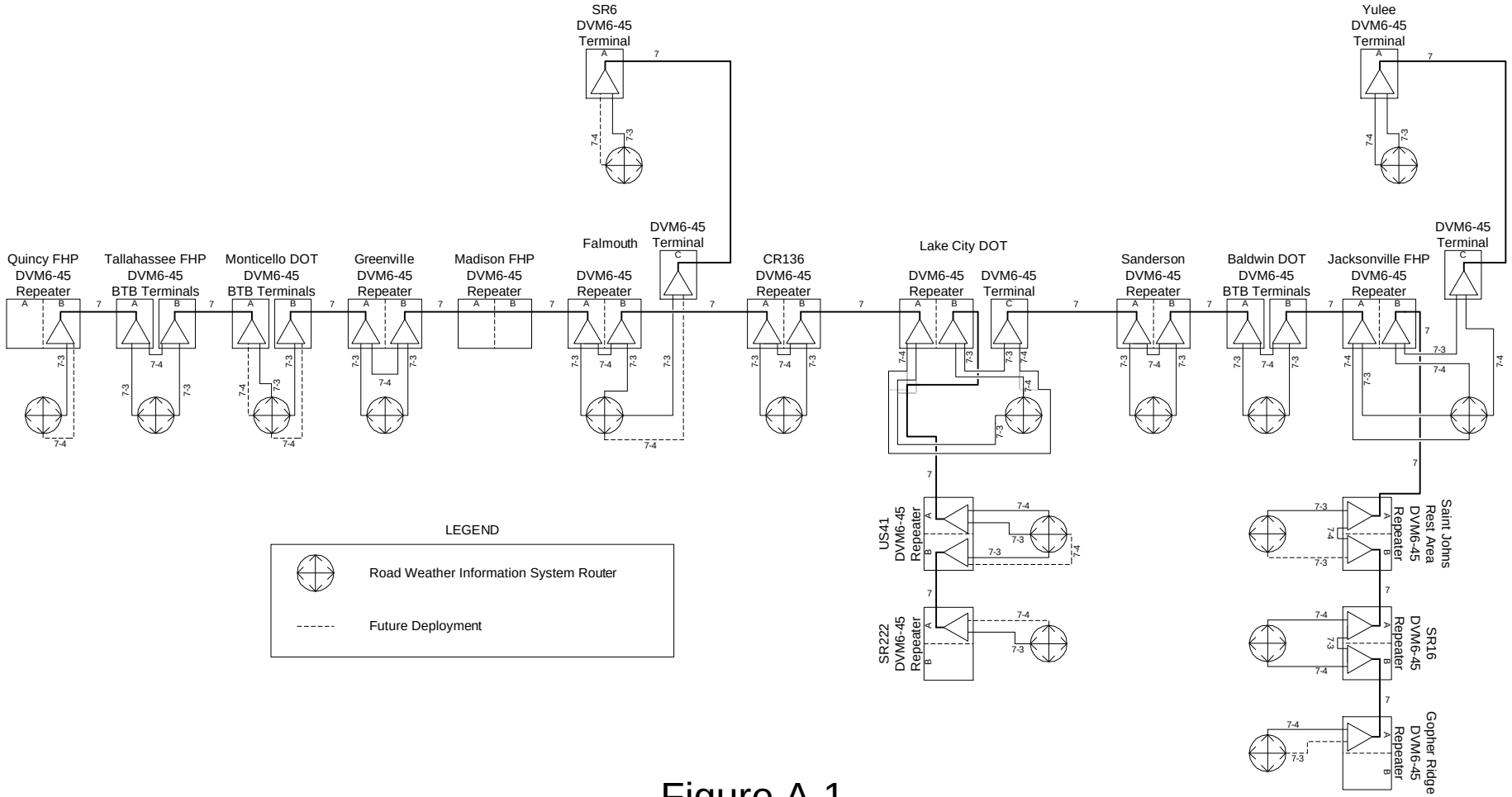


Figure A-1
Road Weather Information System
Physical Network Configuration

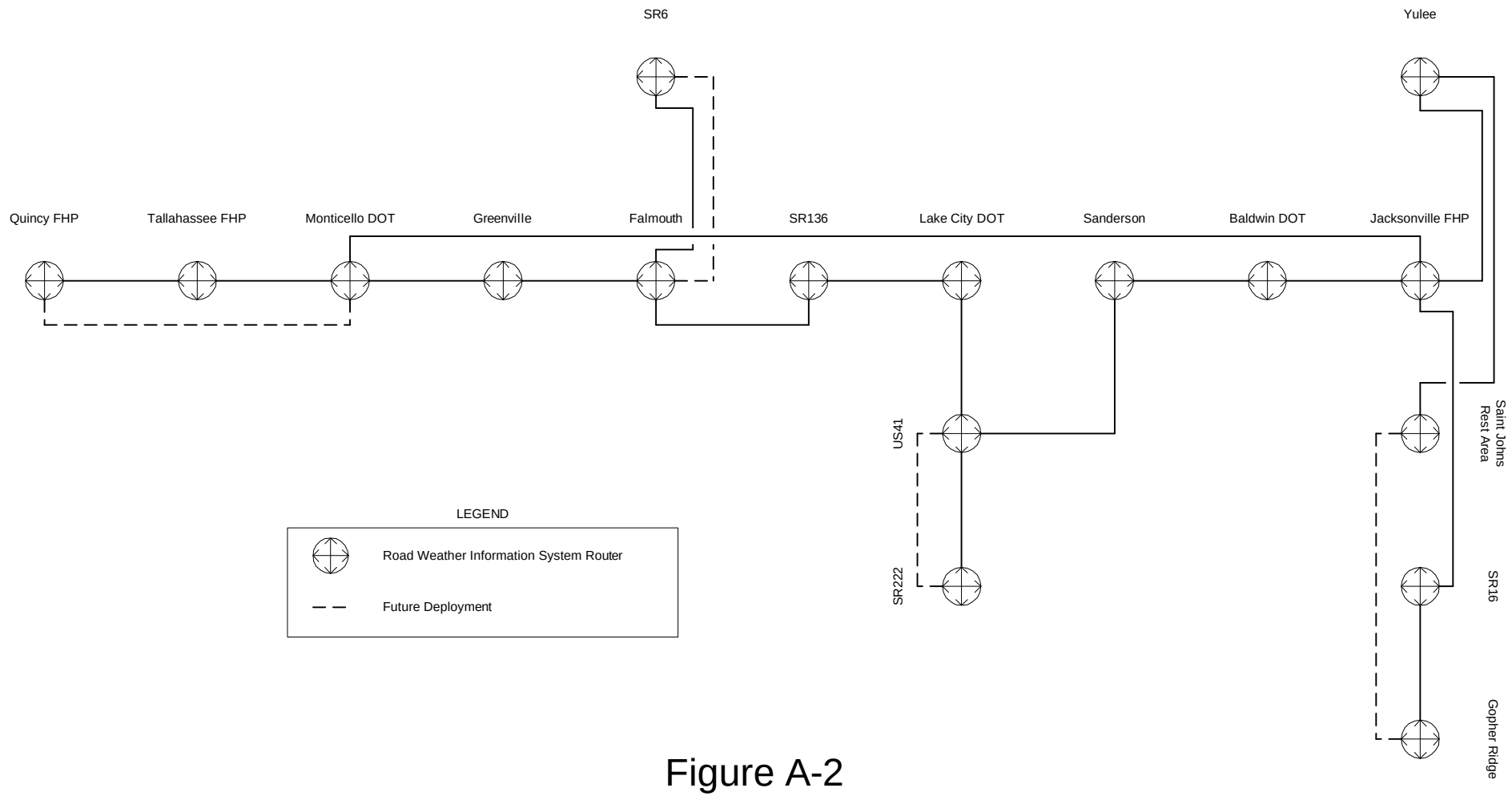
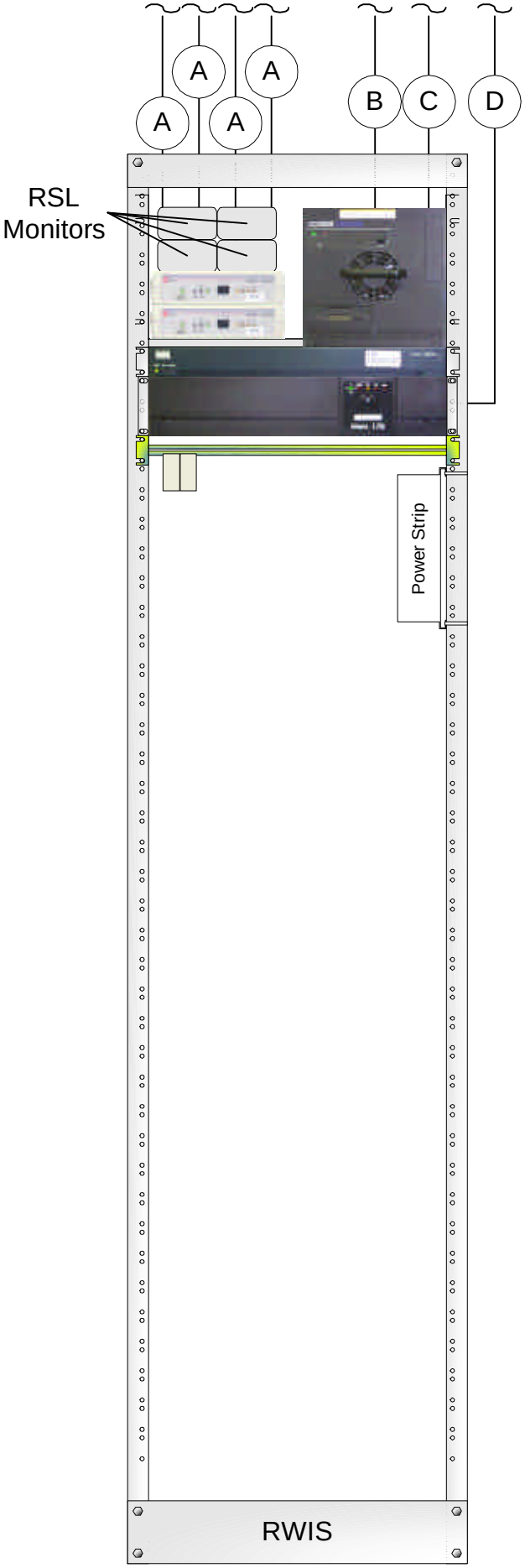


Figure A-2
Road Weather Information System
Logical Router Configuration

Scale: 1 1/4" = 1'-0"



A: Test leads from RSL test points of AGC on microwave receivers module to RSL monitor.

B: Serial data cable from TVSS device to CrystalPC.

C: 120 VAC power from UPS to overhead twistlock receptacle.

D. 120 VAC power from UPS to TVSS unit and outdoor data logger. Flexible conduit is grounded to rack.

Figure A-3
Configuration 1
RWIS Rack Elevation
Front View

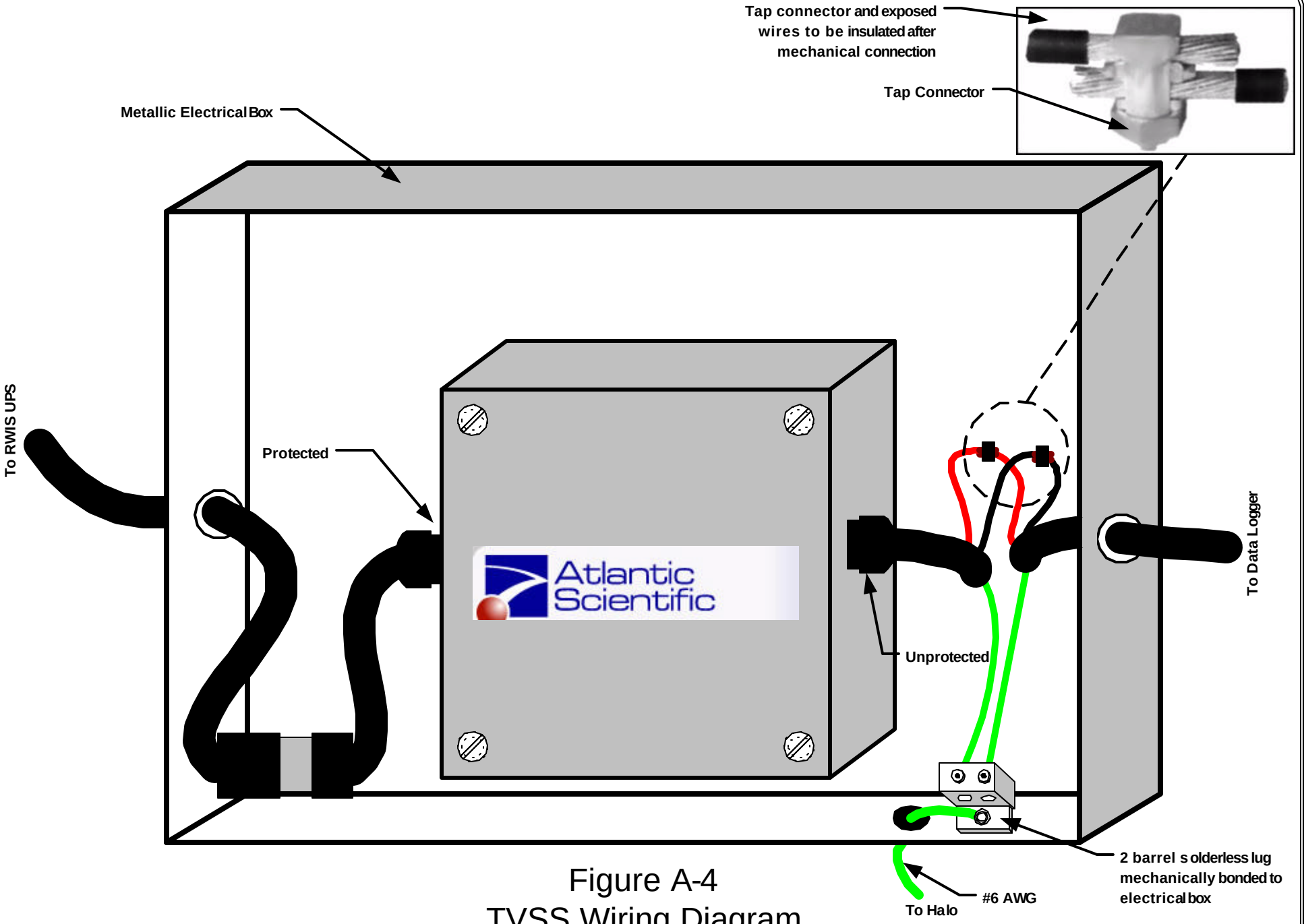
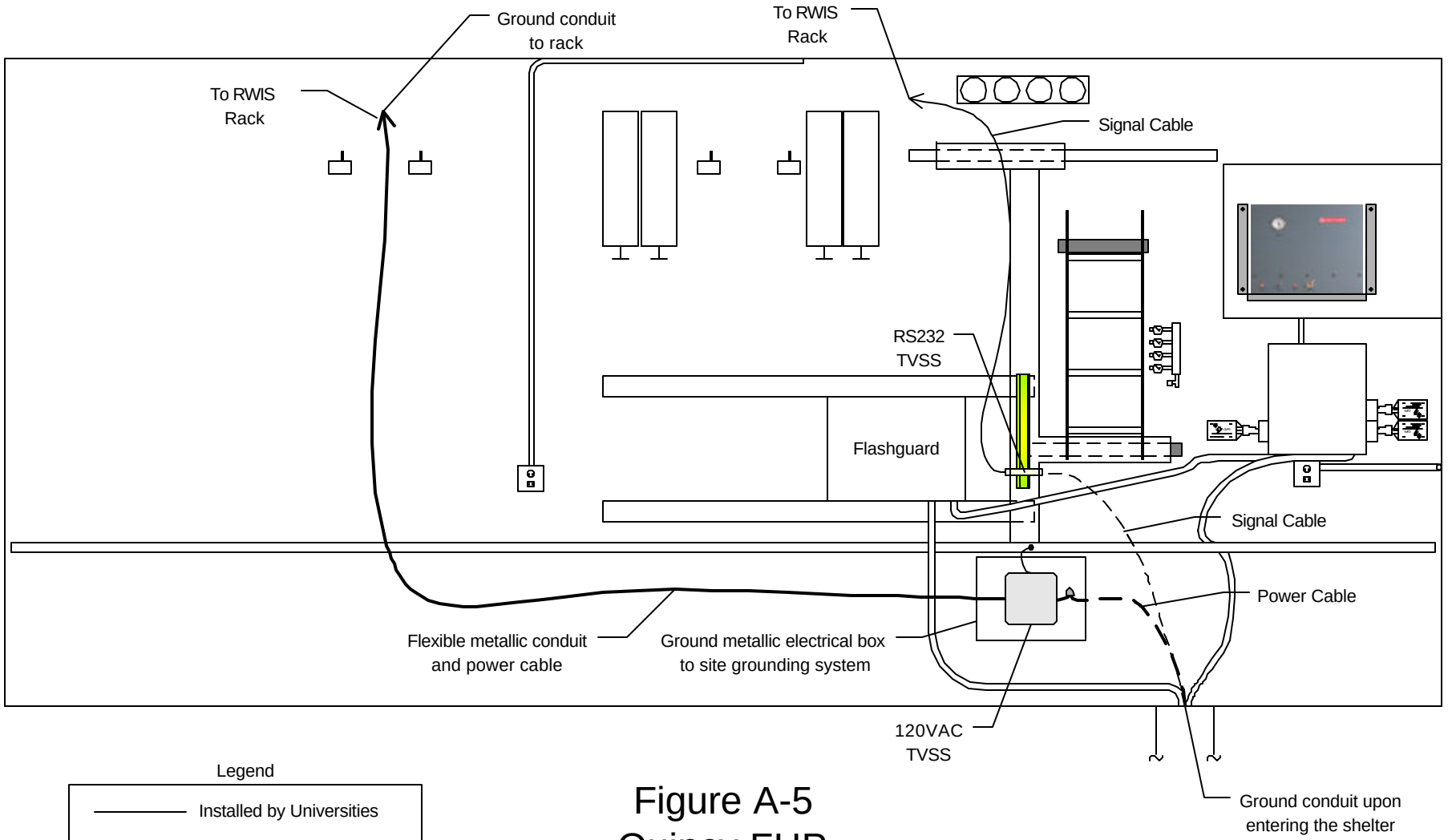


Figure A-4
TVSS Wiring Diagram

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA04_TVSSWiringDiagram.vsd
02/11/03

Scale: 1/2" = 1'-0"



Legend

Installed by Universities

Installed by Contractor

Figure A-5
Quincy FHP
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA05_QuincyFHP_InteriorEastWall.vsd
02/27/03

Scale: 3/8" = 1'

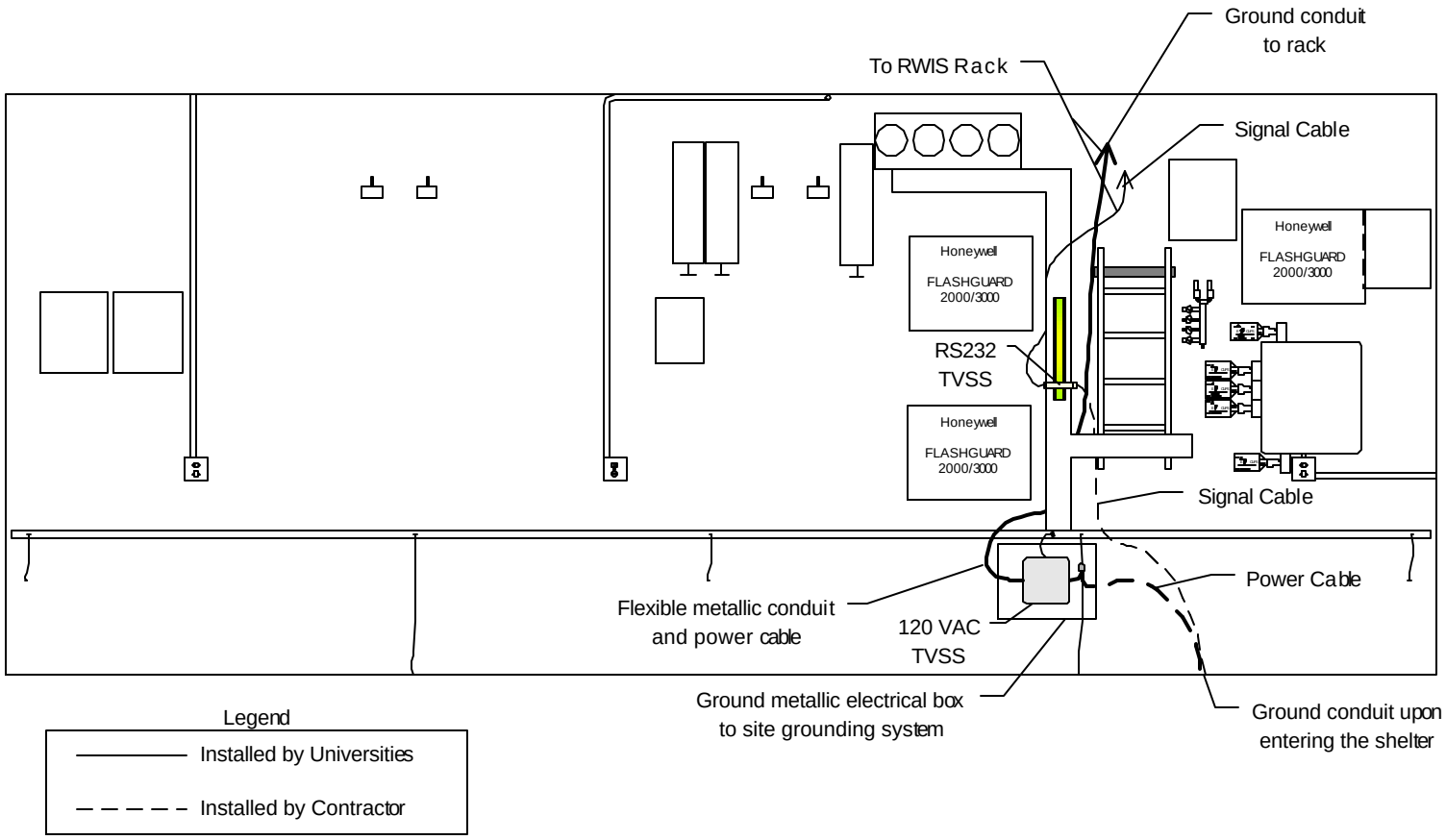
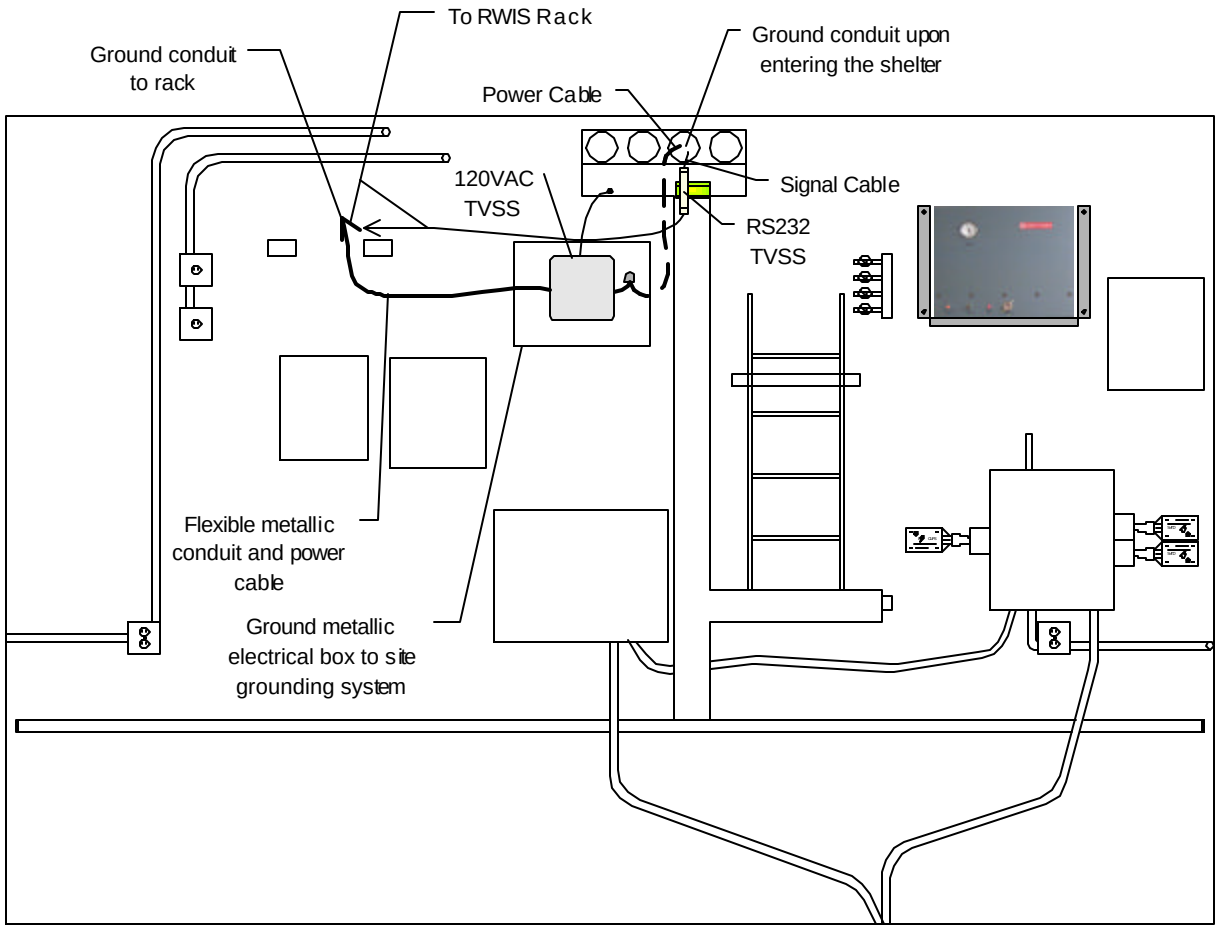


Figure A-6
Tallahassee FHP
Interior South Wall

Scale: 1/2" = 1'-0"



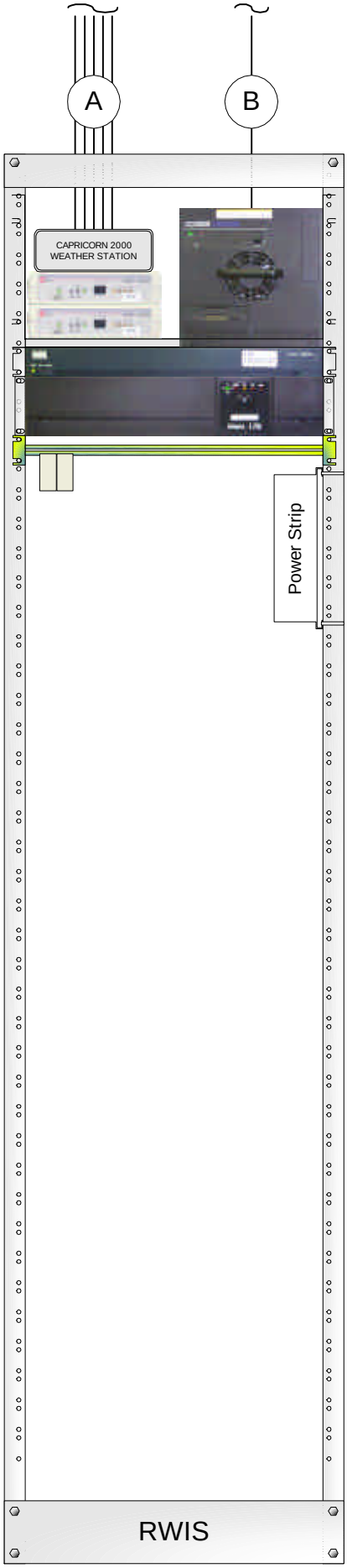
Legend

Installed by Universities

Installed by Contractor

Figure A-7
Monticello DOT
Interior East Wall

Scale: 1 1/4" = 1'-0"

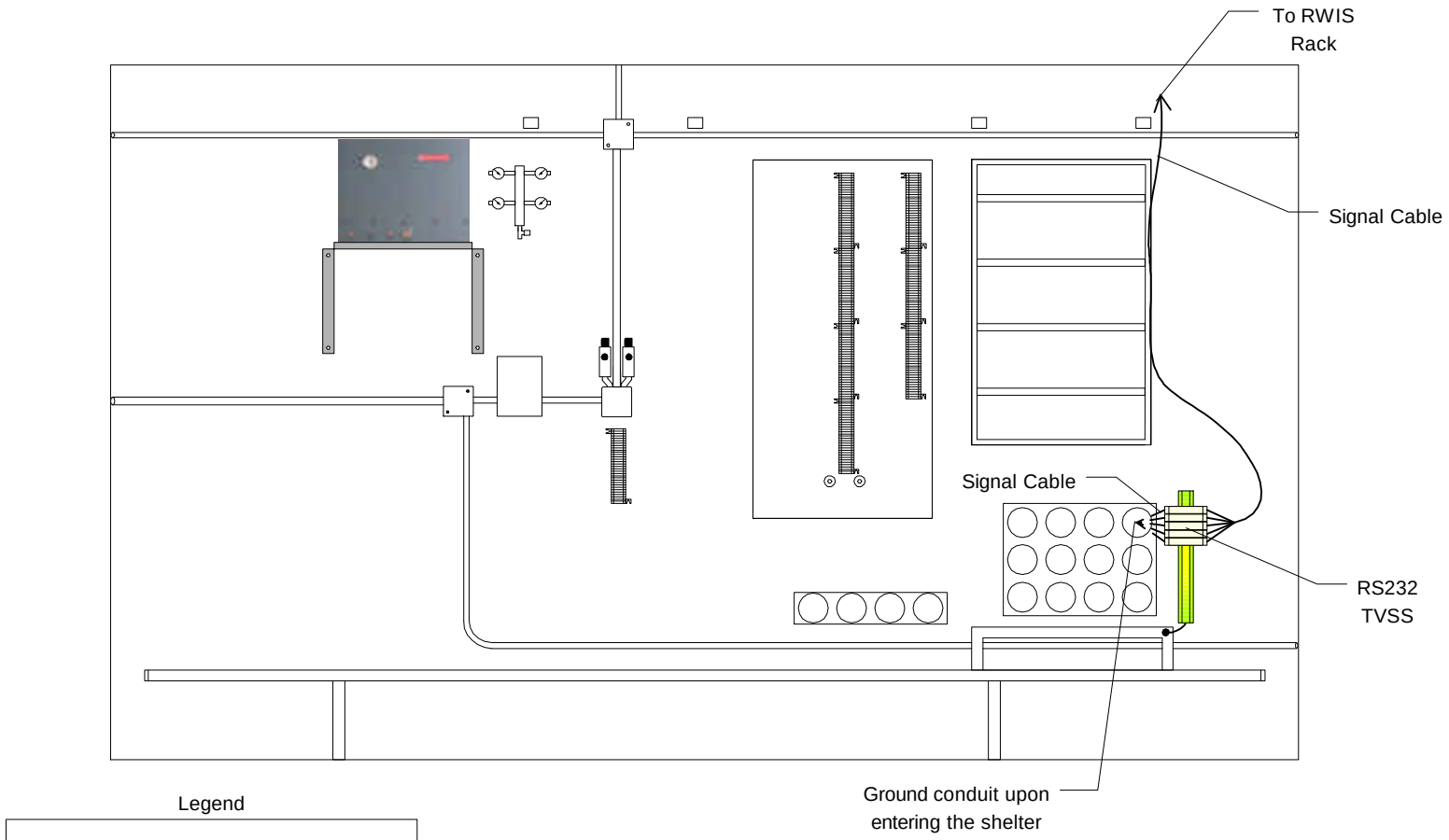


A: Serial data cables from TVSS devices to data logger.

B: 120 VAC power from UPS to overhead twistlock receptacle.

Figure A-8
Configuration 2
RWIS Rack Elevation
Front View

Scale: 1/2" = 1'-0"



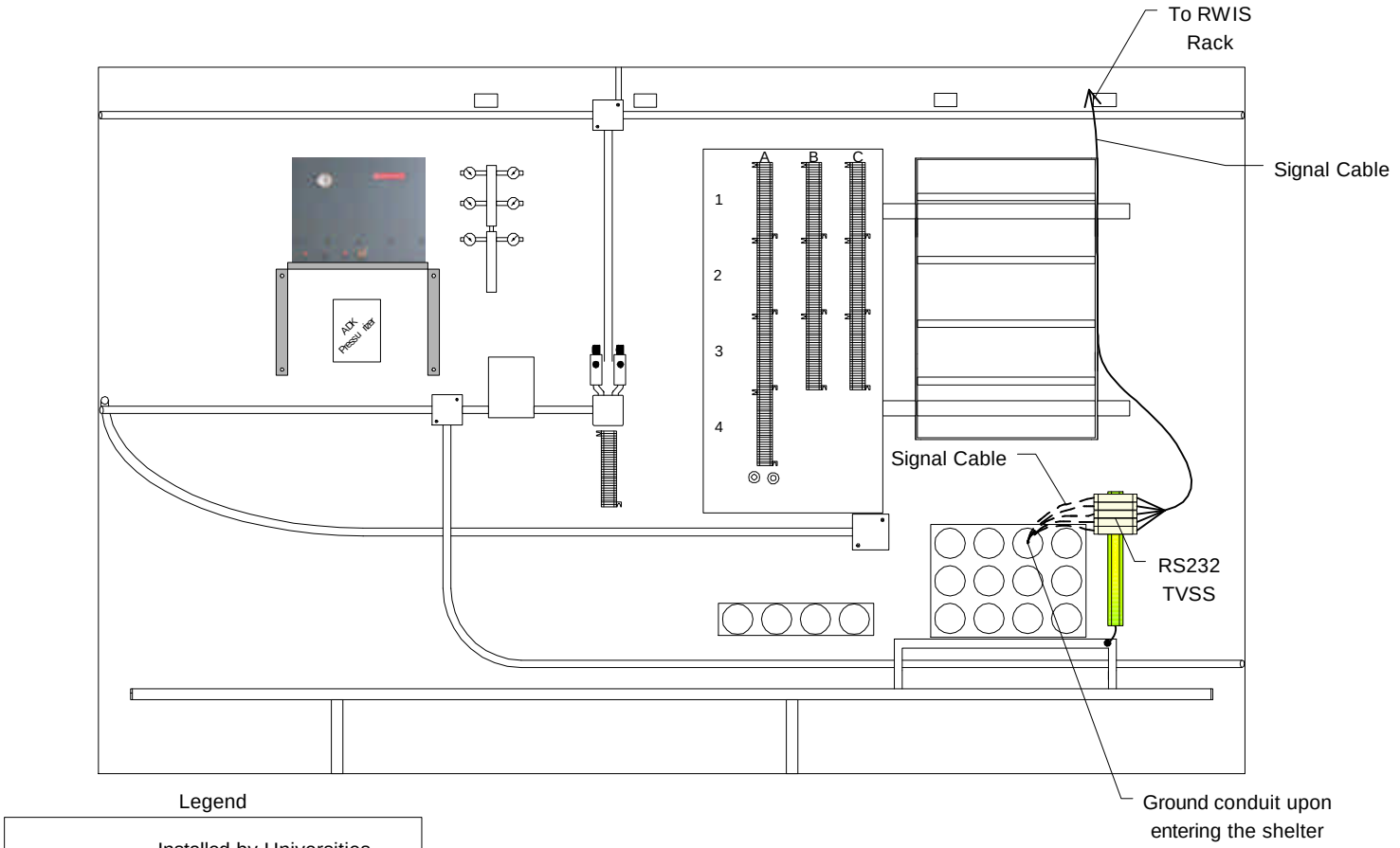
Legend

Installed by Universities

Installed by Contractor

Figure A-9
Greenville
Interior West Wall

Scale: 1/2" = 1'



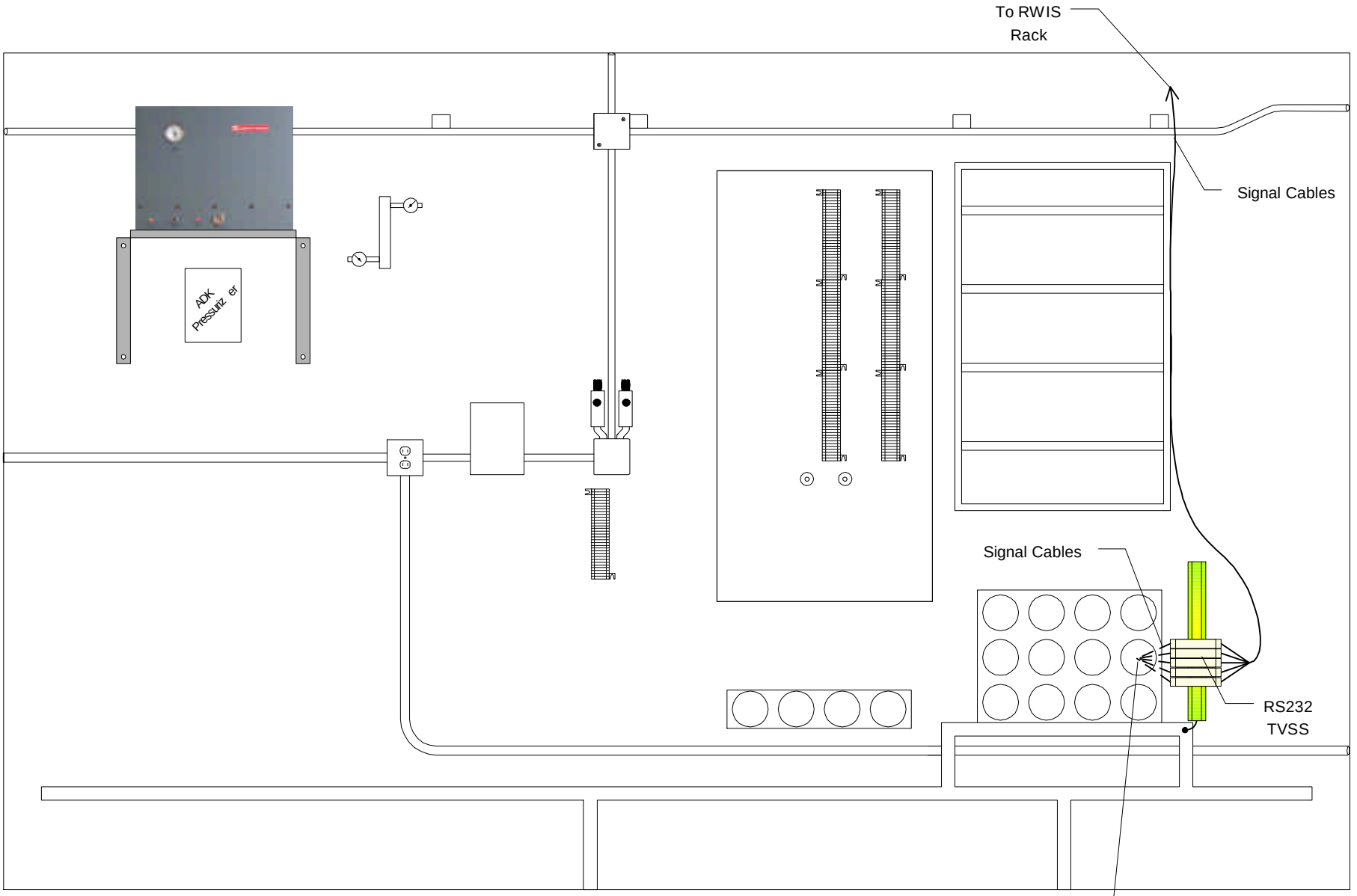
Legend

Installed by Universities

Installed by Contractor

Figure A-10
Falmouth
Interior North Wall

Scale: 3/4" = 1'-0"



Legend

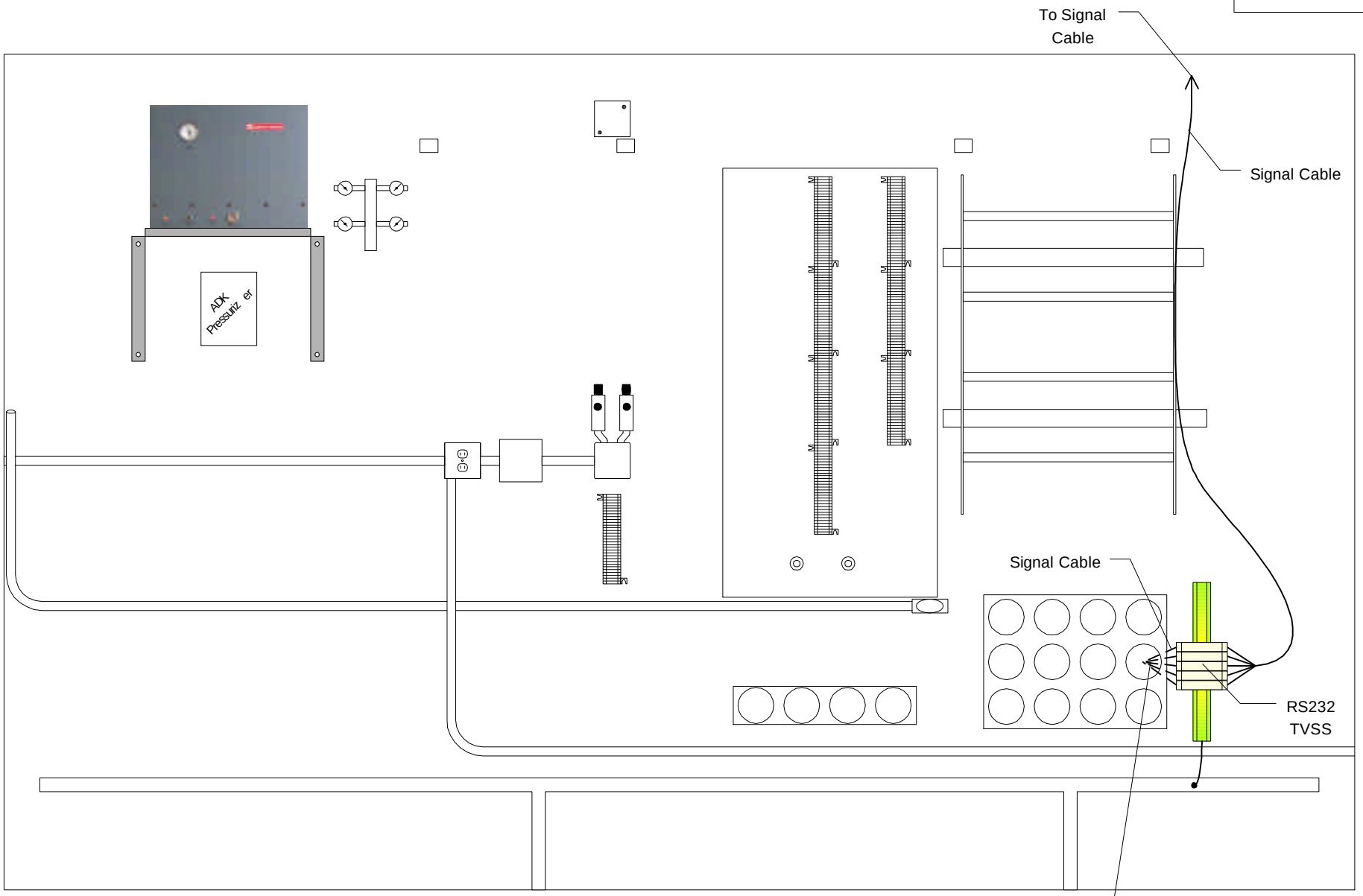
Installed by Universities

Installed by Contractor

Figure A-11
SR6
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA11_SR6_InteriorEastWall.vsd
02/27/03

Scale: 3/4" = 1'-0"



Legend

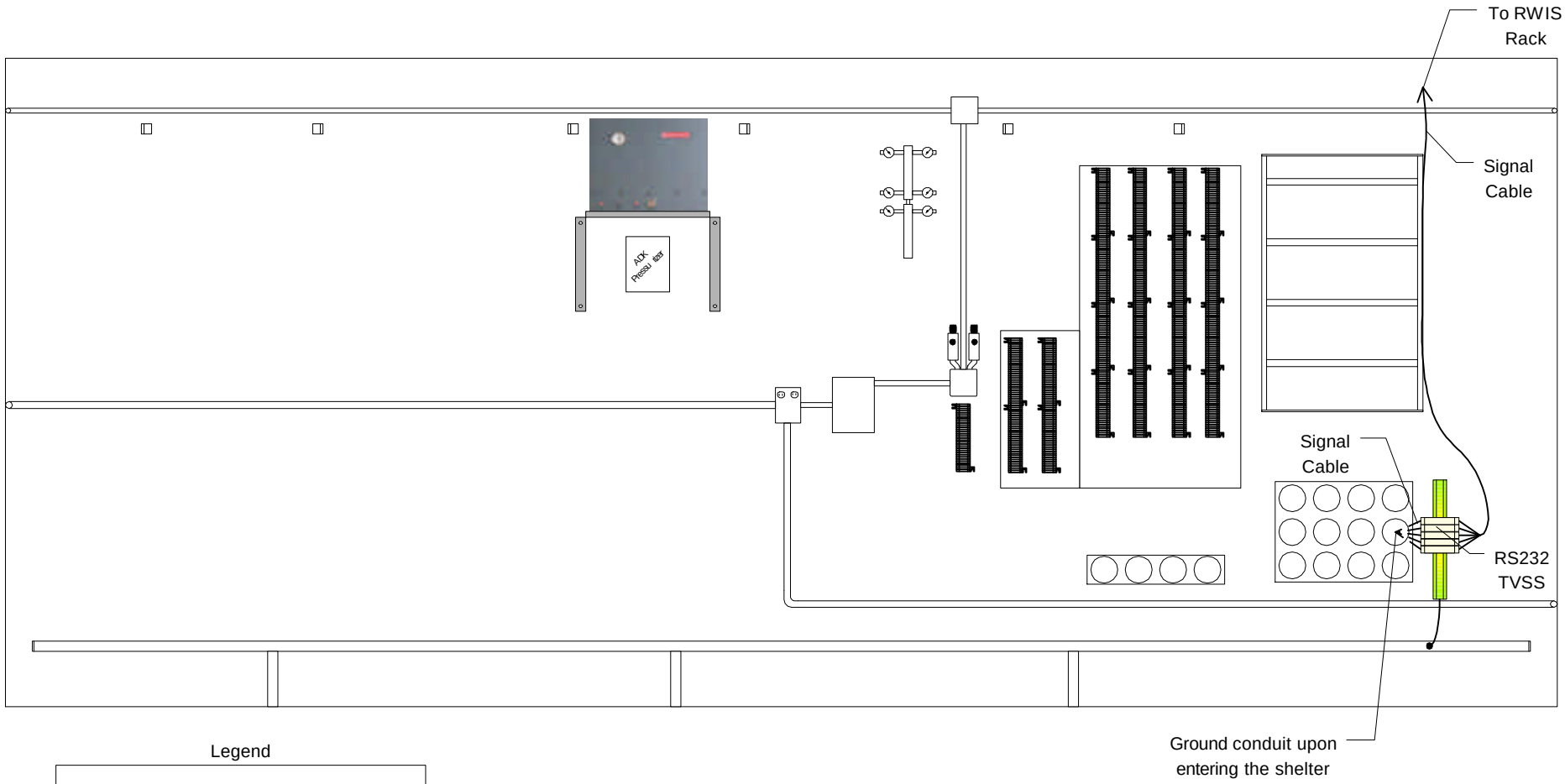
Installed by Universities

Installed by Contractor

Figure A-12
SR136
Interior South Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA12_SR136_InteriorSouthWall.vsd
02/27/03

Scale: 1/2" = 1'-0"



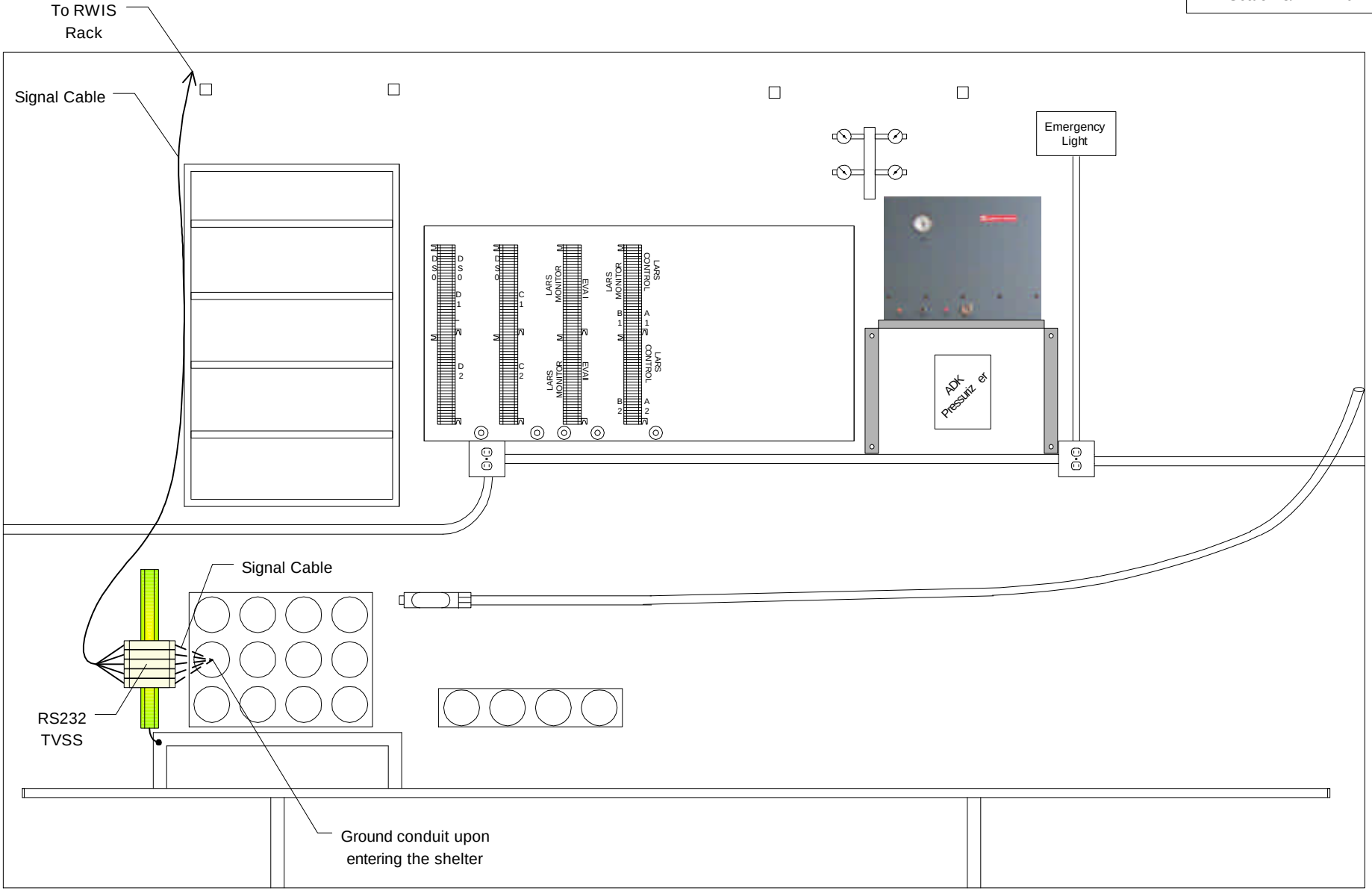
Legend

Installed by Universities

Installed by Contractor

Figure A-13
Lake City DOT
Interior North Wall

Scale: 3/4" = 1'-0"



Legend

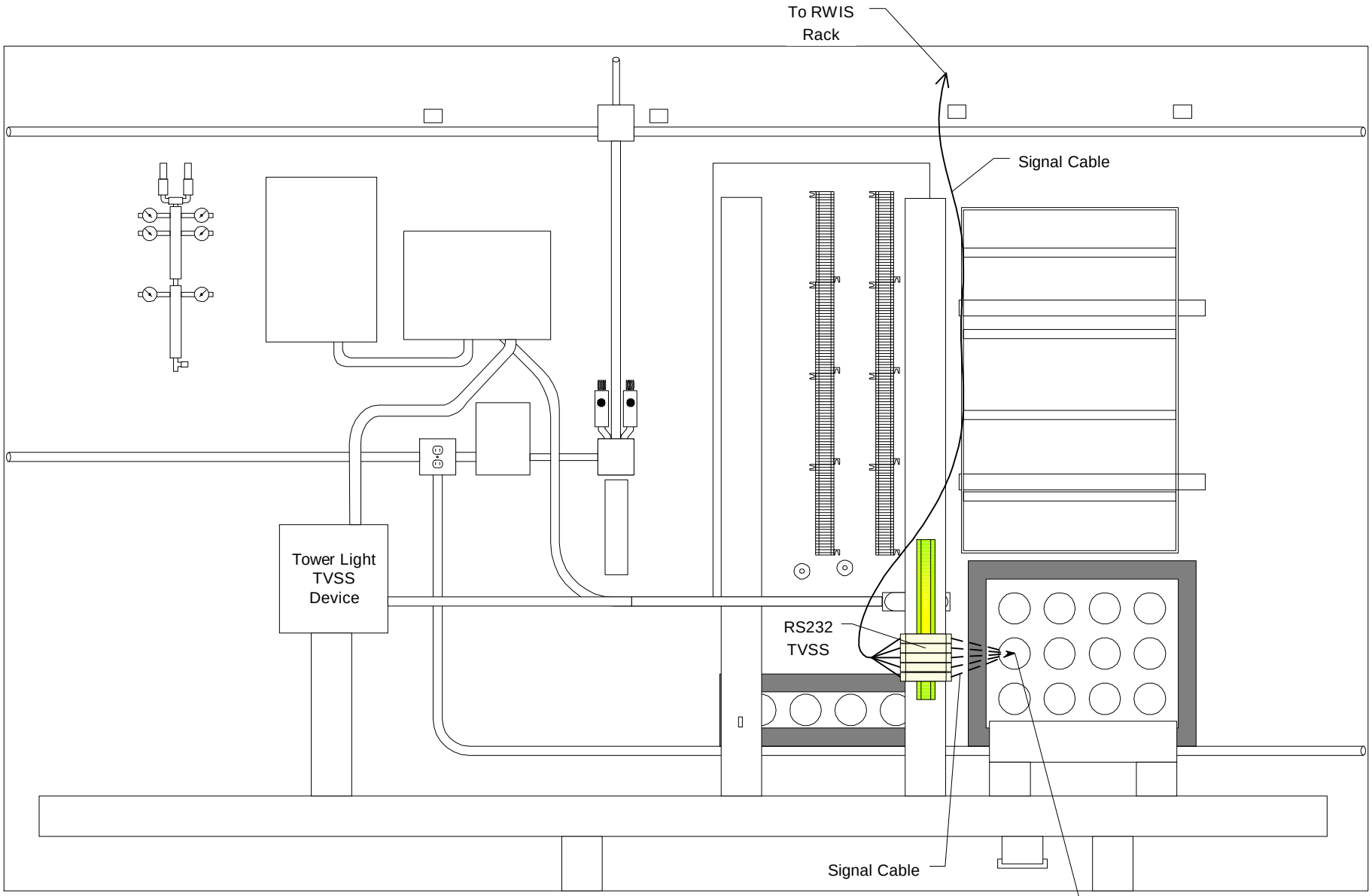
Installed by Universities

Installed by Contractor

Figure A-14
US41
Interior North Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA14_US41_InteriorNorthWall.vsd
02/27/03

Scale: 3/4" = 1'-0"



Legend

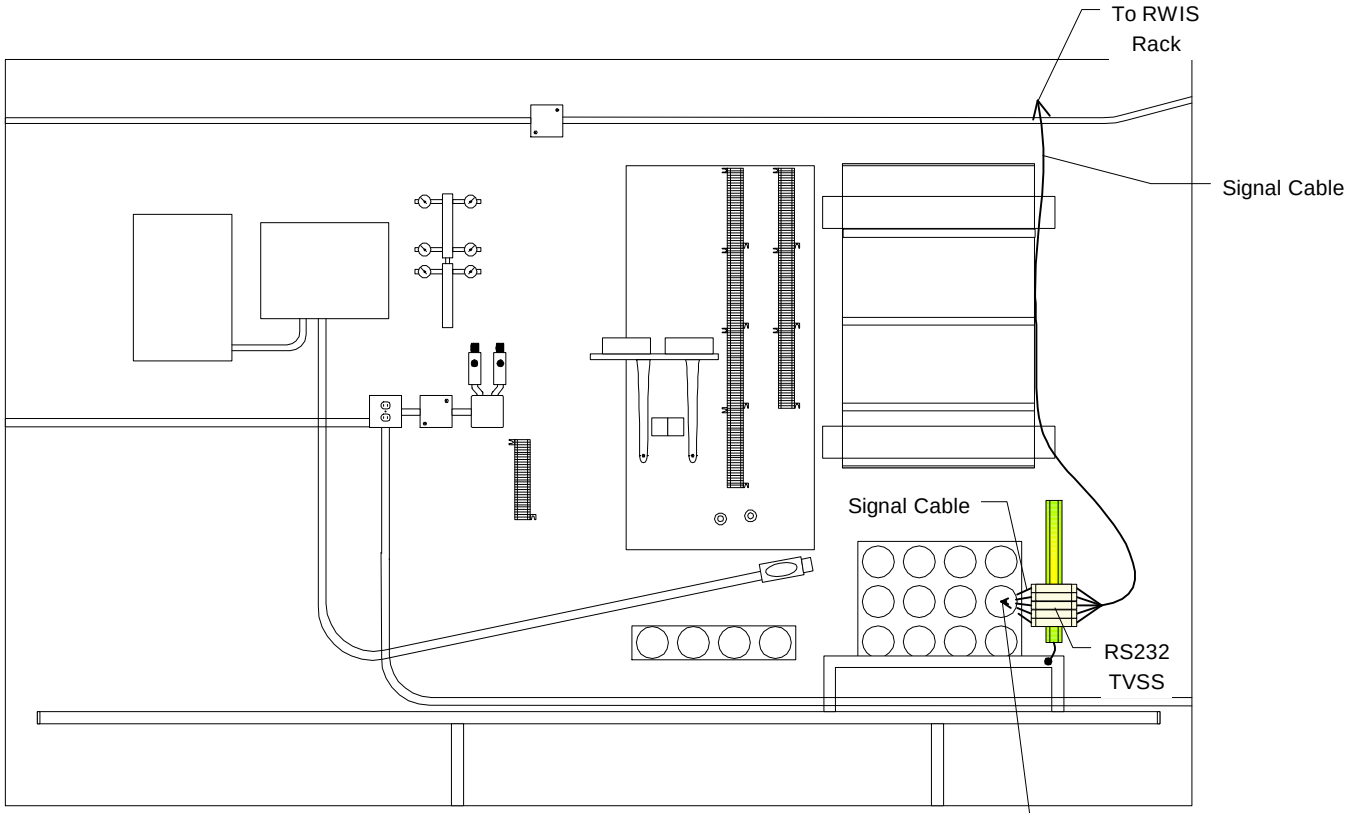
Installed by Universities

Installed by Contractor

Figure A-15
SR 222
Interior West Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA15_SR222_InteriorWestWall.vsd
02/27/03

Scale: 1/2" = 1'-0"



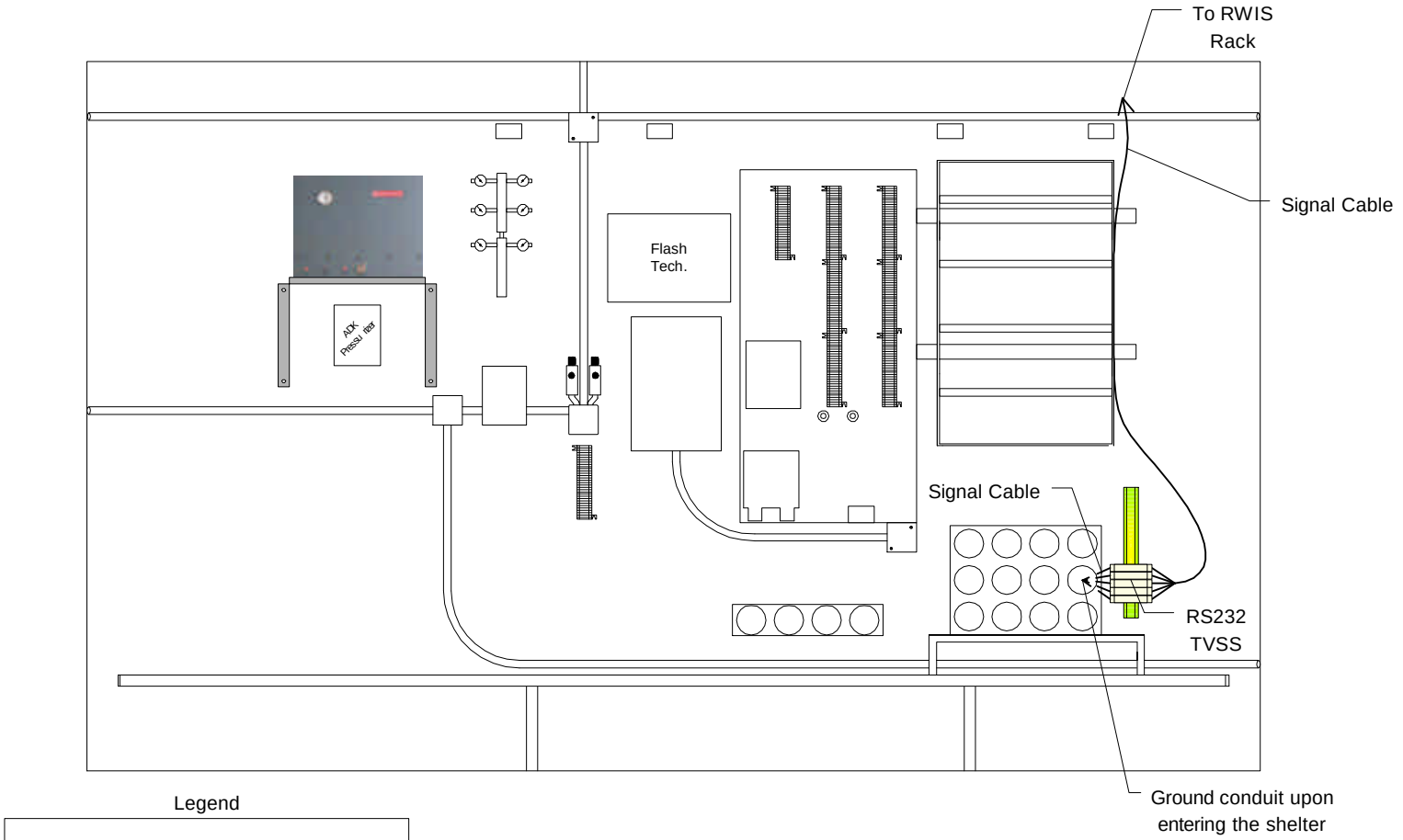
Legend

Installed by Universities

Installed by Contractor

Figure A-16
Sanderson
Interior West Wall

Scale: 1/2" = 1'



Legend

Installed by Universities

Installed by Contractor

Figure A-17
Baldwin DOT
Interior West Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA17_BaldwinDOT_InteriorWestWall.vsd
02/27/03

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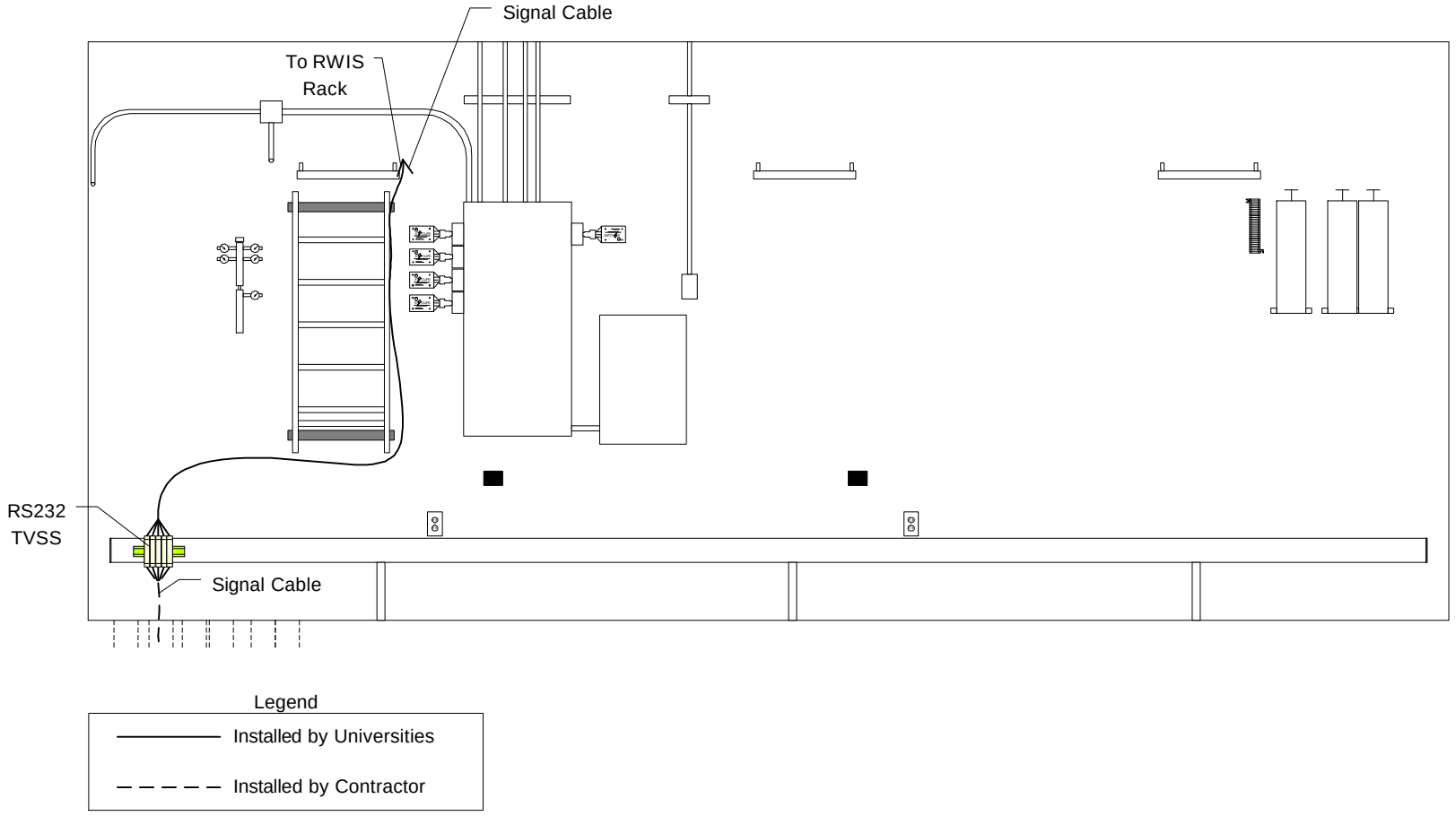
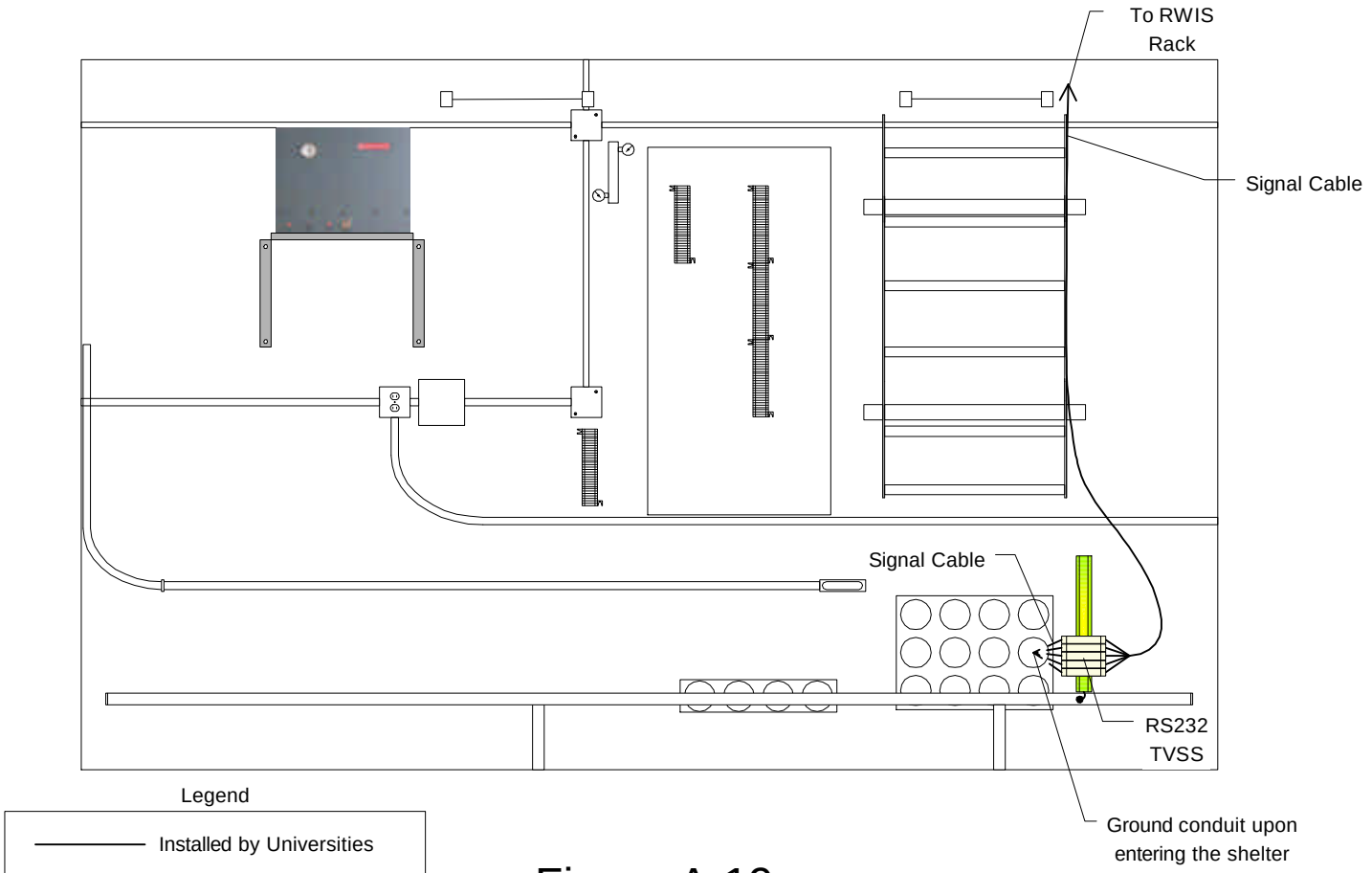


Figure A-18
Jacksonville FHP
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA18_JacksonvilleFHP_InteriorEastWall.vsd
02/27/03

Scale: 1/2" = 1'-0"



Legend

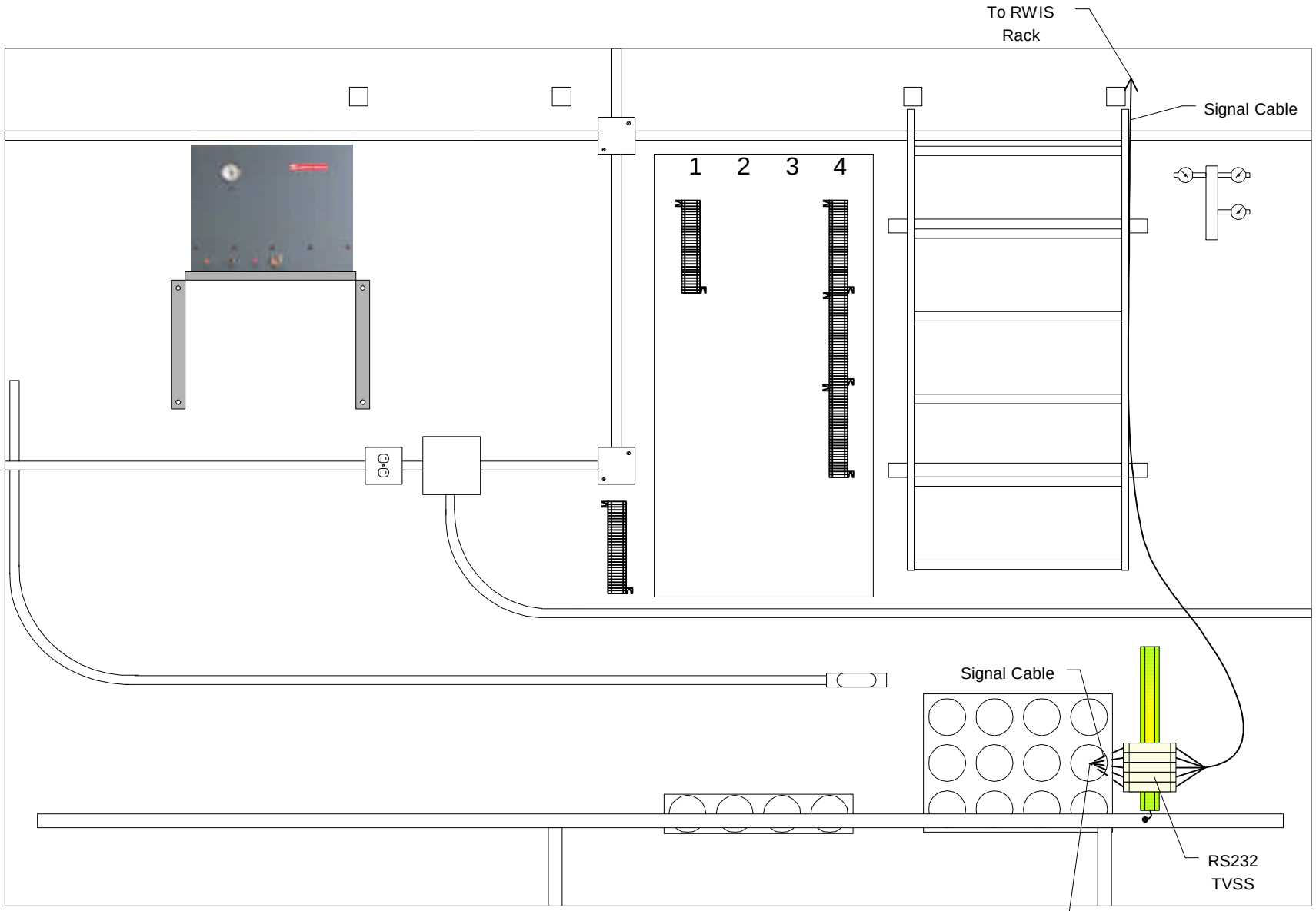
Installed by Universities

Installed by Contractor

Figure A-19
Yulee
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA19_Yulee_InteriorEastWall.vsd
02/27/03

Scale: 3/4" = 1'-0"



Legend

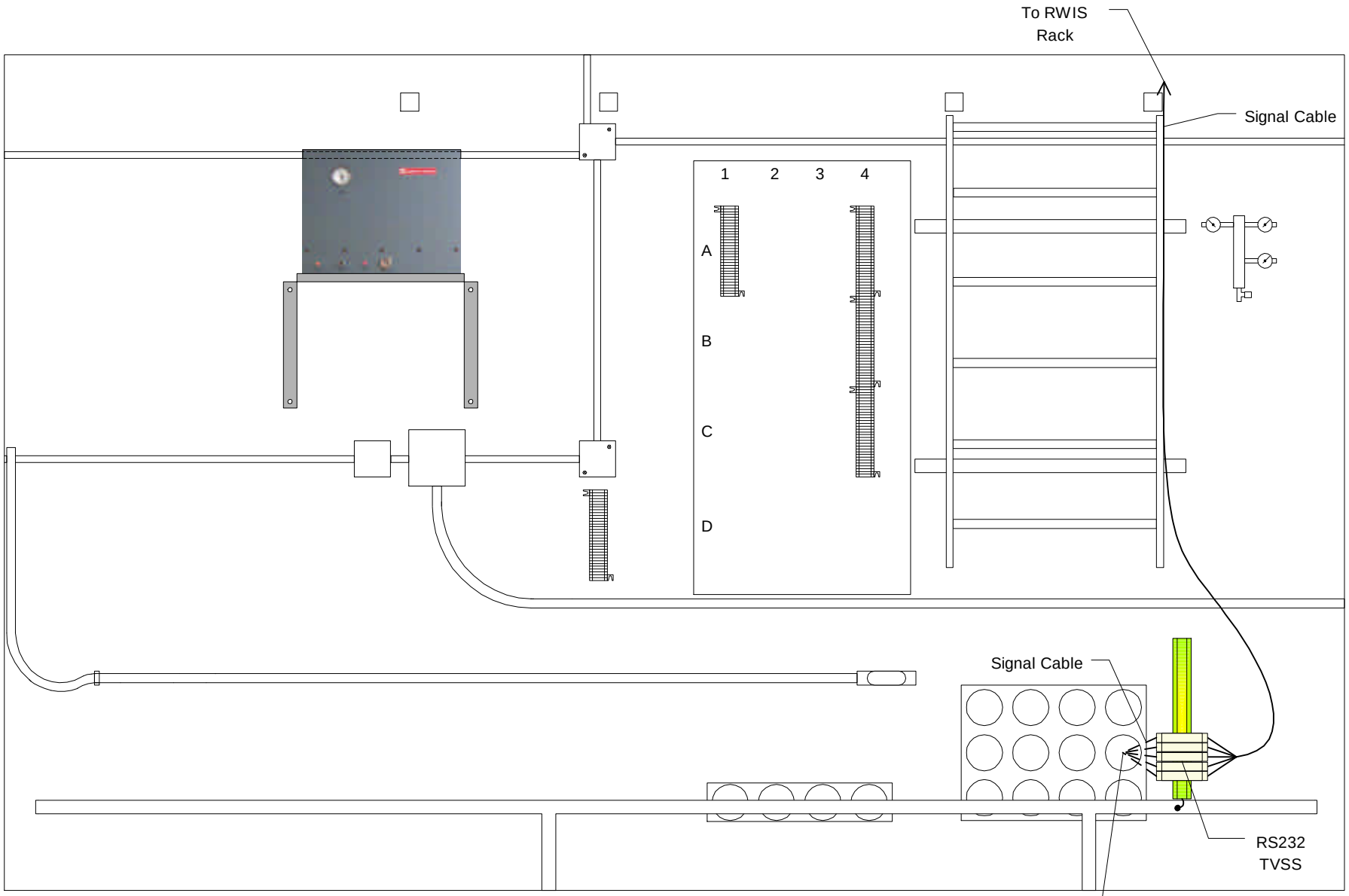
Installed by Universities

Installed by Contractor

Figure A-20
Saint Johns Rest Area
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA20_StJohnsRestArea_InteriorEastWall.vsd
02/27/03

Scale: 3/4" : 1'



Legend

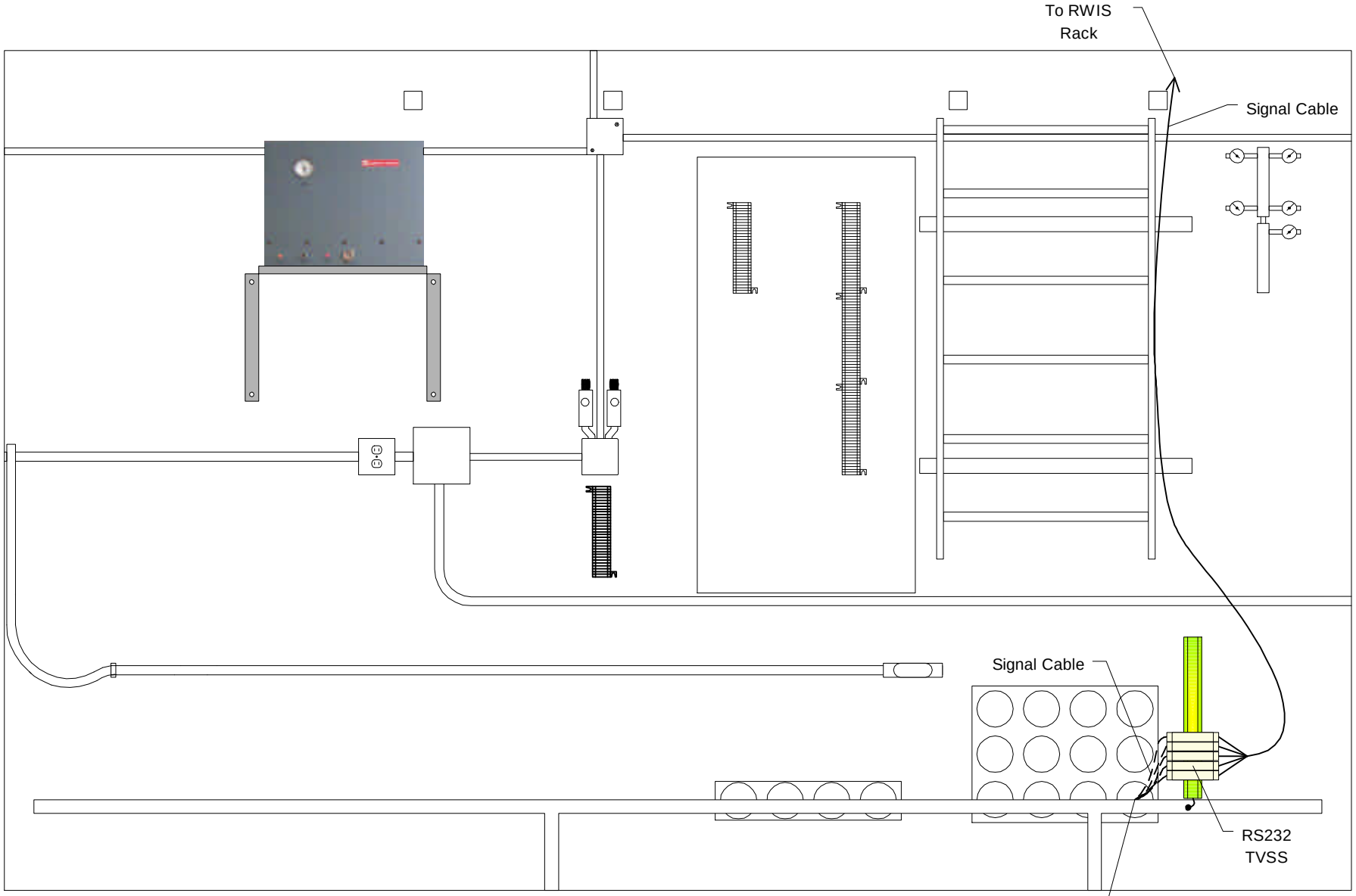
Installed by Universities

Installed by Contractor

Figure A-21
SR16
Interior South Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA21_SR16_InteriorSouthWall.vsd
02/27/03

Scale: 3/4" = 1'-0"



Legend

Installed by Universities

Installed by Contractor

Figure A-22
Gopher Ridge
Interior West Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\UNF-AtmosphericResearch\RWISInstallationSpecs\DataEquipmentInstallation\FigureA22_GopherRidge_InteriorWestWall.vsd
02/27/03

Florida Department of Transportation

Development of a Road Weather Information System (RWIS) for

Florida's Intelligent Transportation System - Phase I

TECHNICAL STATEMENT OF WORK

PART 3

WEATHER SENSOR INSTALLATIONS

ON

MOTORIST AID SYSTEM TOWERS

March 14, 2003

TRANSCORE

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TABLE OF CONTENTS

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1. SCOPE OF SERVICES

This Technical Statement of Work is the third part of a three-part installation for the first phase of a Road Weather Information System (RWIS) research project. This Statement of Work provides technical specifications for the installation of weather sensor packages on various Florida Department of Transportation (FDOT) Motorist Aid System (MAS) communications sites. The work specified herein consists of installation tasks that are required by the microwave maintenance contractor (Contractor) to help implement the first phase of a Road Weather Information System (RWIS) research project. The FDOT commissioned the University of North Florida (UNF) and the Florida State University (FSU), collectively known as the Universities, to conduct the RWIS research project. The project's weather information will be carried over the FDOT digital microwave system. The intent is to provide timely and useful "early warning" weather information to travelers, transportation managers, law enforcement, and emergency managers to ensure safe transportation in both normal and evacuation conditions for residents, visitors, and commerce. Weather data that is detected and generated by equipment installed at 17 sites along I-10, I-75, and I-95, will be carried over the digital microwave circuit and delivered to a network server at Jacksonville FHP. The data will then be collected by UNF's network server (located at the university) via a DSL connection.

As a component to the RWIS project, investigators from the Florida State University (FSU) Departments of Electrical Engineering, Geography, and Meteorology will conduct research related to atmospheric effects on microwave transmissions and on improving road weather forecasting through the use of data provided by the new RWIS. The microwave transmission paths to be studied are between the Quincy FHP and Tallahassee FHP towers, and between the Tallahassee FHP and Monticello DOT towers. These paths were chosen due to their geographic locations and the distances between the towers. Both paths are greater than 20 miles in length and have displayed signal fading problems in the past; therefore, making them ideal candidates for this research project.

The Contractor shall provide all mounting hardware, expendable installation supplies, and the installation work necessary to install the weather sensor packages that will be provided by the Universities as described herein. Figure A-1 in Appendix A is a system diagram that illustrates the location of all tower sites that require the installation of weather sensors, which are the subject of this installation Statement of Work.

The installation of the weather sensor packages and data serial cables, and all associated hardware, on the tower must be neat, secure, and free of sharp bends. The installation must also be in accordance with good engineering practice.

The installation work shall be of high quality and of the type and quantity prescribed by this specification. In all cases, the routing of the wiring and its dressing shall be neat, secure, and free of sharp bends. All cables and wiring shall be cut to appropriate lengths without being too taut or too slack. The Contractor is responsible for the removal of any surplus materials and all other debris from the site at the conclusion of the work activities.

2. APPLICABLE PUBLICATIONS AND STANDARDS

The latest issues of the following publications and standards, unless otherwise specified, shall be part of this installation Statement of Work. In the event of inconsistencies between this Statement of Work and these publications and standards, the requirements of this specification shall take precedence.

A. ASTM: Standard Specification for: Zinc (Hot Galvanized) coatings on products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip.

B. ASTM: Standard Specification for: Zinc coating (hot-dip) on iron or steel hardware.

C. NFPA 70 National Electric Code (NEC).

D. Applicable Manufacturer's Instructions and Standard Practices.

E. Applicable Occupational Safety and Health Administration

3. TERMS

AGC:	Automatic Gain Control
CE&I:	Construction Engineering and Inspection
DSL:	Digital Subscriber Line
FCC:	Federal Communications Commission
FDOT:	Florida Department of Transportation
FDOT Microwave Maintenance Contractor:	TransCore 5744 S. Semoran Blvd. Orlando, FL 32822 Contact: Bill Eatley Telephone: (407) 382-1301
FDOT TGC:	FDOT Telecommunications General Consultant. PB Farradyne, Inc. and RCC Consultants, Inc. 605 Swannee St. MS 90 Tallahassee, FL 32399-0450 Contact: Russell Allen Telephone: 850-410-5626

FSU:	Florida State University 2525 Pottsdamer Street Tallahassee, FL 32310 Contact: Simon Y. Foo, Ph.D. Telephone: 850-410-6474
ITS:	Intelligent Transportation Systems
NEC:	National Electric Code
RSL:	Receive Signal Level
RWIS:	Road Weather Information System
TVSS:	Transient Voltage Surge Suppression
UNF:	University of North Florida 4567 St. Johns Bluff Road, South Jacksonville, FL 32224-2645 Contact: J. David Lambert, Ph.D. Telephone: 904-620-3881
Universities:	UNF and FSU Staff/Contractors
UV:	Ultra Violet
VAC:	Volts Alternating Current

4. SITES OF WORK

The installation materials shall be delivered and installed as outlined in these specifications at the following FDOT communications sites:

1. Quincy FHP (Site # 3-3425)
   2 Miles West of Quincy on US90
   Quincy, FL
   Lat: 30-35-10.2N Lon: 84-37-13.6W NAD83

2. Tallahassee FHP (Site # 3-3424)
   2100 Mahan Drive
   Tallahassee, FL
   Lat: 30-27-18.9N Lon: 84-14-43.2W NAD83

3. Monticello DOT (Site # 3-3423)
   FDOT Maintenance Yard on US19
   Monticello, FL
   Lat: 30-31-45.9N Lon: 83-52-7.5W NAD83

4. Greenville (Site # 2-2514)
   0.6 Miles West of US-221 on I-10
   Greenville, FL
   Lat: 30-26-8.7N Lon: 83-38-16.5W NAD83

5. Falmouth (Site # 2-2510)
   NW Quadrant of US90 & I-10 Intersection (Old Exit 39 / New Exit 275)
   Falmouth, FL
   Lat: 30-20-33.0N Lon: 83-05-25.0W NAD83

6. SR6 (Site # 2-2508)
   NW Quadrant of SR6 & I-75 Intersection
   Jennings, FL
   Lat: 30-31-04.8N Lon: 83-03-27.5W NAD83

7. SR136 (Site # 2-2506)
   NE Quadrant of SR136 & I-75 Intersection (Old Exit 84 / New Exit 439)
   White Springs, FL
   Lat: 30-19-09.0N Lon: 82-48-29.0W NAD83

8. Lake City DOT (Site # 2-2504)
   1650 Lake Jeffrey Road
   Lake City, FL
   Lat: 30-11-42.0N Lon: 82-39-11.0W NAD83

9. US41 (Site # 2-2516)
   NE Quadrant of US41 & I-75 Intersection (Old Exit 80 / New Exit 414)
   Ellisville, FL
   Lat: 25-59-59.0N Lon: 82-35-54.0W NAD83

10. SR222 (Site # 2-2518)
    SW Quadrant of SR222 & I-75 Intersection (Old Exit 77 / New Exit 390)
    Gainesville, FL
    Lat: 29-41-16.0N Lon: 82-26-46.0W NAD83

11. Sanderson (Site # 2-2502)
    SE Quadrant of US90 & I-10 Intersection (Old Exit 45 / New Exit 324)
    Sanderson, FL
    Lat: 30-14-16.0N Lon: 82-18-14.0W NAD83

12. Baldwin DOT (Site # 2-2500)
    FDOT Maintenance Yard on US301
    Baldwin, FL
    Lat: 30-18-27.0N Lon: 81-58-19.0W NAD83

13. Jacksonville FHP (Site # 2-2524)
    Normandy Blvd & I-295 Intersection (Old Exit 7 / New Exit 19)
    Jacksonville, FL
    Lat: 30-17-50.0N Lon: 81-41-11.0W NAD83

14. Yulee (Site # 2-2522)
    NE Quadrant of SR200/A1A & I-95 Intersection (Old Exit 129 / New Exit 373)
    Italia, FL
    Lat: 30-37-13.0N Lon: 81-38-59.0W NAD83

15. St. Johns Rest Area (Site # 2-2526)
    SW Corner of Southbound Rest Area on I-95
    Durbin, FL
    Lat: 30-05-34.0N Lon: 81-30-00.0W NAD83

16. SR16 (Site # 2-2528)
    SW Quadrant of SR16 & I-95 Intersection (Old Exit 95 / New Exit 318)
    St. Augustine, FL
    Lat: 29-55-01.0N Lon: 81-24-45.0W NAD83

17. Gopher Ridge (Site # 2-2530)
    SE Quadrant of US1/SR5 & I-95 Intersection (Old Exit 92 / New Exit 298)
    Marineville, FL
    Lat: 29-39-45.0N Lon: 81-17-12.0W NAD83

5. EXAMINATION OF SITES AND SPECIFICATIONS

The Contractor and the Universities each are required to carefully examine the specifications contained herein and inform themselves thoroughly regarding any and all site conditions and requirements that may, in any manner, affect the work to be performed under this installation Technical Statement of Work.

Notwithstanding the details presented in this specification, it is the responsibility of the Contractor to verify the completeness of the materials required and suitability of mounting devices to meet this specification. Any additional communications equipment and communications hardware required for operation in accordance with these specifications shall be provided and installed by the Universities.

6. CONTRACTOR'S QUALIFICATIONS

The Contractor shall possess the qualifications, skills, and experience necessary to accomplish the work required by this specification without adversely impacting the critical operations of the FDOT's microwave network. These requirements are in addition to the normal contractor licensing requirements of the State of Florida.

7. EQUIPMENT INSTALLATION

7.1 General

The equipment installations required by this specification include, but are not limited to, all of the previously described equipment and services and associated ancillary hardware. All installations shall be accomplished in accordance with good engineering practice.

The FDOT shall provide space for the weather sensor packages on the communications facilities. The Contractor shall install the weather sensor packages at various tower heights in accordance with this installation Statement of Work. The Contractor shall install the wiring to the weather sensor packages and connect them to the associated TVSS devices. The TVSS devices represent the demarcation point between the inside and the outside installations.

The Contractor is required to adhere to FCC Rules, NEC, all local codes, and building regulations. Additionally, the Contractor must perform all work in a manner consistent with good engineering practice. The Contractor is required to coordinate with the FDOT Intelligent Transportation Systems (ITS) Office and the Universities prior to the commencement of any installation work at any FDOT microwave communications site.

7.2 Corrosion Protection

All steel (except for stainless steel) shall be hot-dip galvanized after fabrication per ASTM A123 with a minimum application of two ounces of zinc per square foot of surface area. All hardware and other attachments shall be galvanized per ASTM A153.

7.3 Equipment and Materials List

The Universities will provide to the Contractor the following equipment/materials prior to beginning any installation work.

Item	Description	Manufacturer	Part Number	Qty
Configuration 1				
1	Data Logger inside Weatherproof Box	Coastal Environmental	Zeno 3200	3
2	Aspirator (Temperature and Relative Humidity)	Coastal Environmental	S1276Z	15
3	Anemometer	Coastal Environmental	S5777	6
4	Junction Box	Custom	N/A	15
Configuration 2				
5	Capricorn 2000 Kit	Columbia Weather Systems	8150-D-1	14
6	Self Aspirating Radiation Shield	Columbia Weather Systems	82103	14
7	Relative Humidity	Columbia Weather Systems	82201	14
8	Precipitation Sensor	Columbia Weather Systems	82300	14
All Sites				
9	4” Boot Assembly w/ one 1-1/4” Cushion Port	Microflect (Tessco)	B1152A (22195)	14
10	4” Boot Assembly w/ four 1-1/4” Cushion Ports	Microflect (Tessco)	B1566 (92005)	1
11	1-1/4” Cushion Port Plug (5 pk.)	Wireless Solutions (Tessco)	WCP-114 (69346)	1
12	Roof Entry Boot Sealer	Microflect (Tessco)	B1177 (22919)	4
13	Sealing Tape	Microflect	B299	Lot

7.4 Installation

This pilot project is being undertaken through a joint effort of the FDOT ITS Office and the Universities, utilizing their respective general staff, consultants, and sub-contractors for requisition of the materials and execution of the installation work.

The Contractor will perform the tasks required to install the weather sensor packages. The Universities' staff and sub-contractors will provide on-site guidance to the Contractor during the installation work. The Universities' staff will provide the weather sensors hook-up and wiring details to the Contractor. The Contractor shall mount all weather sensors and connect all wires from the sensors to the unprotected side of the TVSS device previously installed by the Universities (See Figure A-4). The TVSS device will serve as the installation demarcation point for the Contractor.

Additionally, the FDOT TGC will perform the Construction Engineering and Inspection (CE&I) for all installation activities.

7.5 Weather Sensor Package Mounting

All mounting brackets, platforms, and hardware for the weather sensor packages shall be stainless steel or hot-dipped galvanized metal. All bracket and hardware material lists and designs must be submitted to the FDOT for pre-approval.

The Universities shall provide all weather sensor packages, signal cables, power cables, and connecting hardware as listed in Section 7.3. The Contractor shall provide all mounting brackets and associated hardware to mount the weather sensors and associated cabling to the tower. (Refer to Appendix B for weather sensors photos).

7.6 Weather Sensor Package Data/Power Cabling

If the cabling is not housed in metallic conduit, then the cabling must be UV protected, and listed for outdoor use. All cabling must be approved by the ITS Office. The cabling/conduit must be supported and attached to the transmission line bridge and tower ladder with stainless steel (or hot-dipped galvanized metal) hardware. The spacing between supports shall be a maximum of 3 feet. All stainless steel (or hot-dipped galvanized metal) support hardware shall be sized appropriately to the corresponding cabling and conduit. If the appropriate size support hardware is not available for the cabling, then the cabling shall be wrapped with outdoor-rated sealing tape to accommodate for the size difference. All conduits entering the communications shelter shall be plugged and sealed.

The Universities shall provide all weather sensor packages, signal cables, power cables, and connecting hardware as listed in Section 7.3. The Contractor shall provide all mounting brackets and associated hardware to mount the weather sensors and associated cabling to the tower. (Refer to Appendix B for weather sensors photos).

7.7 Transmission Line Bridge Installation

The cabling/conduit must be supported and attached to the transmission line bridge with stainless steel (or hot-dipped galvanized metal) hardware. The spacing between supports shall be a maximum of 3 feet. All cabling/conduit must be installed at an upward slope from the tower to the entry port, or contain a drip loop for water runoff.

The Universities shall provide all weather sensor packages, signal cables, power cables, and connecting hardware as listed in Section 7.3. The Contractor shall provide all mounting brackets and associated hardware to mount the weather sensors and associated cabling to the tower. (Refer to Appendix B for weather sensors photos).

7.8 Entry Port Installation

All data/power cabling and metallic conduits shall enter the shelter through entry ports, in accordance with the site specific requirements, as shown in Appendix A. All entry ports shall be sealed with entry port boot assemblies or roof entry boot sealer, in accordance with the site specific requirements, as shown in Appendix A.

All conduits entering the shelters shall be watertight. All conduits shall be sealed at the end with expanding foam spray, or approved equivalent.

7.9 Grounding

Installation practices for the FDOT sites must meet the requirements herein to ensure compliance with FDOT construction practices.

All metallic conduits entering the equipment room shall be grounded to the site grounding system.

7.10 Site Specific Installations

The work specified in this section shall be done in accordance with the equipment and hardware installation parameters provided herein. These parameters include, but are not limited to, weather sensor package placement, and weather sensor package installation.

All weather sensor equipment shall be installed in accordance with the site specific requirements.

This section comprises two subsections. The first subsection lists the installation requirements for the three tower sites that FSU will be using for their research. These tower sites are Quincy FHP, Tallahassee FHP, and Monticello DOT, which will be referred to as “Configuration 1” sites. The second subsection lists the installation

requirements for the remaining tower sites, which will be referred to as "Configuration 2" sites.

All weather sensor devices must be secured to the towers in accordance with good engineering practices. Positioning of tower weather sensor devices are shown in the site specific figures in Appendix A. Positioning of the precipitation sensors shall be on the transmission line bridge at all Configuration 2 sites as shown in Figure A-14 (location to be determined on-site). All sensors shall be mounted level and true in three-dimensional space. All anemometer sensor devices shall be oriented referenced to true North.

7.10.1 Configuration 1 (FSU Sensors)

The Contractor shall install the weather sensor packages at the Configuration 1 sites, in accordance with the site specific requirements as shown in Appendix A. The temperature and relative humidity sensors with their associated aspirator shall be mounted with a minimum horizontal separation of 2-feet from the tower leg. The anemometer sensors shall be mounted with a minimum horizontal separation of 3-feet from the tower leg. A minimum vertical separation of 12-inches shall separate the anemometer and the aspirator at both the 35-foot and 200-foot weather sensor package. The aspirator shall be mounted above the anemometer. The Contractor shall mount the data logger on the tower leg, and install separate metallic conduits into the shelter for power and signal cabling (See Figures A-2, A-3, A-7, A-10 and A-13). The weather sensors shall be connected to the data loggers using UV protected cables that are listed for outdoor use.

The Universities' staff and sub-contractors will provide on-site guidance to the Contractor during the installation work. The Universities' staff will provide weather sensors hook-up and wiring details to the Contractor. The Universities shall also be responsible for appropriate connections to the TVSS devices.

Additionally, the Contractor shall interface the Receive Signal Level (RSL) monitoring devices, previously installed by the Universities, to the Automatic Gain Control (AGC) on the microwave radios.

7.10.1.1 Configuration 1 Power Hook Up

The Universities shall be responsible for the power hook-up inside the shelter at all communications sites.

7.10.2 Configuration 2 (Integrated Sensors)

The Contractor shall install the weather sensor packages at the Configuration 2 sites, in accordance with the site specific requirements as shown in Appendix A. Each weather sensor package consists of a temperature and relative humidity sensor with its respective aspirator and an anemometer. The aspirators and the anemometers shall be installed on a vertical mounting pipe with a minimum vertical separation of 12-inches. The aspirator shall be mounted above the anemometer. The weather sensor packages shall be installed with a minimum horizontal separation of 3-feet from the tower leg. Positioning of the precipitation sensors shall be on the transmission line bridge and shall be determined on-site as shown in Figure A-14.

All outdoor weather sensor cabling shall be housed in rigid metallic conduit. A moisture proof, cast aluminum round junction box with drain fitting shall be installed at the end of the vertical run of the metallic conduit as show in Figures A-14 and A-15. The purpose of the fitting is to drain moisture caused by condensation.

The Universities' staff and sub-contractors will provide on-site guidance to the Contractor during the installation work. The Universities' staff will provide hook-up and wiring details for the weather sensors to the Contractor. The Universities shall also be responsible for appropriate connections to the TVSS devices.

7.10.2.1 Configuration 2 Power Hook Up

The Universities shall be responsible for the power hook-up inside the shelter at all communications sites.

7.11 Installation Inspections

7.11.1 General

The FDOT's Telecommunications General Consultant (TGC) shall be present to oversee and inspect the installation of the weather sensor packages. The Universities and the Contractor shall notify the individuals listed below of the start of work a minimum of 10 working days in advance. The TGC has the authority to stop work at the site if the work is not being performed in a manner consistent with these specifications or is being performed in an unsafe manner.

Name	Organization	Telephone Number
Nick Adams	Florida Department of Transportation	(850) 410-5608
Terry Posey	RCC Consultants, Inc.	(850) 410-5611
Russell Allen	RCC Consultants, Inc.	(850) 410-5626

8. AS-BUILT DOCUMENTATION

The Contractor shall provide detailed updated as-built documentation to the FDOT ITS Office upon completion of this project in both hard and soft copy formats. The as-built documentation shall, at a minimum, consist of the following information:

1) Tower loading diagrams showing the height (to the nearest foot) and tower leg placement of the weather sensor packages.

2) Exterior and Interior walls modified as part of this project.

APPENDIX A

FIGURES

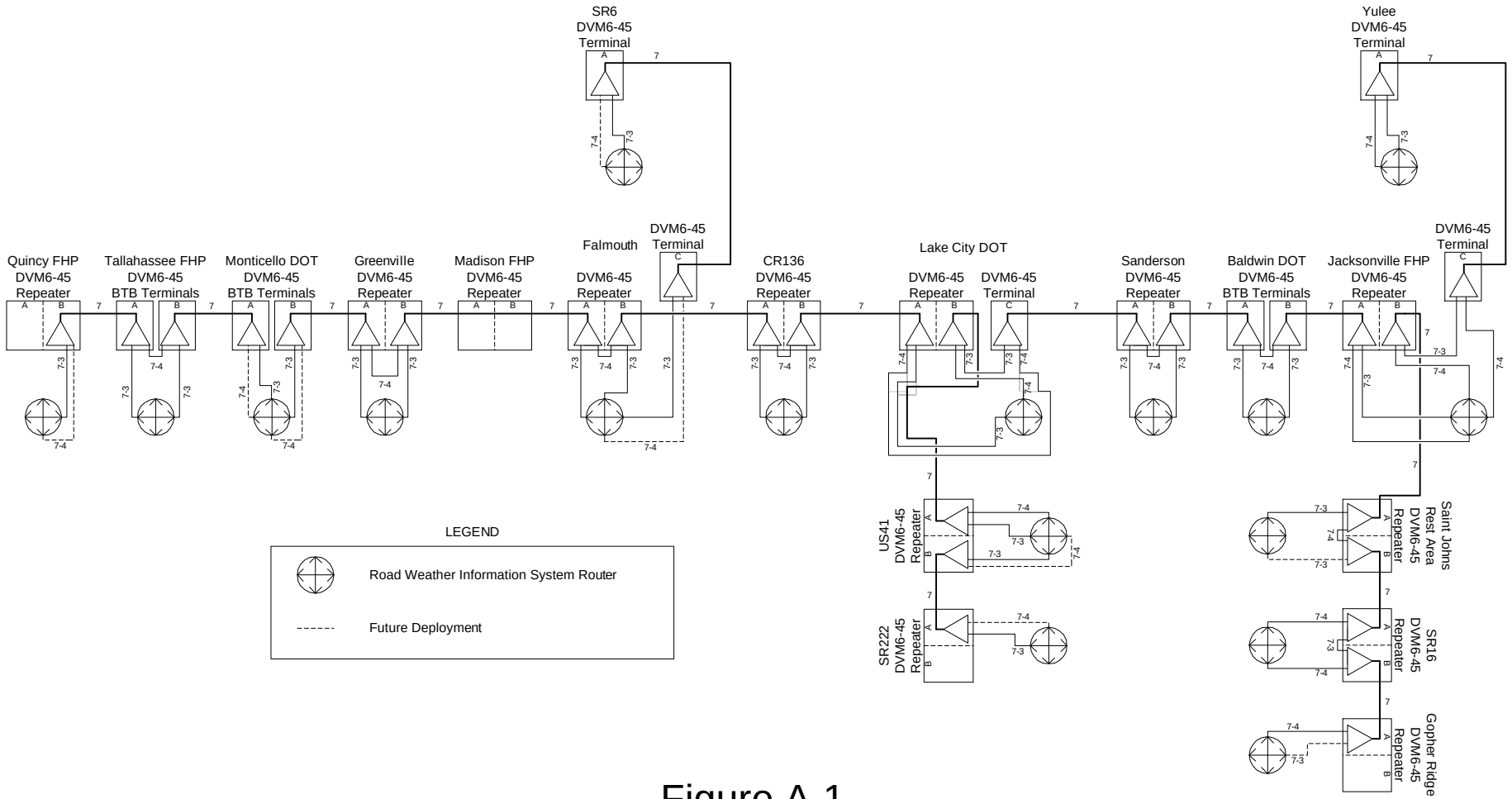


Figure A-1
Road Weather Information System
Physical Network Configuration

NOT TO SCALE

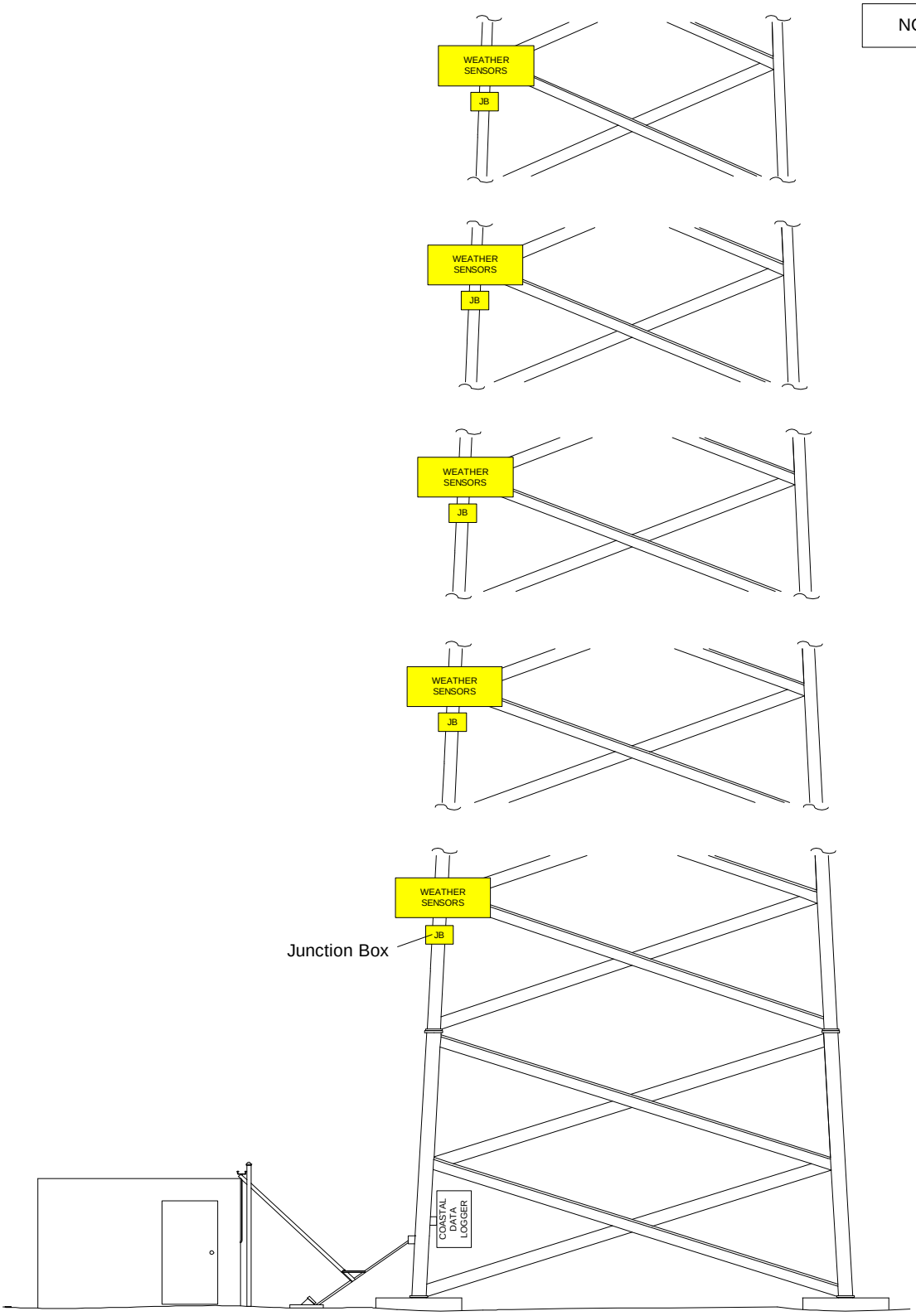


Figure A-2
Configuration 1
(FSU Sensors)
Exterior Equipment Installation Diagram

Not To Scale

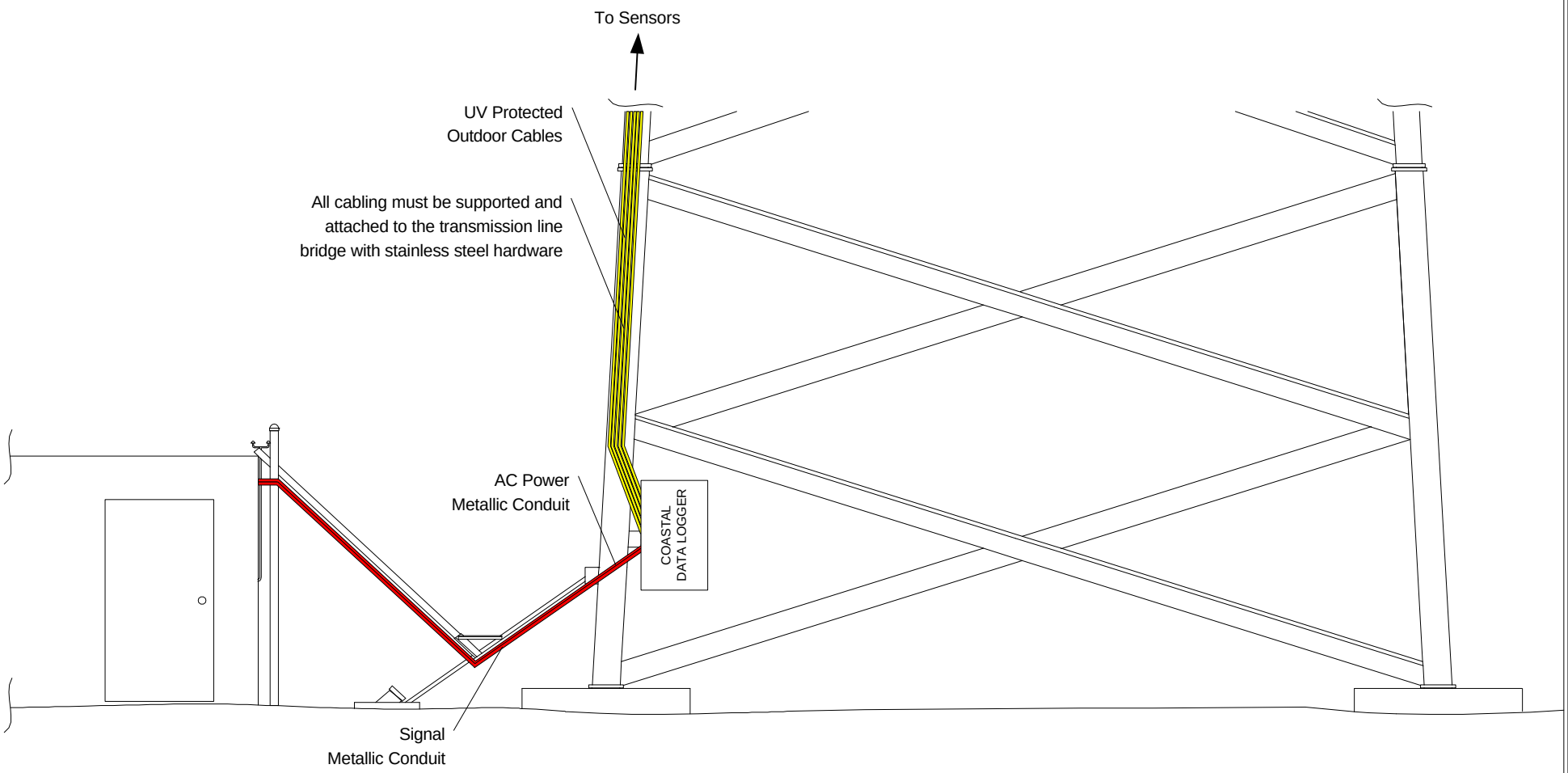


Figure A-3
Configuration 1
(FSU Sensors)
Data Logger Installation Diagram

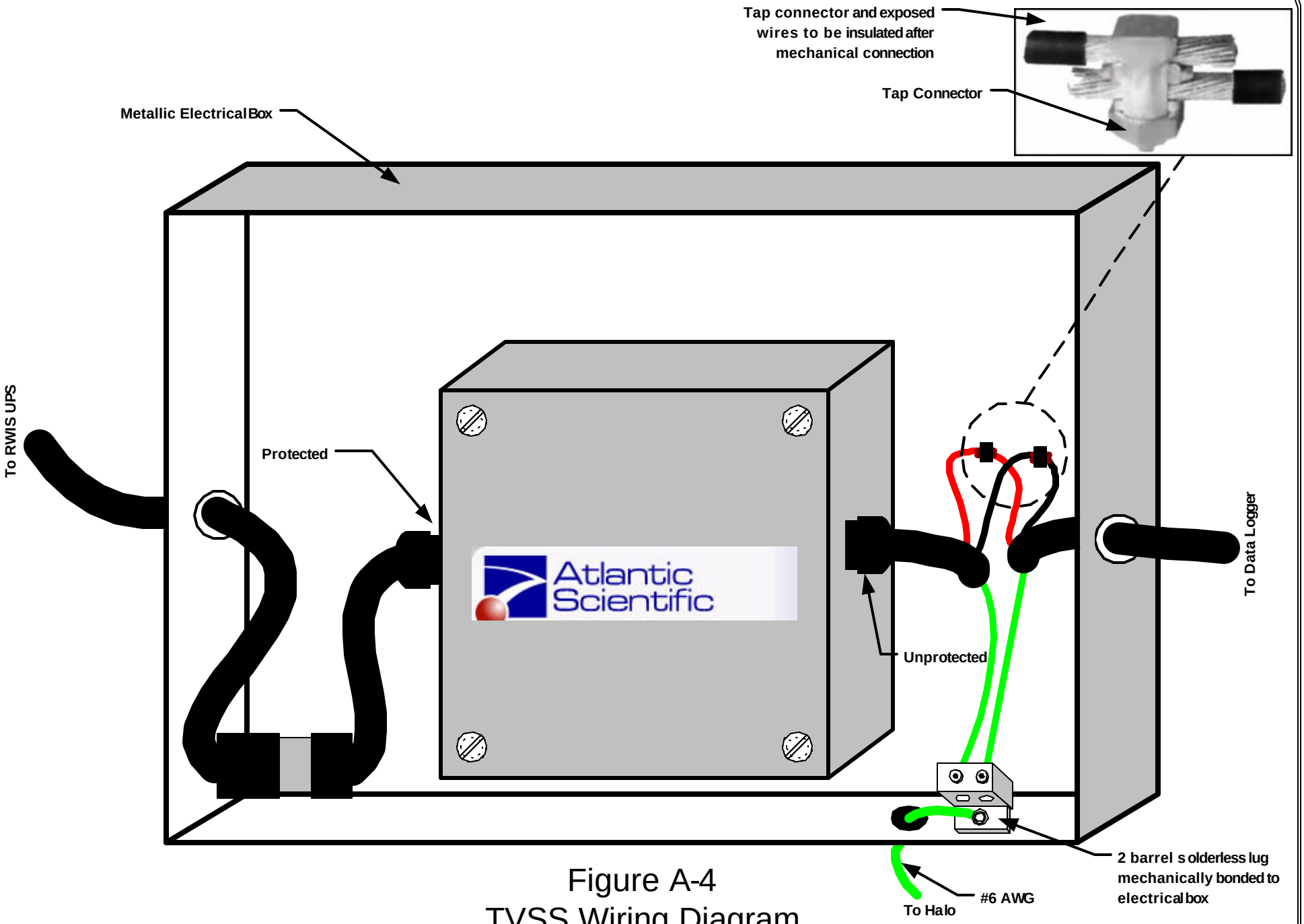
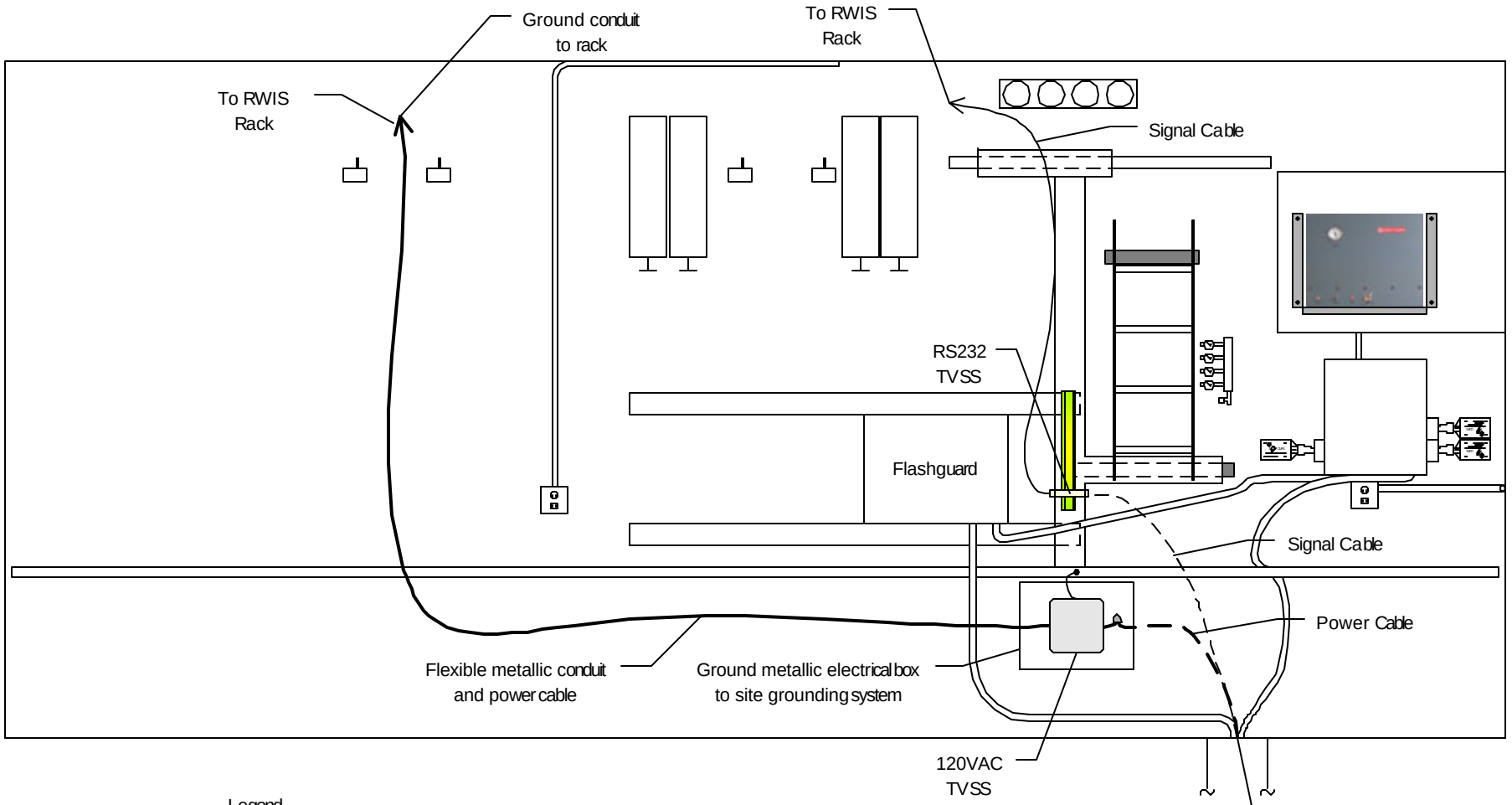


Figure A-4
TVSS Wiring Diagram

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\ FigureA04_TVSSWiringDiagram.vsd
02/11/03

Scale: 1/2" = 1'-0"



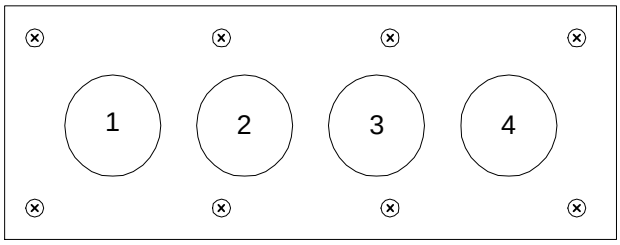
Legend

Installed by Universities

Installed by Contractor

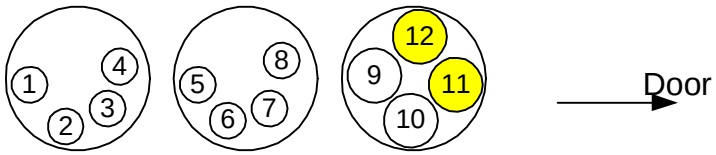
Figure A-5
Quincy FHP
Interior East Wall

Scale: 1 1/2" = 1'-0"



1.-4. Andrew Heliax EW-63 elliptical waveguide

Exterior View

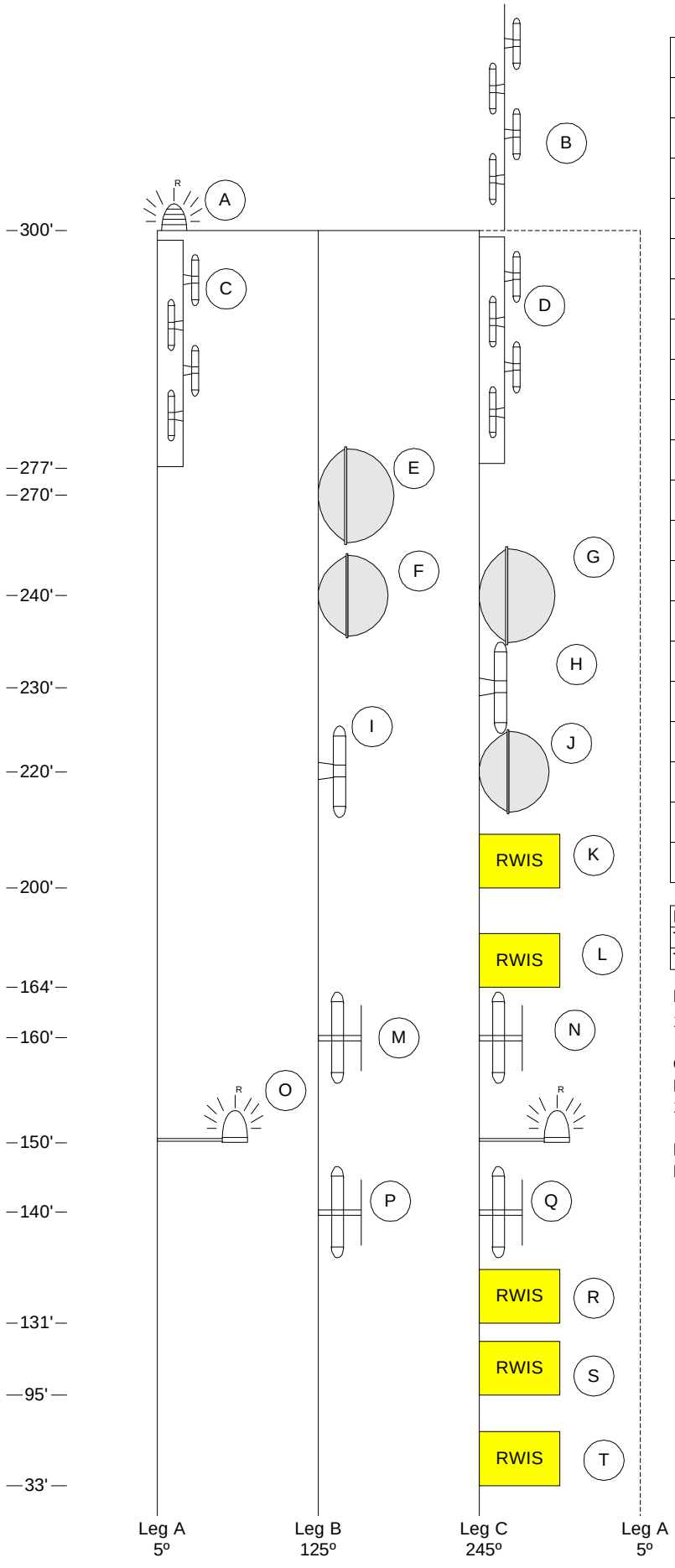


1.-3. 1" coaxial
4. 1/2" coaxial
5. 2" coaxial
6. 1" coaxial
7.-8. 1/2" coaxial
9. 1" flexible conduit (tower lights)
10. 1" flexible conduit (tower lights)
11. RWIS SERIAL CABLES TO BE INSTALLED IN METALLIC CONDUIT
12. RWIS POWER CABLE TO BE INSTALLED IN METALLIC CONDUIT

Interior View (Floor Entry Ports)

Figure A-6
Quincy FHP
Entry Port Diagram

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Strobe	A	300' (Base)	-	-	-	
B	DB-224E	C	300' (Base)	-	3.15	7/8"	
C	DB-224E	A	277' (Base)	-	3.15	7/8"	
D	DB-224E	C	277' (Base)	-	3.15	7/8"	
E	P8-65D	B	270' (C.L.)	-	-	EW-63	
F	P6-65D	C	240' (C.L.)	-	-	EW-63	
G	P8-65D	B	240' (C.L.)	-	-	EW-63	
H	DB-212	C	230' (C.L.)	-	-	1/2"	
I	DB-212	B	220' (C.L.)	-	-	1/2"	
J	P6-65D	C	220' (C.L.)	-	-	EW-63	
K	Temp/RH (S1267Z) Anemometer (S5777)	C	200' (C.L.)	-	-	-	1
L	Temp/RH (S1267Z)	C	164' (C.L.)	-	-	-	1
M	DB-212	B	160' (C.L.)	-	-	1/2"	
N	DB-212	C	160' (C.L.)	-	-	1/2"	
O	Side Beacons	A, C	150' (Base)	-	-	-	
P	DB-212	B	140' (C.L.)	-	-	1/2"	
Q	DB-212	C	140' (C.L.)	-	-	1/2"	
R	Temp/RH (S1267Z)	C	131' (Base)	-	-	-	1
S	Temp/RH (S1267Z) Anemometer (S5777)	C	95' (Base)	-	-	-	1
T	Temp/RH (S1267Z)	C	33' Base)	-	-	-	1

FCC Registration #	1065296	Tower Manufacturer	Andrew Corporation
Tower Model Number	LST		
Tower Serial Number	LI-0350-12	Tower Light Controllers	Dual: Honeywell/FC&T

Notes:

1) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
EW-63	Andrew Corporation Elliptical Waveguide
1/2", 7/8"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
DB-XXX	Decibel Products Antenna
PX-65D	Andrew Corporation Microwave Antenna

Figure A-7
Quincy FHP
Antenna Loading Diagram

Quincy FHP
March 11, 2003
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA07_QuincyFHP_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/8" = 1'

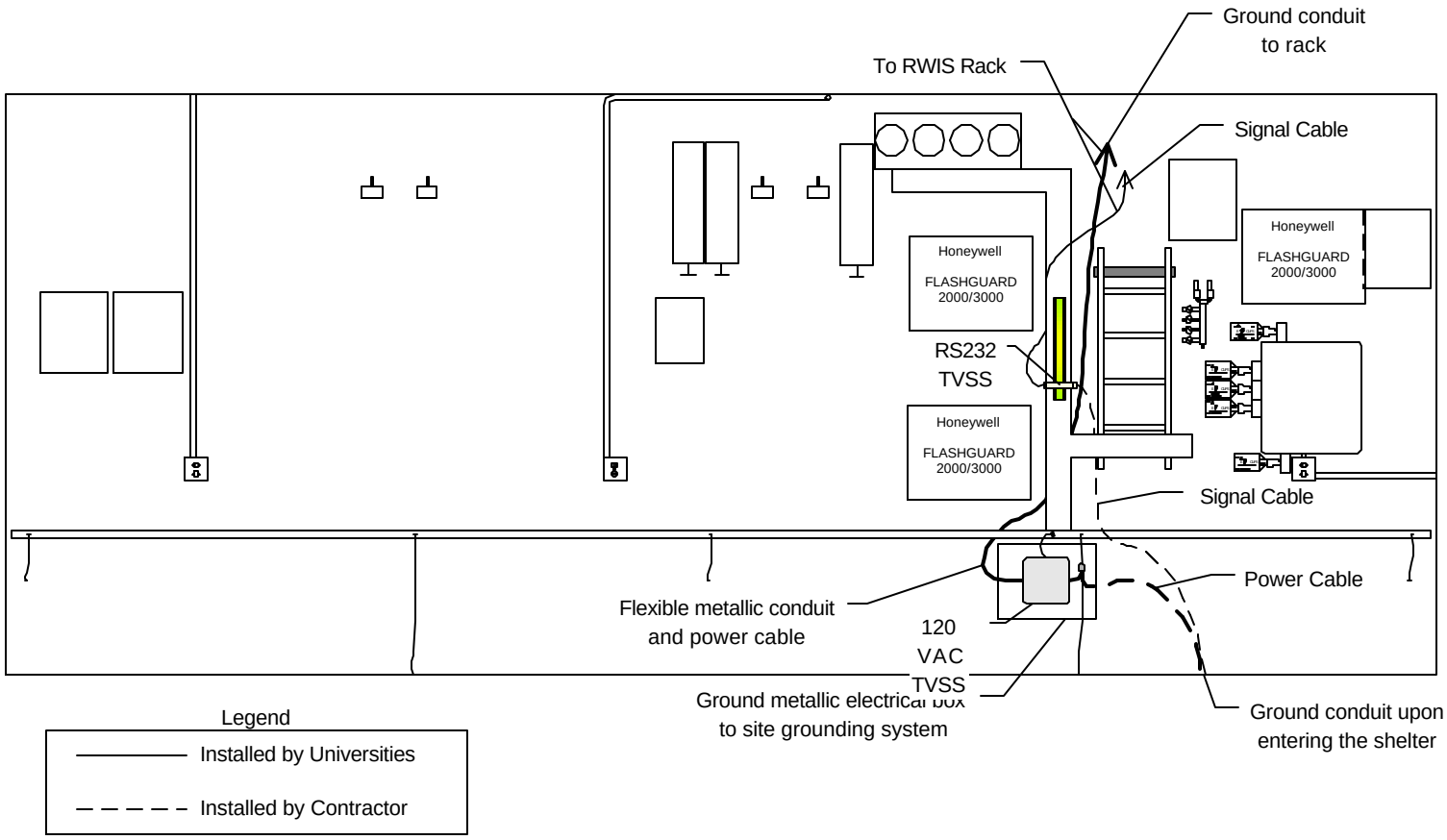
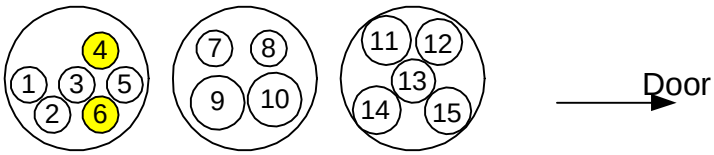


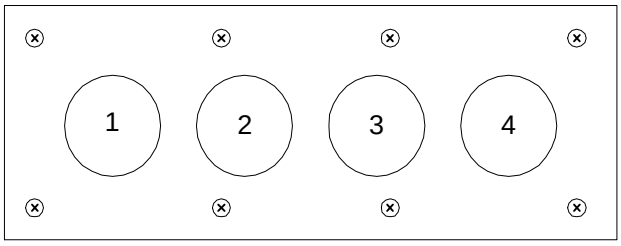
Figure A-8
Tallahassee FHP
Interior South Wall

Scale: 1 1/2" = 1'-0"



1. 3/4" metallic flexible conduit (tower lights)
2. Andrew Heliax LDF5-50A coaxial
3. Andrew Heliax LDF5-50A coaxial
4. RWIS SERIAL CABLES TO BE INSTALLED IN METALLIC CONDUIT
5. 3/4" metallic flexible conduit (tower lights)
6. RWIS POWER CABLE TO BE INSTALLED IN METALLIC CONDUIT
7. Andrew Heliax LDF4-50A coaxial Connected to DB-214 at 160'
8. Andrew Heliax LDF4-50A coaxial Connected to DB-214 at 140'
9. Andrew RG-319A/UHJ7-50A coaxial Disconnected from GP10F 18A at 292'
10. Andrew RG-319A/UHJ7-50A coaxial Disconnected from GP10F 18A at 285'
11. 1/2" metallic flexible conduit (automatic transfer switch)
12. 3/4" metallic flexible conduit (automatic transfer switch)
13. 3/4" metallic flexible conduit (tower lights)
14. Andrew Heliax LDF5-50A coaxial cable Connected to FDOT's 47 MHz base station
15. RFS Cablewave Systems FLC 78-50J coaxial Connected to Dept. of Agriculture's base station

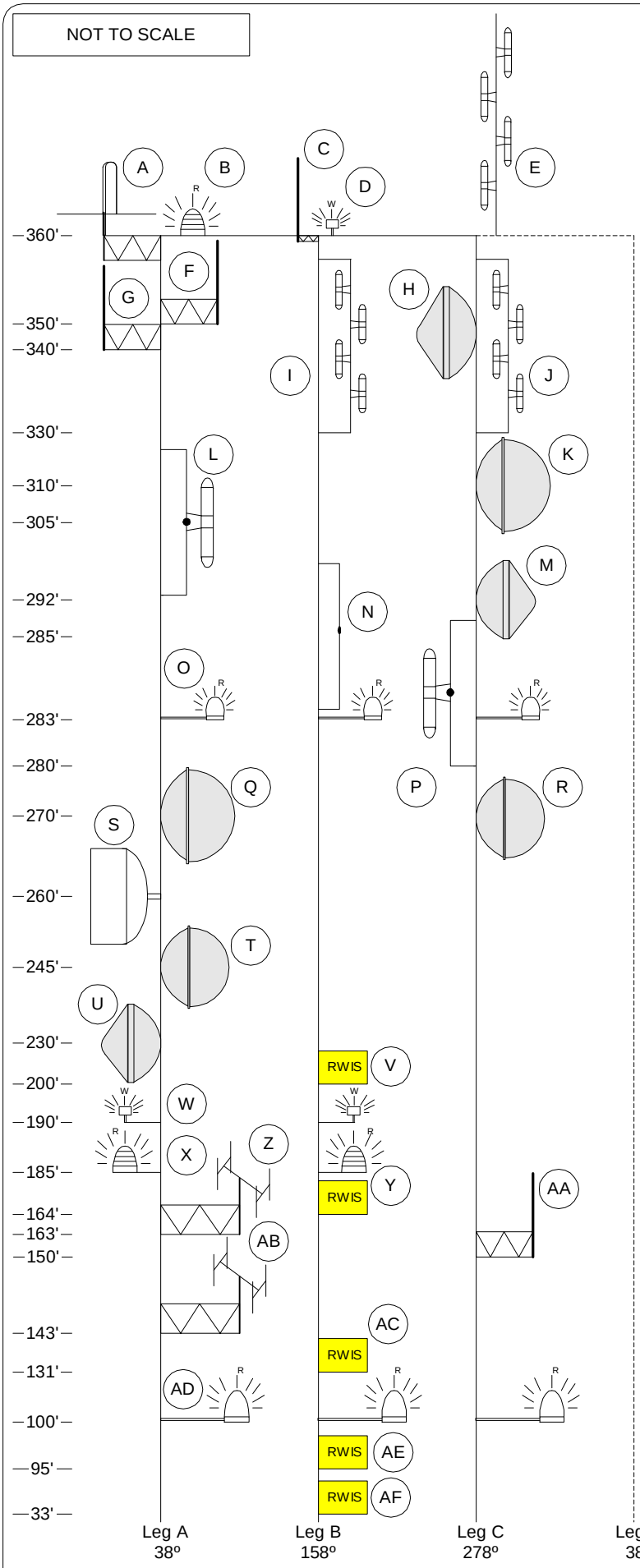
Interior View (Floor Entry Ports)



1. Andrew Heliax EW63 eliptical waveguide (Quincy FHP Main)
2. Andrew Heliax EW63 eliptical waveguide (Quincy FHP Diversity)
3. Andrew Heliax EW63 eliptical waveguide (Monticello DOT Main)
4. Andrew Heliax EW63 eliptical waveguide (Monticello DOT Diversity)

Exterior View

Figure A-9
Tallahassee FHP
Entry Port Diagram



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	DB201	A	360' (Base)	-	0.8	7/8"	1
B	Red Beacon	A	360' (Base)	-	-	-	
C	Monopole	B	360' (Base)	-	-	-	
D	White Strobe	B	360' (Base)	-	-	-	
E	DB224	C	360' (Base)	-	3.15	7/8"	
F	Monopole	A	350' (Base)	-	-	-	2
G	Monopole	A	350' (Base)	-	-	-	2
H	PA8-65	C	350' (C.L.)	-	-	WE-65	
I	DB224	B	330' (Base)	-	3.15	7/8"	
J	DB224	C	330' (Base)	-	3.15	7/8"	
K	P8-65D	C	310' (C.L.)	-	-	WE-65	
L	DB212	A	305' (C.L.)	-	-	1/2"	
M	PA6-65	C	293' (C.L.)	-	-	WE-65	
N	Bracket	B	285' (C.L.)	-	-	-	
O	Red - Side Beacons	A, B, C	283' (Base)	-	-	-	
P	DB212	A	280' (Base)	-	-	1/2"	
Q	P8-65D	A	270' (C.L.)	-	-	EW-63	
R	P6-65D	C	270' (C.L.)	-	-	EW-63	
S	10' RFS HP Dish	A	260' (C.L.)	-	-	-	
T	P6-65D	A	245' (C.L.)	-	-	EW-63	
U	PA6-65	A	230' (C.L.)	-	-	WE-65	
V	Temp/RH (S1276Z) Anemometer (S5777)	B	200' (Base)	-	-	-	3
W	White - Side Strobes	A, B	190' (Base)	-	-	-	
X	Red - Side Beacons	A, B	185' (Base)	-	-	-	
Y	Temp/RH (S1276Z)	B	164' (Base)	-	-	-	3
Z	DB214	A	163' (Base)	-	-	1/2"	2
AA	Monopole	C	150' (Base)	-	-	-	
AB	DB214	A	143' (Base)	-	-	1/2"	2
AC	Temp/RH (S1276Z)	B	131' (Base)	-	-	-	3
AD	Red - Side Beacons	A, B, C	100' (Base)	-	-	-	
AE	Temp/RH (S1276Z) Anemometer (S5777)	B	95' (Base)	-	-	-	3
AF	Temp/RH (S1276Z)	B	33' (Base)	-	-	-	3

FCC Registration #	1065297	Tower Manufacturer	Andrew Corporation
Tower Model Number	3ST		
Tower Serial Number	SI-0350-11	Tower Light Controllers	Dual: Honeywell/FC&T

Notes:

1) This antenna is mounted on a three-foot (3') sidearm.
2) This antenna is mounted on a ten-foot (10') sidearm.
3) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
7/8" 1/2"	Coaxial Transmission Line
EW-63	Andrew Corporation Elliptical Waveguide
WE-65	RFS Cablewave Systems Elliptical Waveguide
DB-XXX	Decibel Products Antenna
PX-65D	Andrew Corporation Microwave Dish
PA8-65	RFS Cablewave Systems Microwave Dish

Figure A-10
Tallahassee FHP
Antenna Loading Diagram

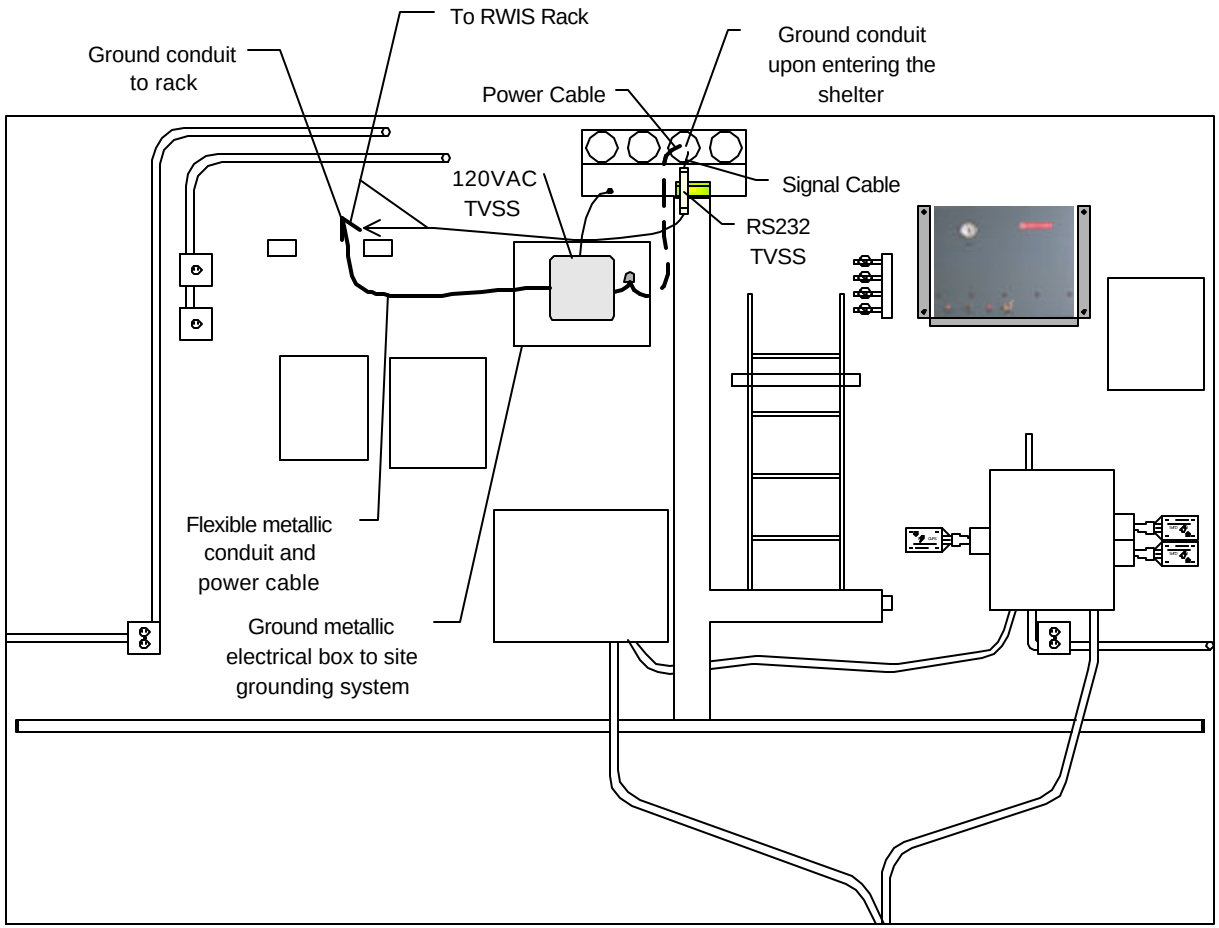
Tallahassee FHP
January 09, 2003
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA10_TallahasseeFHP_AntennaLoadingDiagram.vsd
02/11/03

Scale: 1/2" = 1'-0"



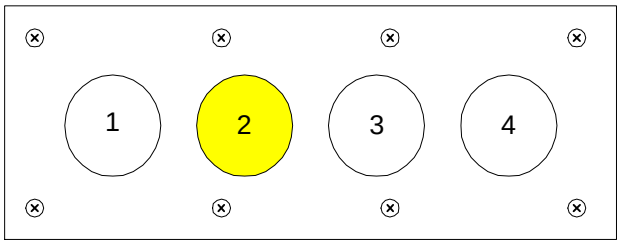
Legend

Installed by Universities

Installed by Contractor

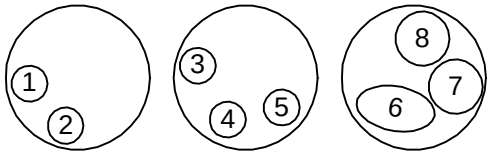
Figure A-11
Monticello DOT
Interior East Wall

Scale: 1 1/2" = 1'-0"



1. Empty
2. RWIS SERIAL AND POWER CABLES TO BE INSTALLED IN METALLIC CONDUIT
3.-4. Andrew Heliax EW-63 elliptical waveguide

Exterior View

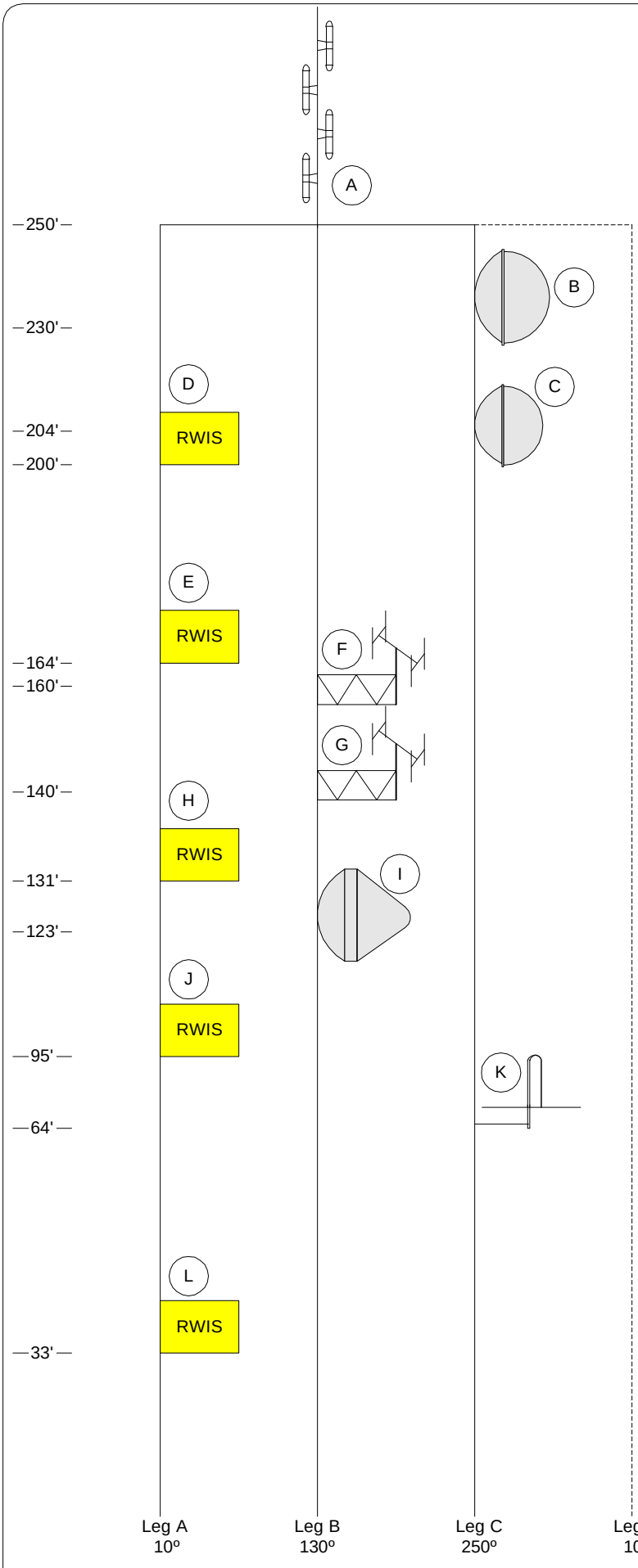


1. - 5. Andrew Corporation Heliax LDF4-50A Coaxial
6. RFS Cablewave Systems WE-65
7. - 8. 1" Flexible Conduit (Tower Light Controller)

Interior View (Floor Entry Ports)

Figure A-12
Monticello DOT
Entry Port Diagram

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	DB-224	B	250' (Base)	-	3.15	-	
B	P8-65D	C	230' (C.L.)	257.3	-	EW-63	
C	P6-65D	C	204' (C.L.)	257.3	-	EW-63	
D	Temp/RH (S1276Z) Anemometer (S5777)	A	200' (Base)	-	-	-	3
E	Temp/RH (S1276Z)	A	164' (Base)	-	-	-	3
F	DB214	B	160' (Base)	90	3.0	5/8	1
G	DB-214	B	140' (Base)	180	3.0	5/8"	2
H	Temp/RH (S1276Z)	A	131' (Base)	-	-	-	3
I	PA8-65	B	123' (C.L.)	115.1	-	WE-65	
J	Temp/RH (S1276Z) Anemometer (S5777)	A	95' (Base)	-	-	-	3
I	DB-201	C	64' (Base)	-	0.8	5/8"	
G	Temp/RH (S1276Z)	A	33' (Base)	-	-	-	3

FCC Tower Registration	1065299
Tower Manufacturer	Andrew Corporation
Tower Model Number	LST
Tower Serial Number	LI-0350-10
Tower Light Controllers	Dual: Honeywell/FC&T

Notes:

1) This antenna is mounted on a six-foot (6') side arm. The base of the antenna is at 160 feet.
2) This antenna is mounted on a six-foot (6') side arm. The base of the antenna is at 140 feet.
3) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
EW-63	Andrew Corporation Elliptical Waveguide
DB-XXX	Decibel Products Antenna
PX-65D	Andrew Corporation Microwave Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna
5/8"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series

Figure A-13
Monticello DOT
Antenna Loading Diagram

Monticello DOT
March 7, 2003
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA13_MonticelloDOT_AntennaLoadingDiagram.vsd
02/11/03

NOT TO SCALE

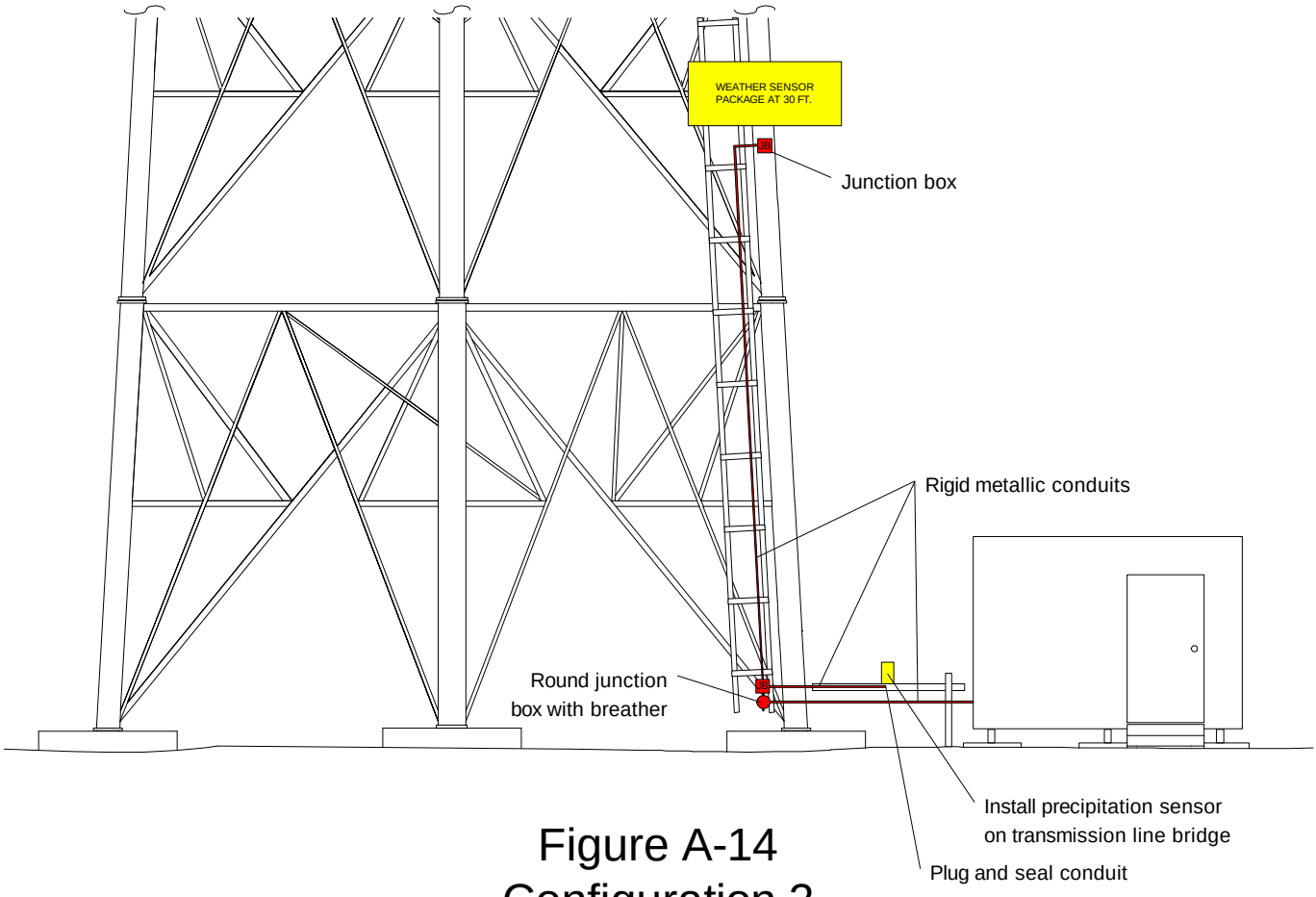


Figure A-14
Configuration 2
(Integrated Sensors)
Exterior Equipment Installation Diagram

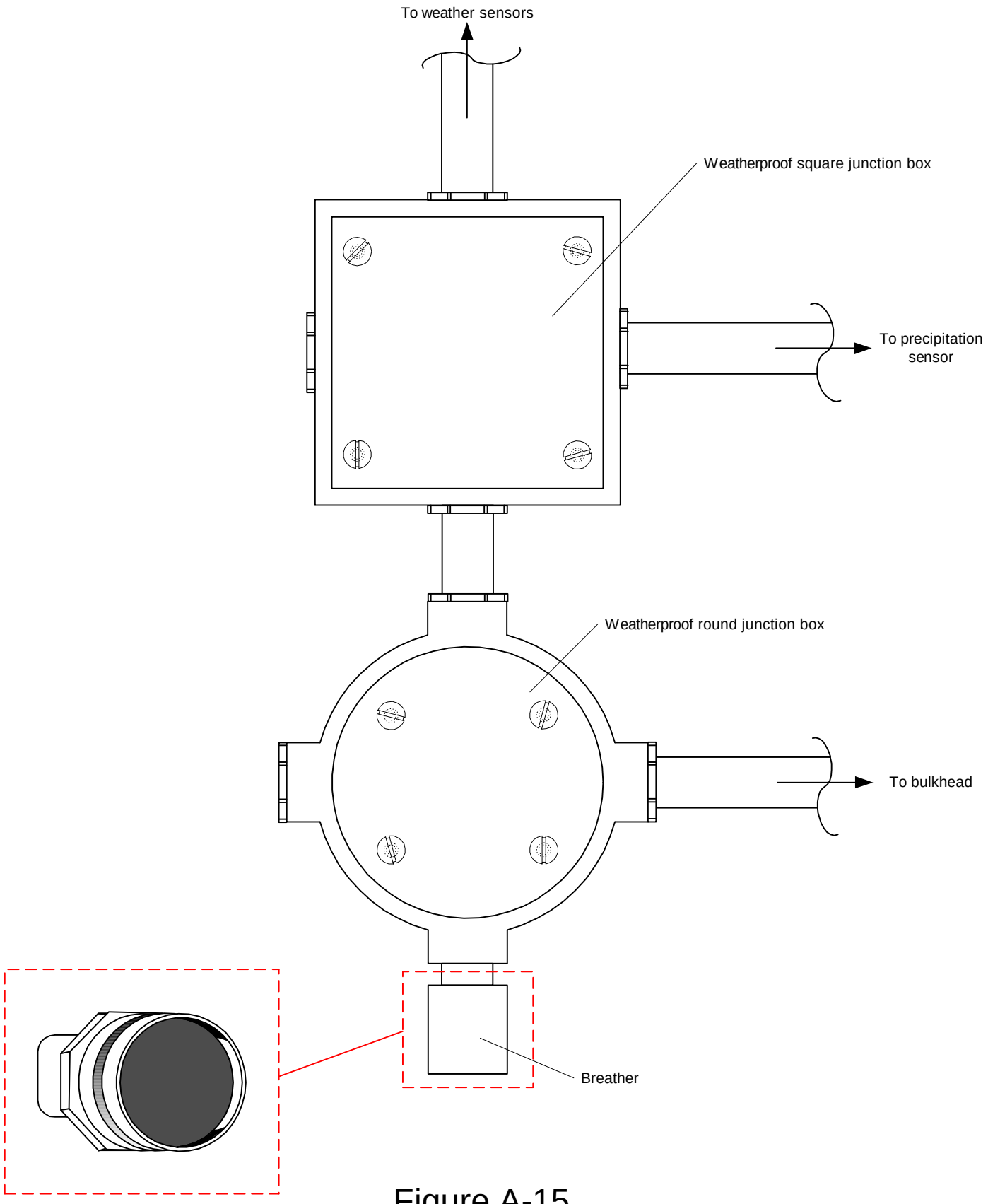
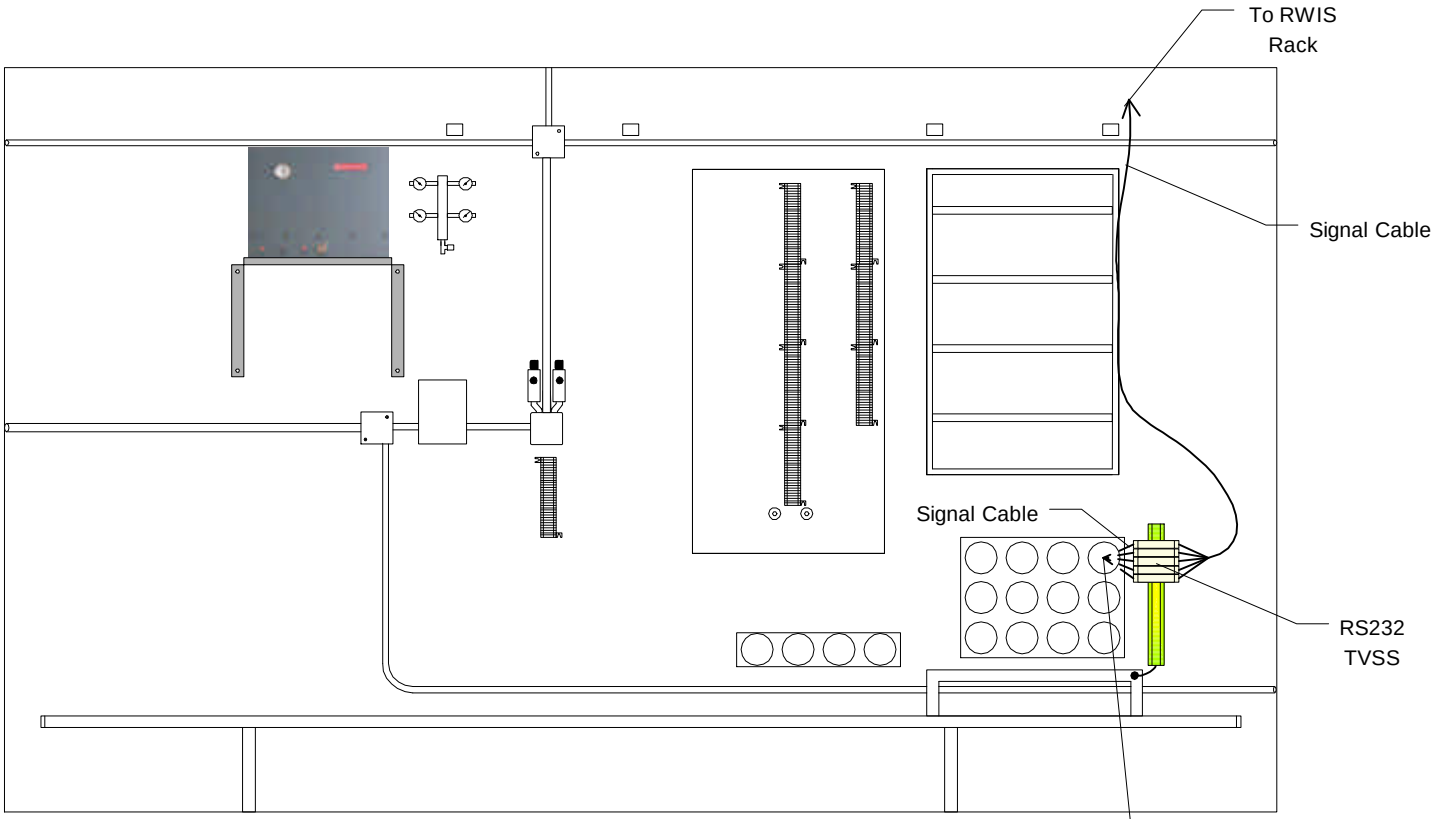


Figure A-15
Configuration 2
Conduit Installation

Scale: 1/2" = 1'-0"



Legend

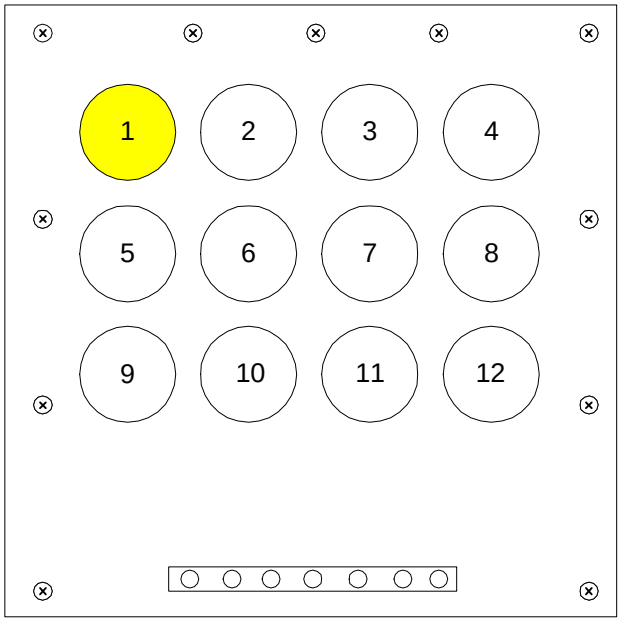
Installed by Universities

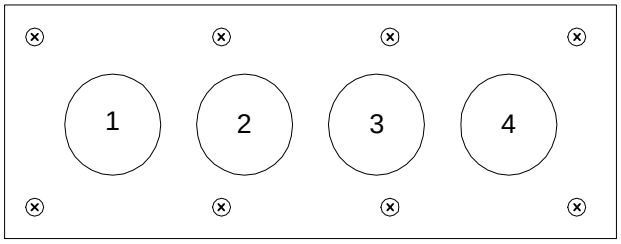
Installed by Contractor

Figure A-16
Greenville
Interior West Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA16_Greenville_InteriorWestWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"





1.-4. Empty

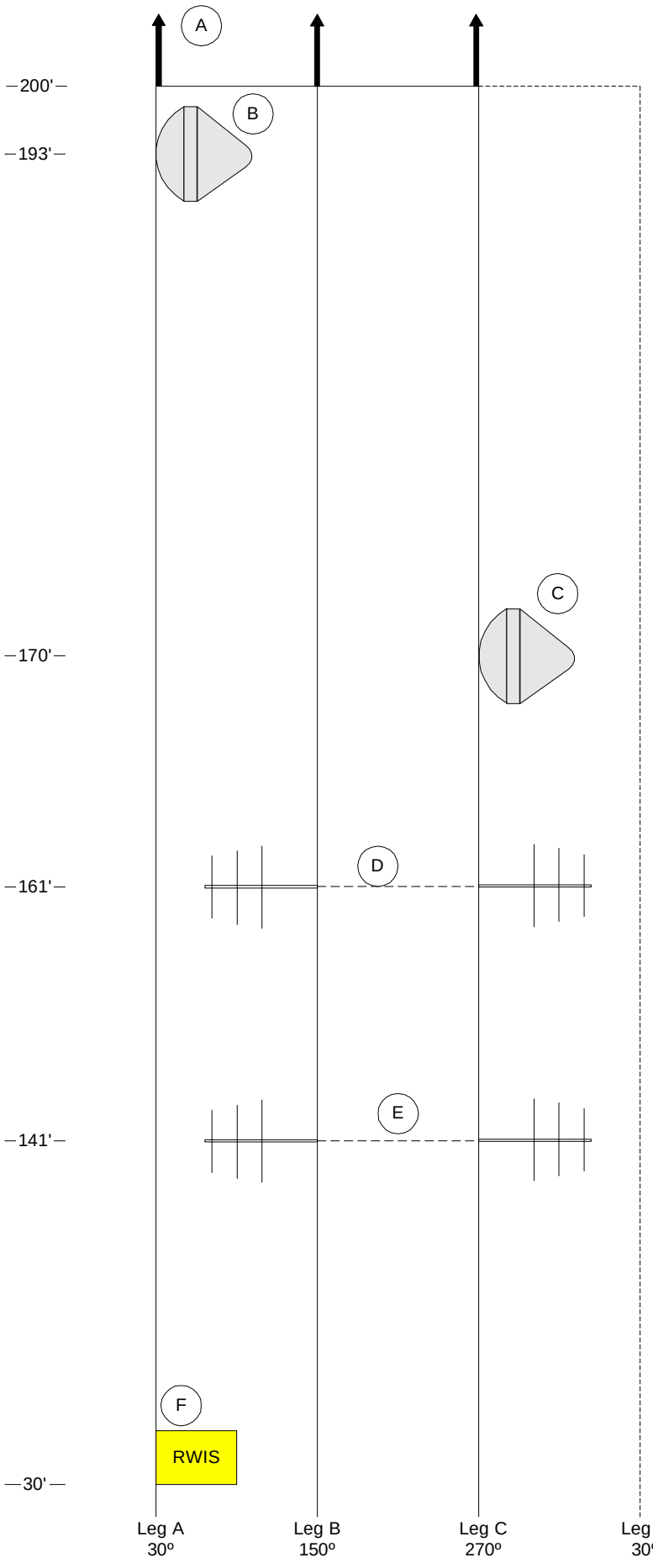
1. RWIS SERIAL CABLES
2. Empty
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Madison FHP)
4. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Monticello DOT)

5.-10. Empty

11. RFS Cablewave Systems S-FLC 12-50 J Flexwell coaxial (Connected to SigCom 75.56 MHz base receiver on MAS Call Box Rack)
12. RFS Cablewave Systems S-FLC 12-50 J Flexwell coaxial (Connected to Glenayre 75.62 MHz transmitter on MAS Call Box Rack)

Figure A-17
Greenville
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Lightning Rods	A, B, C	200' (Base)	-	-	-	
B	PA8-65	A	193' (C.L.)	90	-	WE-65	
C	PA8-65	C	170' (C.L.)	300	-	WE-65	
D	DB230-2-E	B, C	161' (C.L.)	300/ 120	2.72	1/2"	1/Rx
E	DB230-2-E	B, C	141' (C.L.)	300/ 120	2.72	1/2"	1/Tx
F	Weather Sensors	A	30' (Base)	-	-	RS-232	2

FCC Tower Registration	N/A
Tower Manufacturer	ROHN
Tower Model Number	SSV
Tower Serial Number	29767AE
Tower Light Controllers	N/A

Notes:
1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
WE-65	RFS Cablewave Systems Elliptical Waveguide
PA8-65	RFS Cablewave Systems Microwave Antenna
Tx	Transmit
Rx	Receive

Figure A-18
Greenville
Antenna Loading Diagram

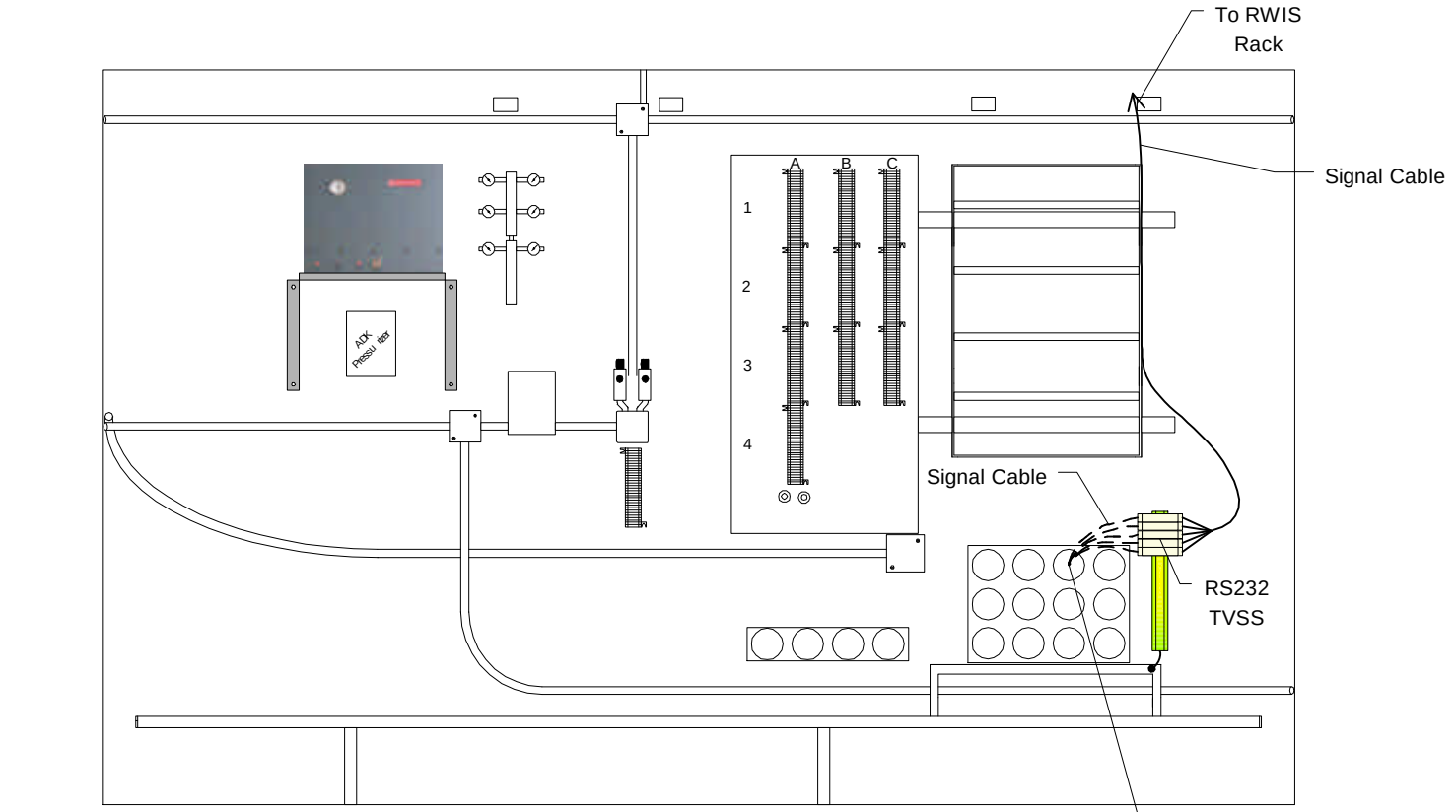
Greenville
January 3, 2003
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA18_Greenville_AntennaLoadingDiagram.vsd
02/11/03

Scale: 1/2" = 1'



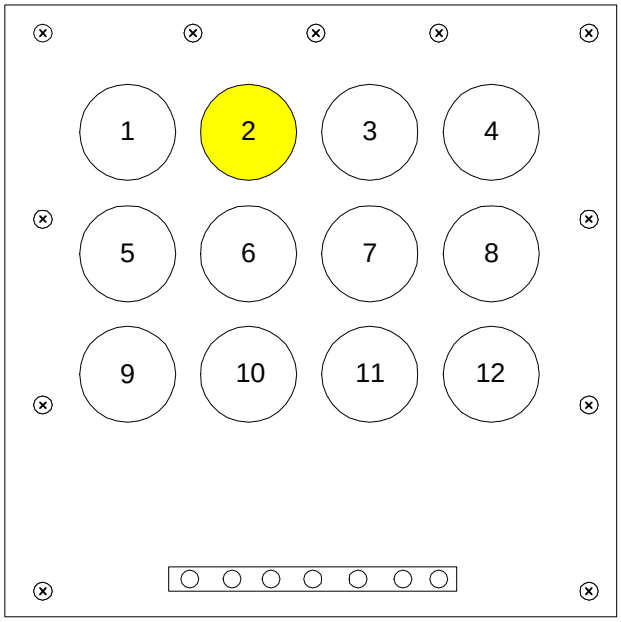
Legend

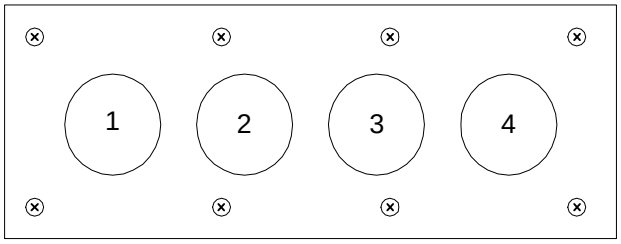
Installed by Universities

Installed by Contractor

Figure A-19
Falmouth
Interior North Wall

Scale: 1 1/2" = 1'-0"



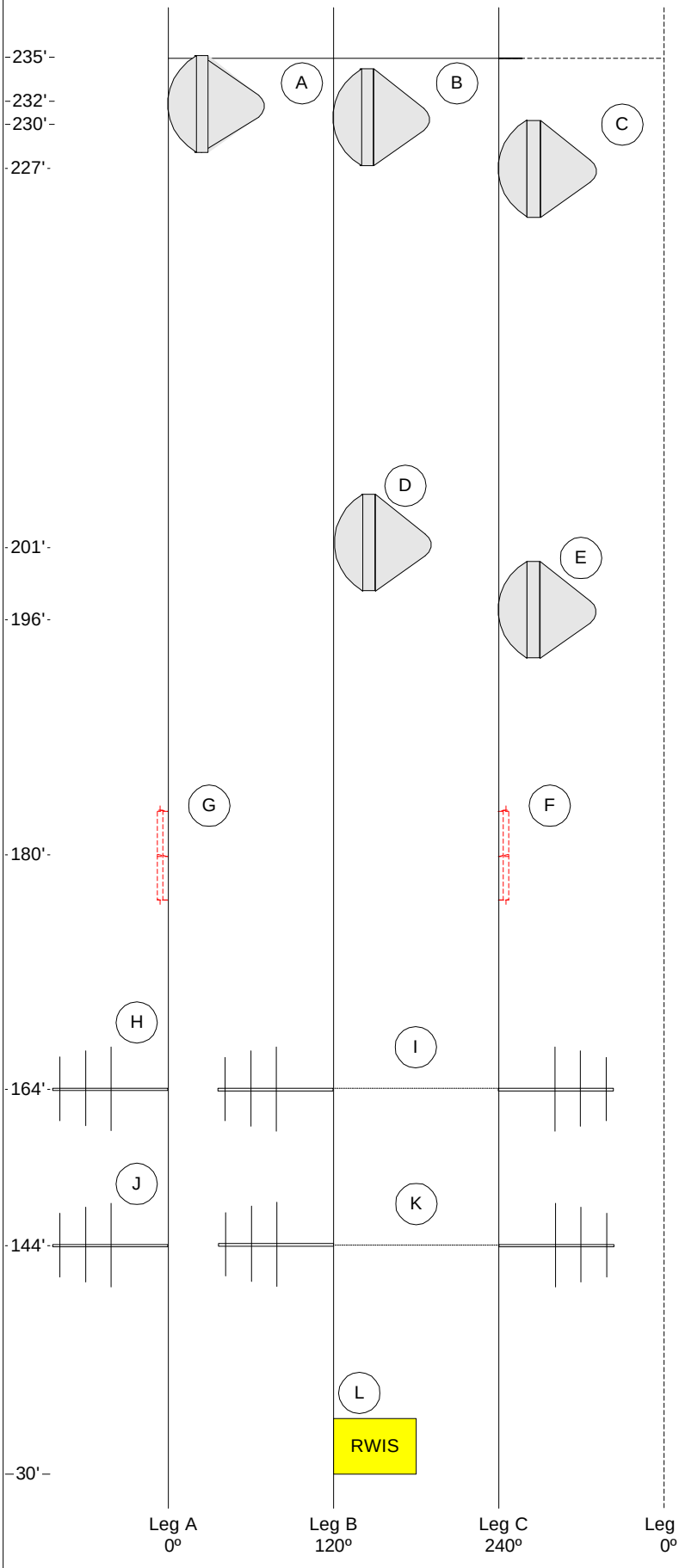


1.-4. Empty

1. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate SR136 - Diversity)
2. RWIS SERIAL CABLES
3.-4. Empty
5. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate SR136 - Main)
6. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Madison FHP - Diversity)
7. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Madison FHP - Main)
8. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate SR6)
9. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (Disconnected from Glenayre 75.62 MHz transmitter on Rack B)
10. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (Connected to Glenayre 75.62 MHz transmitter on Rack A)
11. RFS Cablewave Systems S-FLC 12-50 J Flexwell coaxial (Connected to SigCom 72.28 MHz base receiver on Rack A)
12. RFS Cablewave Systems S-FLC 12-50 J Flexwell coaxial (Disconnected from SigCom 72.88 MHz base receiver on Rack B)

Figure A-20
Falmouth
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	PA8-65	A	232' (C.L.)	290	-	WE-65	
B	PA8-65	B	230' (C.L.)	100	-	WE-65	
C	PA8-65	C	227' (C.L.)	290	-	WE-65	
D	PA8-65	B	201' (C.L.)	100	-	WE-65	
E	PA8-65	C	196' (C.L.)	290	-	WE-65	
F	(F.L.) PD-320	A	180' (C.L.)	-	-	7/8"	
G	(F.L.) PD-320	C	180' (C.L.)	-	-	7/8"	
H	DB-230	A	164' (C.L.)	340	1.36	1/2"	Rx
I	DB 230-2	B, C	164' (C.L.)	280/ 80	2.72	1/2"	1/Rx
J	DB230	A	144' (C.L.)	340	1.36	1/2"	Tx
K	DB 230-2	B, C	144' (C.L.)	280/ 80	2.72	1/2"	1/Tx
L	Weather Sensors	B	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061372
Tower Manufacturer	ROHN
Tower Model Number	SSMW
Tower Serial Number	N/A
Tower Light Controllers	N/A

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
F.L.	Future Load
WE-65	RFS Cablewave Systems Elliptical Waveguide
7/8" ,1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
PD-320	Andrew Corporation Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna
DB-XXX	Decibel Products Antenna
Tx	Transmit
Rx	Receive

Figure A-21
Falmouth
Antenna Loading Diagram

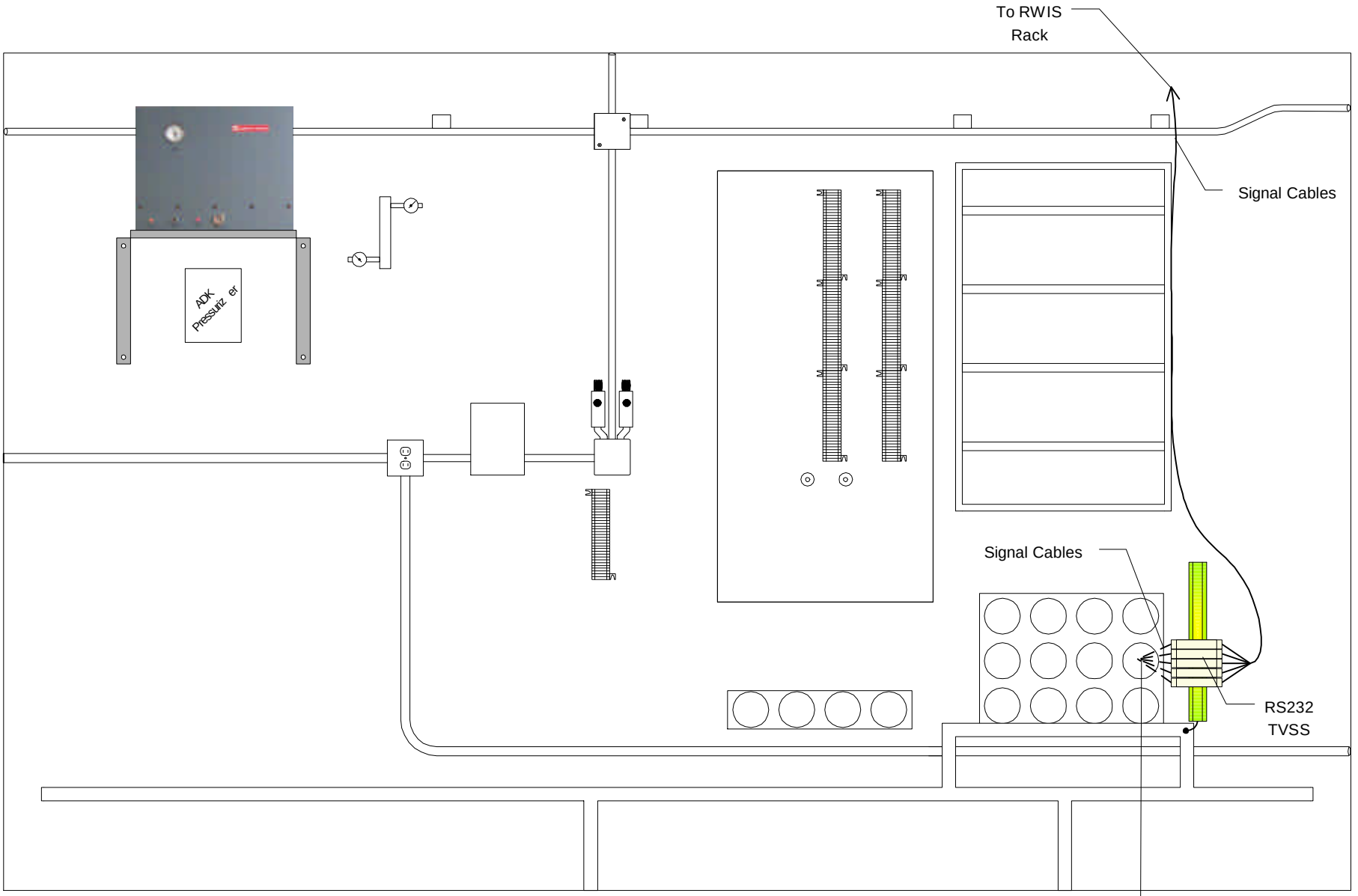
Falmouth
September 23, 2002
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA21_Falmouth_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" = 1'-0"



Legend

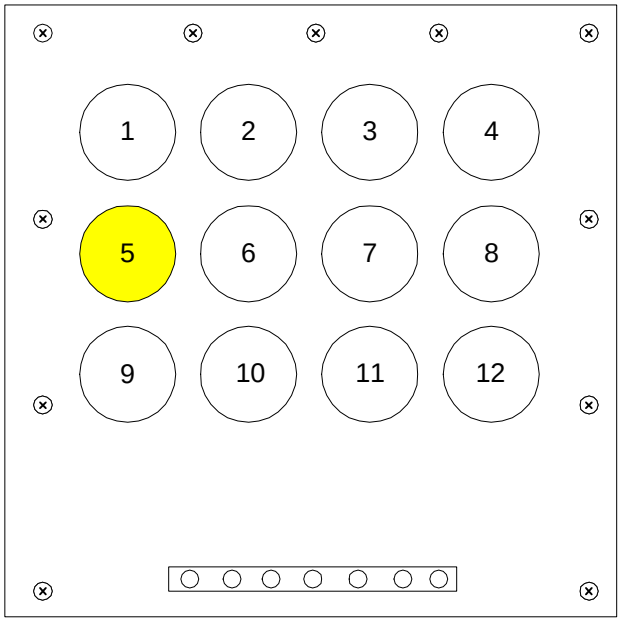
Installed by Universities

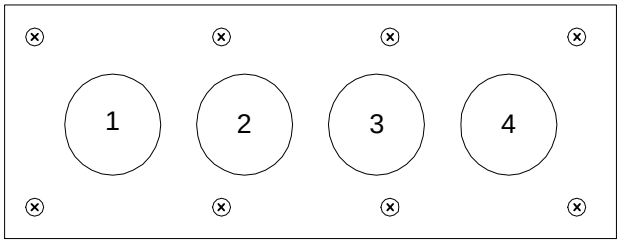
Installed by Contractor

Figure A-22
SR6
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA22_SR6_InteriorEastWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"



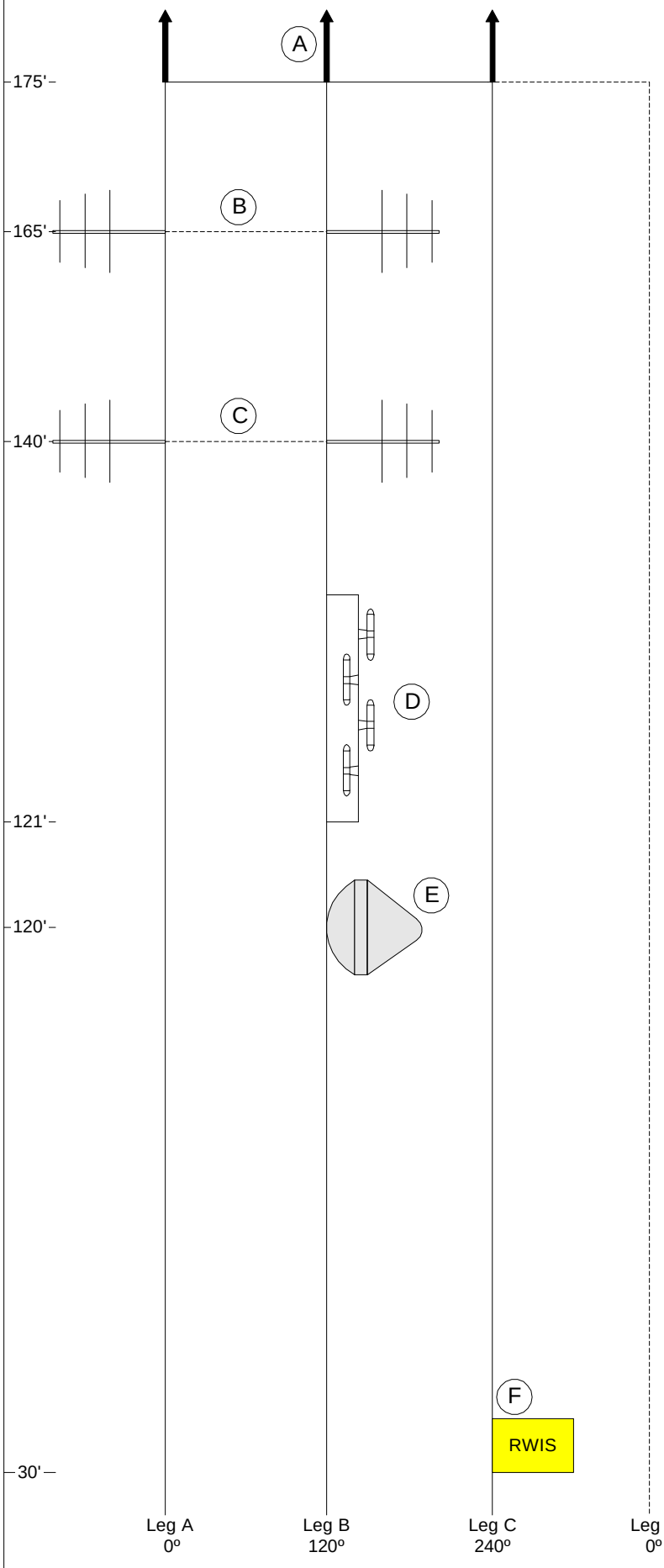


1.-4. Empty

1.-2. Empty
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
4. Empty
5. RWIS SERIAL CABLES
6.-8. Empty
9. Andrew Heliax 0.5" LDF4-50 coaxial
10. Empty
11. RFS Cablewave Systems FLC 12-50J Flexwell coaxial
(Connected to Glenayre transmitter on MAS Call Box Rack)
12. RFS Cablewave Systems FLC 12-50J Flexwell coaxial
(Connected to SigCom base receiver on MAS Call Box Rack)

Figure A-23
SR6
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Lightning Rod	A,B,C	175' (Base)	-	-	-	
B	DB-230-2	A-B	165' (C.L.)	320/ 120	2.72	-	1
C	DB-230-2	A-B	140' (C.L.)	320/ 120	2.72	-	1
D	DB-224	B	121' (Base)	-	3.15	-	
E	PA8-65	B	120' (C.L.)	200	-	WE-65	
F	Weather Sensors	C	30' (Base)	-	-	RS-232	2

FCC Tower Registration	N/A
Tower Manufacturer	ROHN
Tower Model Number	SSV
Tower Serial Number	N/A
Tower Light Controllers	None

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.

2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna
DB-XXX	Decibel Products Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide

Figure A-24
SR6
Antenna Loading Diagram

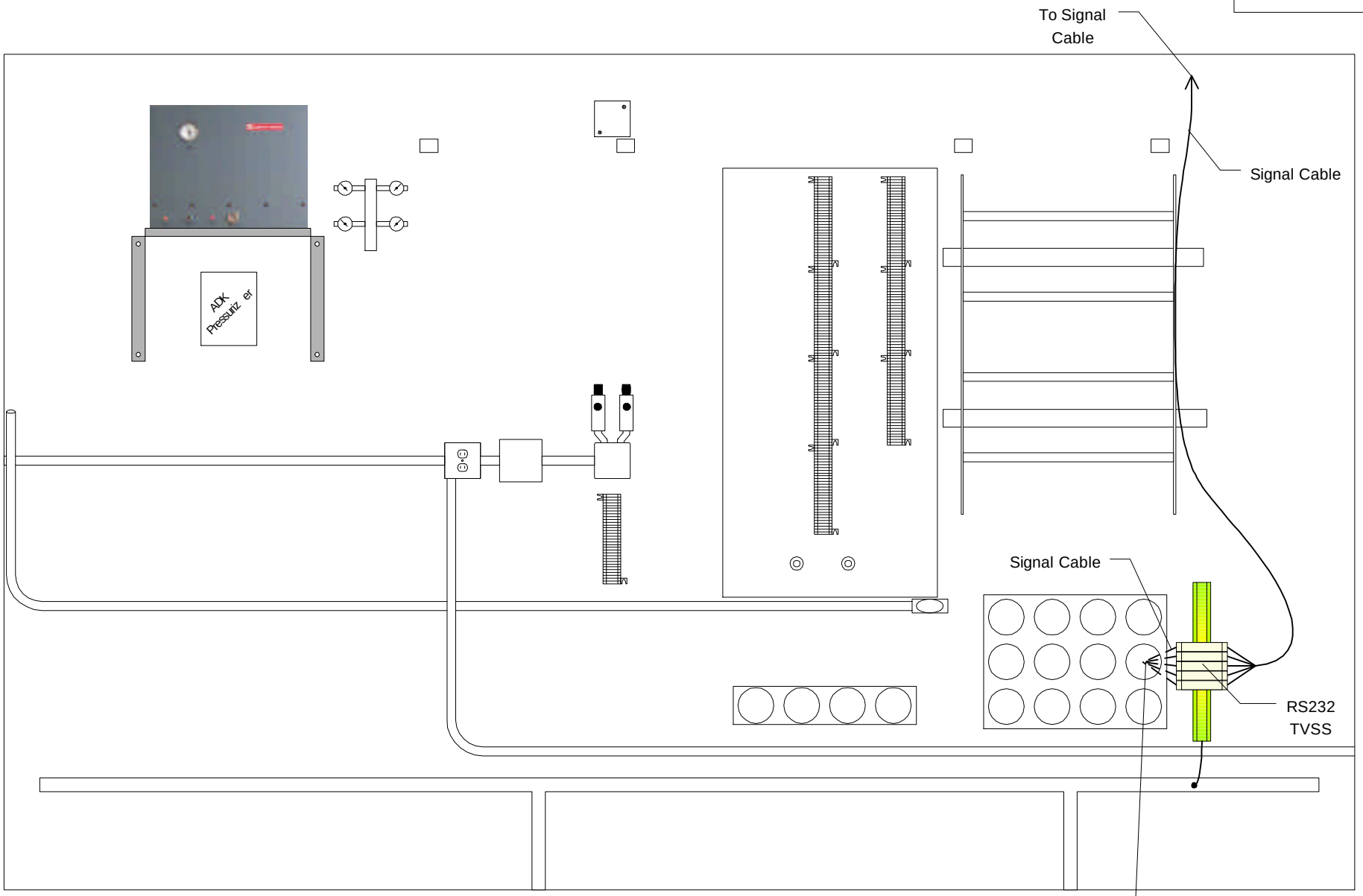
SR6
October 24, 2002
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA24_SR6_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" = 1'-0"



Legend

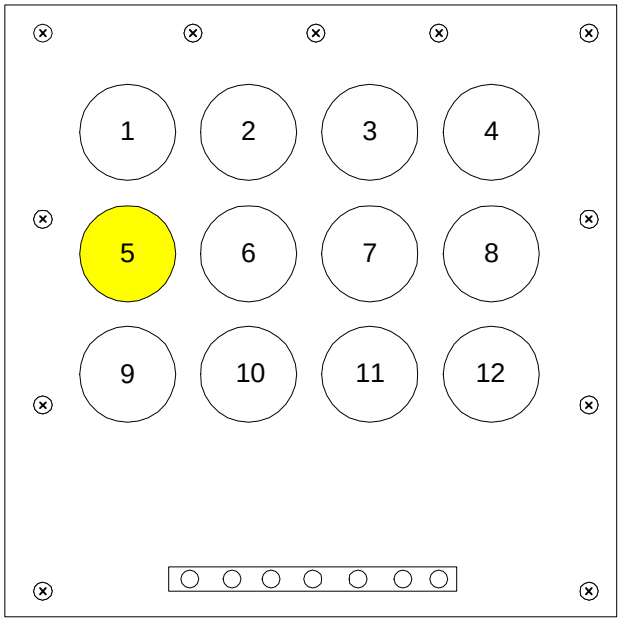
Installed by Universities

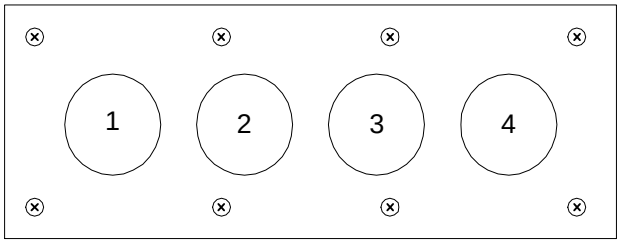
Installed by Contractor

Figure A-25
SR136
Interior South Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA25_SR136_InteriorSouthWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"





1.-4. Empty

1. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Falmouth - Main)
2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Falmouth - Diversity)
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Lake City DOT)
4. Empty
5. RWIS SERIAL CABLES

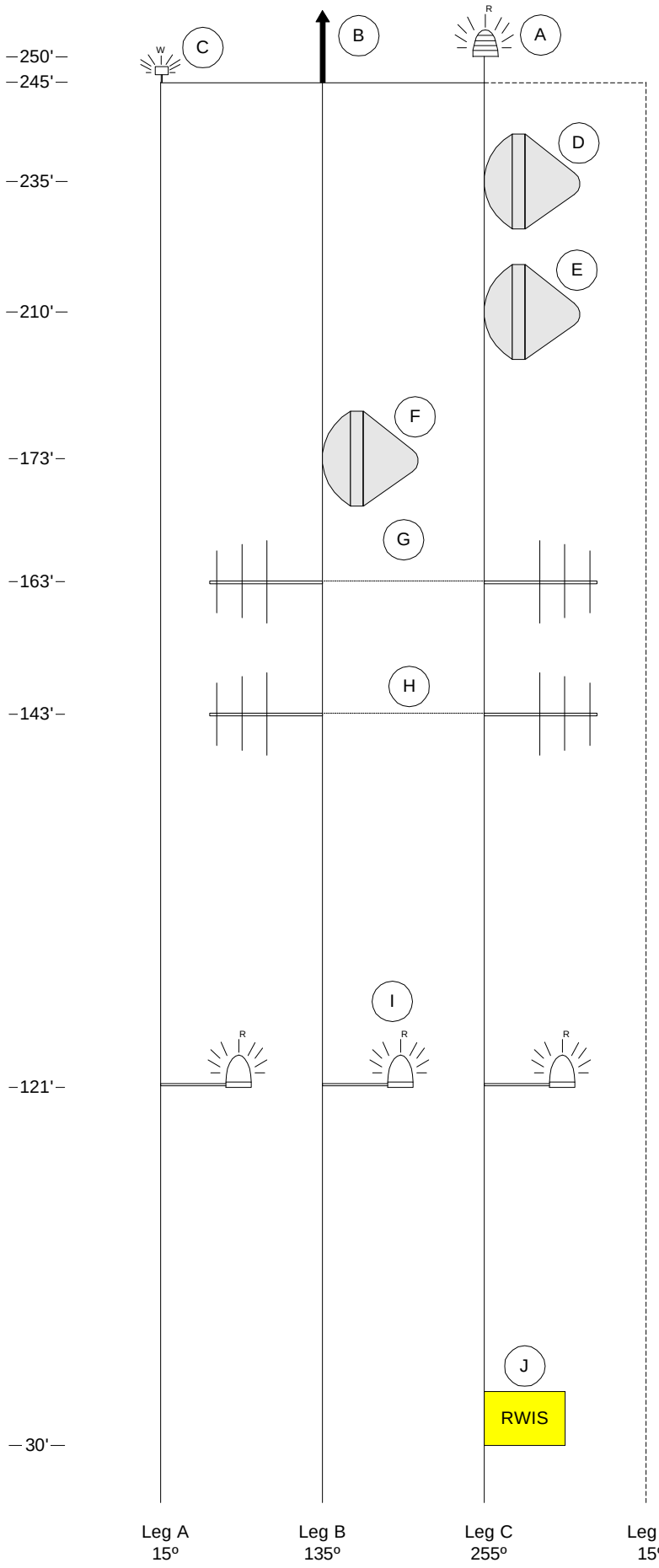
6-8. Empty

9. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (Connected to SigCom 72.60 MHz base receiver on MAS Call Box Rack)
10. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (Connected to Glenayre 72.68 MHz transmitter on MAS Call Box Rack)

11.-12. Empty

Figure A-26
SR136
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Beacon	C	250' (Base)	-	-	-	
B	Lightning Rod	B	245' (Base)	-	-	-	
C	Strobe	A	245' (Base)	-	-	-	
D	PA8-65	C	235' (C.L.)	275	-	WE-65	
E	PA8-65	C	210' (C.L.)	275	-	WE-65	
F	PA8-65	B	173' (C.L.)	135	-	WE-65	
G	DB230-2	B, C	163' (C.L.)	170 320	2.72	1/2"	1/Rx
H	DB230-2	B, C	143' (C.L.)	170 320	2.72	1/2"	1/Tx
I	Side Beacons	A, B, C	121' (Base)	-	-	-	
J	Weather Sensors	C	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061375
Tower Manufacturer	ROHN
Tower Model Number	SSVMW
Tower Serial Number	29767AE
Tower Light Controllers	N/A

Notes:
1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
WE-65	RFS Cablewave Systems Elliptical Waveguide
PA8-65	RFS Cablewave Systems Microwave Antenna
Tx	Transmit
Rx	Receive

Figure A-27
SR 136
Antenna Loading Diagram

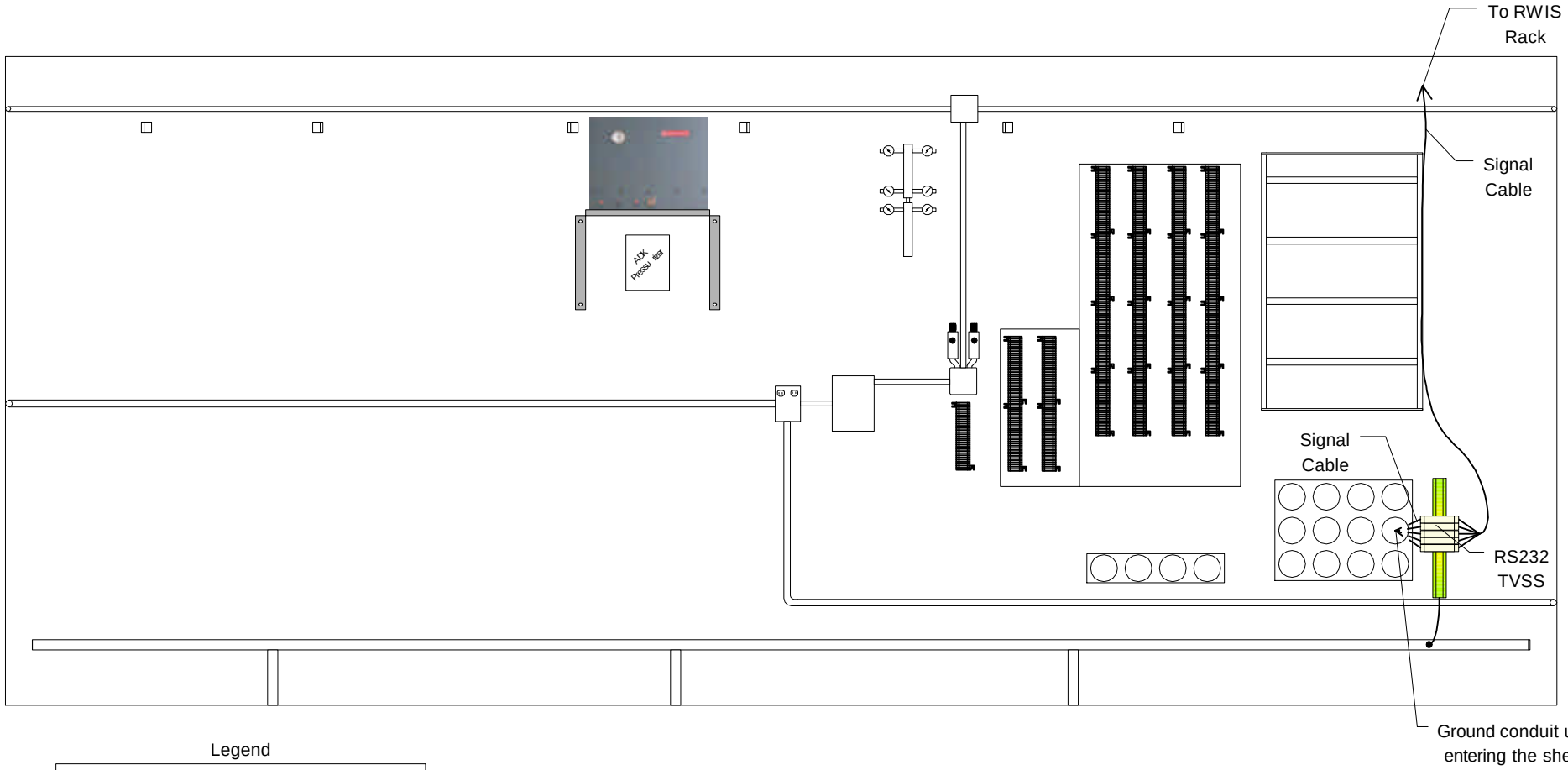
SR 136
October 30, 2002
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA27_SR136_AntennaLoadingDiagram.vsd
02/11/03

Scale: 1/2" = 1'-0"



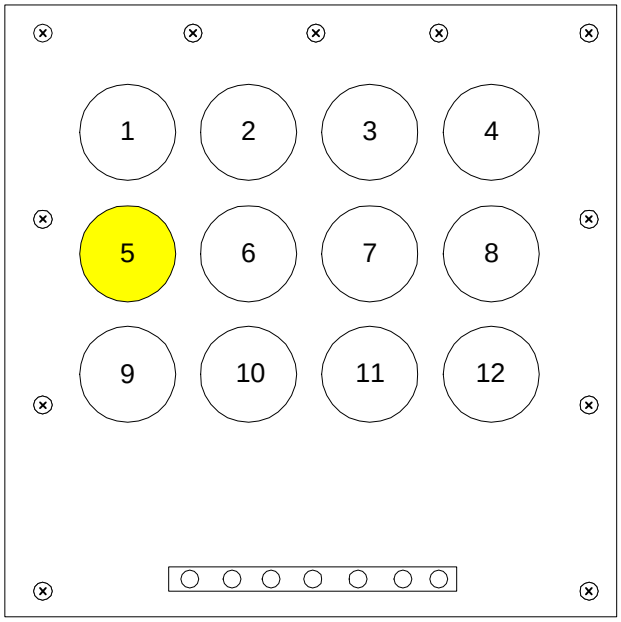
Legend

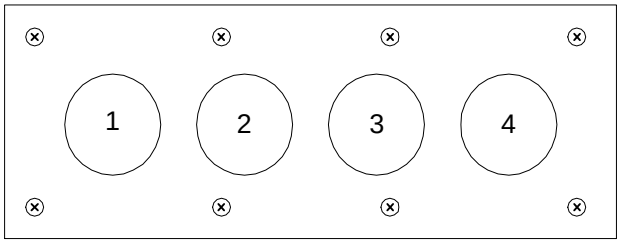
Installed by Universities

Installed by Contractor

Figure A-28
Lake City DOT
Interior North Wall

Scale: 1 1/2" = 1'-0"





1. Empty
2. Telco entrance
3. Telco entrance (2 CAT3 cables)
4. Empty

1. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
4. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
5. RWIS SERIAL CABLES

6-7. Empty

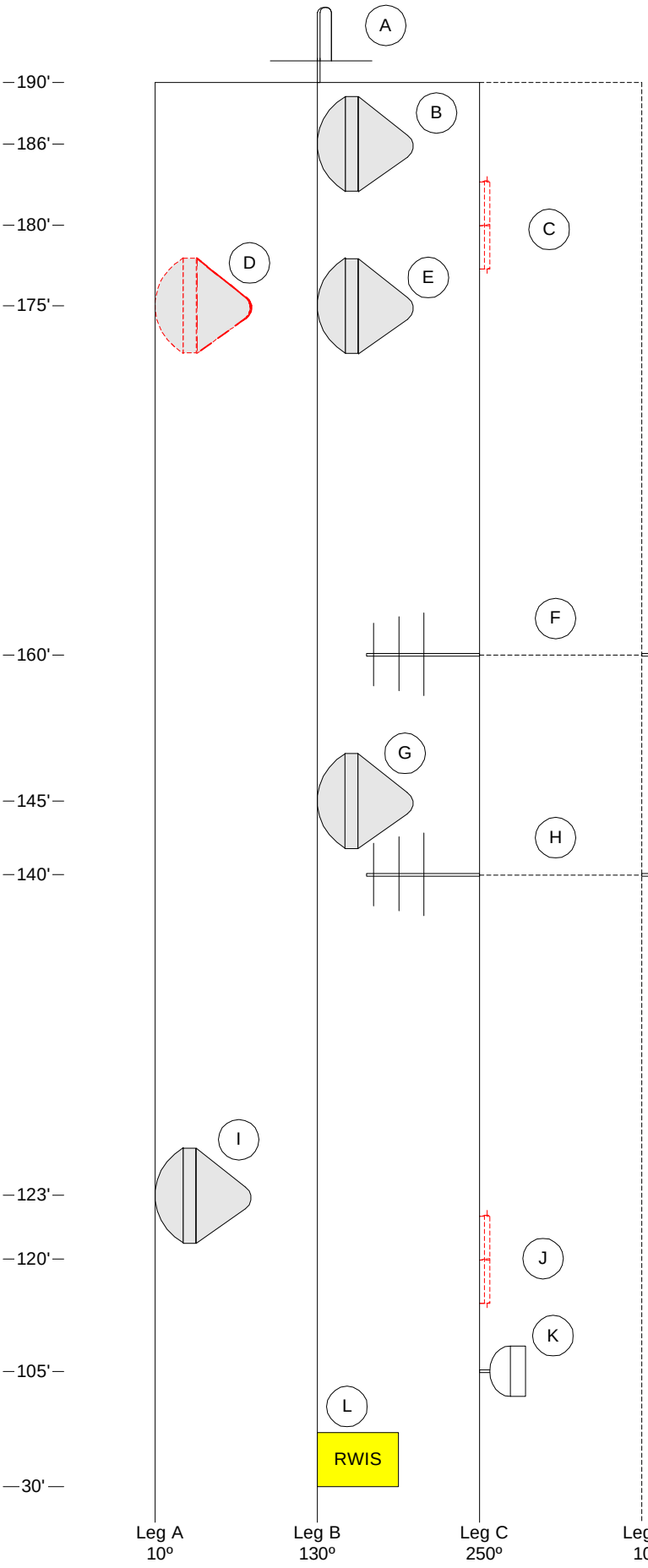
8. RFS Cablewave Systems WE108 Flexwell Elliptical Waveguide (Coordinate Lake City FHP)

9-11. RFS Cablewave Systems FLC 12-50J Flexwell coaxial

12. Empty

Figure A-29
Lake City DOT
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	DB-201	B	190' (Base)	-	0.8	-	
B	PA8-65	B	186' (C.L.)	166	-	WE-65	
C	(F.L.) PD-320	C	180' (C.L.)	-	-	7/8"	
D	(F.L.) PA8-65	A	175' (C.L.)	-	-	WE-65	
E	PA8-65	B	175' (C.L.)	82.2	-	WE-65	
F	DB-230-2	A-C	160' (C.L.)	290/ 65	2.72	1/2"	1/Rx
G	PA8-65	B	145' (C.L.)	82.2	-	WE-65	
H	DB-230-2	A-C	140' (C.L.)	290/ 65	2.72	1/2"	1/Tx
I	PA8-65	A	123' (C.L.)	312.6	-	WE-65	
J	(F.L.) PD-320	C	120' (C.L.)	-	-	7/8"	
K	HP4-105A	C	105' (C.L.)	182	-	WE-108	
L	Weather Sensors	B	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061369
Tower Manufacturer	N/A
Tower Model Number	N/A
Tower Serial Number	N/A
Tower Light Controllers	N/A

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.

2) Weather sensors to be installed as part of this project.

F.L.	Future Load
C.L.	Center Line of Antenna
WE-XX	RFS Cablewave Systems Elliptical Waveguide
7/8"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
1/2"	RFS Cablwave Systems Foam Dielectric Transmission Line, FLC Series
DB-XXX	Decibel Products Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna
PD-320	Andrew Corporation Antenna
Tx	Transmit
Rx	Receive

Figure A-30
Lake City DOT
Antenna Loading Diagram

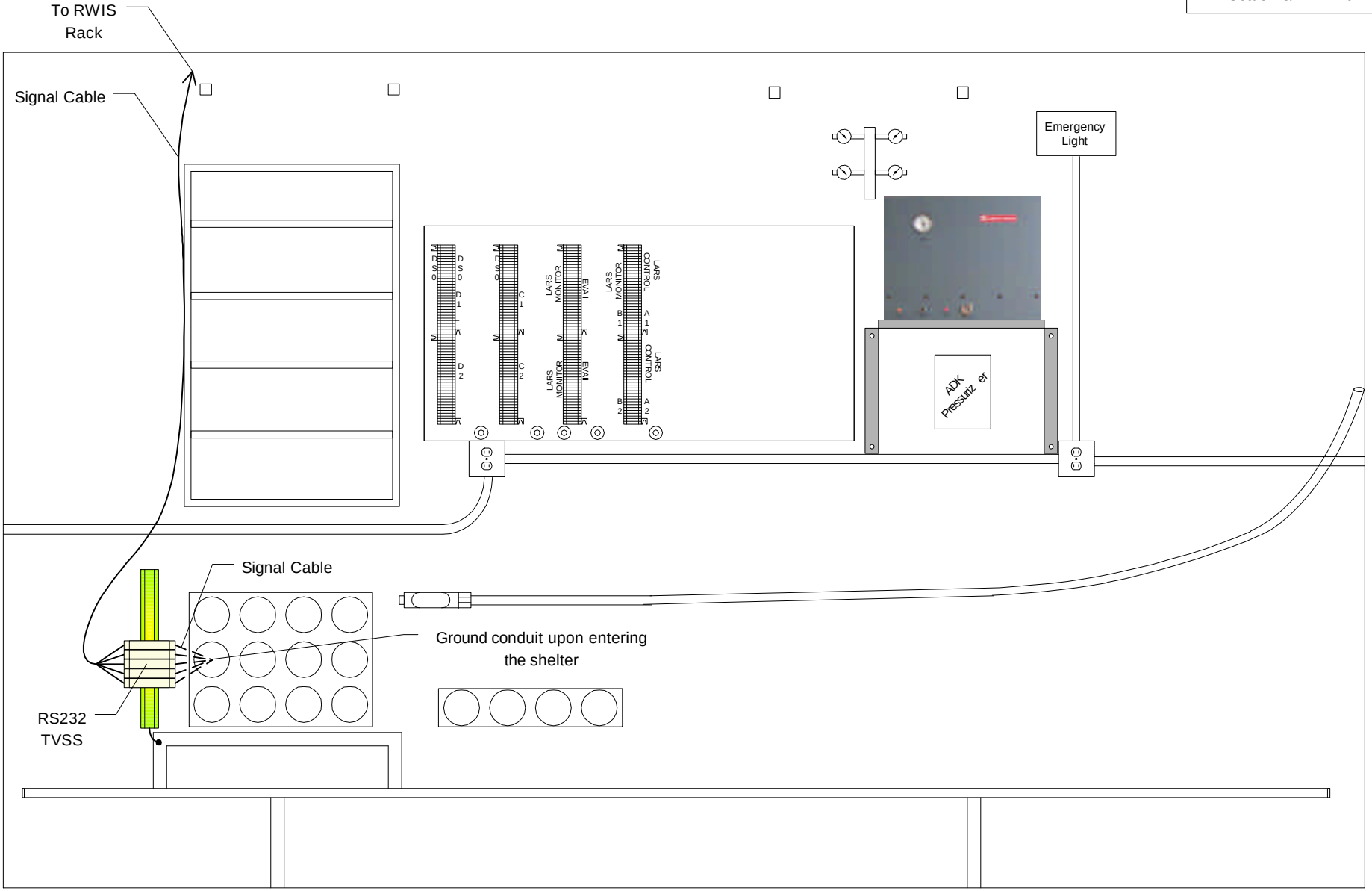
Lake City DOT
March 7, 2003
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA30_LakeCityDOT_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" = 1'-0"



Legend

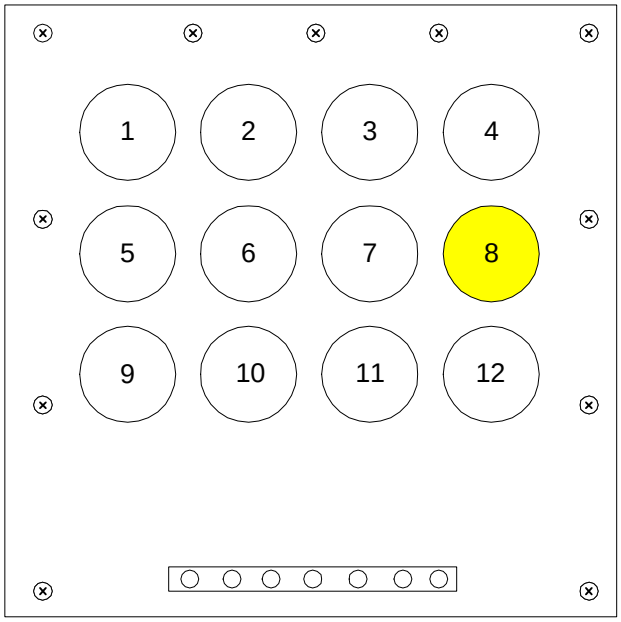
Installed by Universities

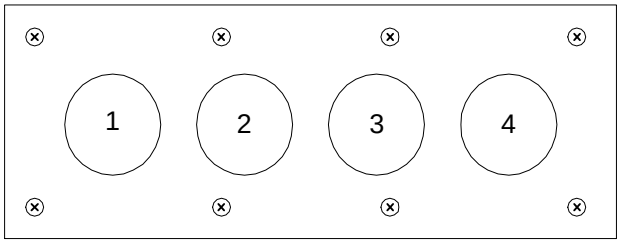
Installed by Contractor

Figure A-31
US41
Interior North Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA31_US41_InteriorNorthWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"





1.-4. Empty

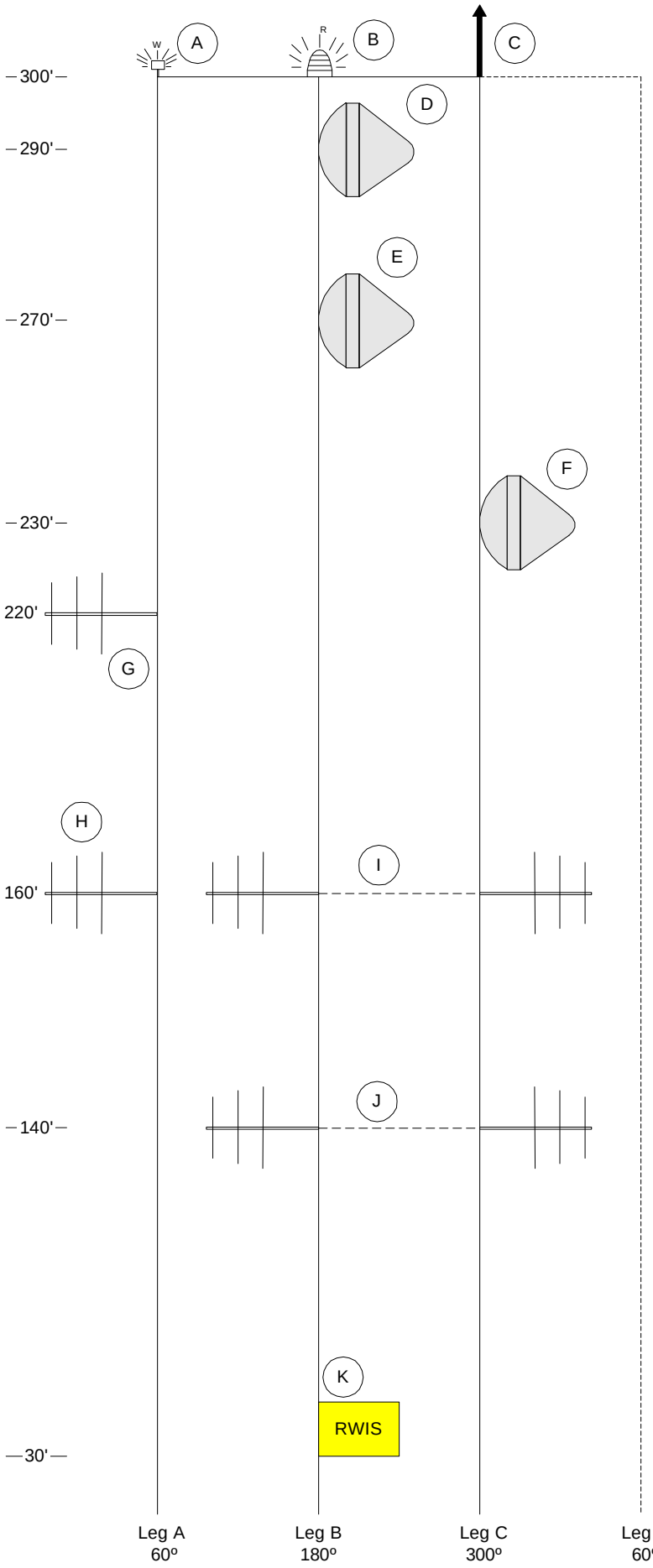
1. Empty
2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Lake City DOT)
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate SR222 - Main)
4. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate SR222 - Diversity)

5.-7. Empty

8. RWIS SERIAL CABLES
9. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (75.62 MHz@140')
10. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (72.58 MHz)
11. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (72.82 MHz)
12. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (75.62 MHz)

Figure A-32
US41
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Strobe	A	300' (Base)	N/A	-	-	
B	Beacon	B	300' (Base)	N/A	-	-	
C	Lightning Rod	C	300' (Base)	N/A	-	-	
D	PA8-65	B	290' (C.L.)	160	-	WE-65	
E	PA8-65	B	270' (C.L.)	160	-	WE-65	
F	PA8-65	C	230' (C.L.)	355	-	WE-65	
G	DB-230	A	220' (C.L.)	160	1.36	1/2"	
H	DB-230	A	160' (C.L.)	160	1.36	1/2"	
I	DB-230-2	B, C	160' (C.L.)	170 330	2.72	1/2"	1
J	DB-230-2	B, C	140' (C.L.)	170 330	2.72	1/2"	1
K	Weather Sensors	B	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061374
Tower Manufacturer	ROHN
Tower Model Number	SSVMW
Tower Serial Number	B932636
Tower Light Controllers	Dual Flash Technologies

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
DB-XXX	Decibel Products Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna
1/2"	RFS Cablewave Systems Foam Dielectric Transmission Line, FLC Series

Figure A-33
US41
Antenna Loading Diagram

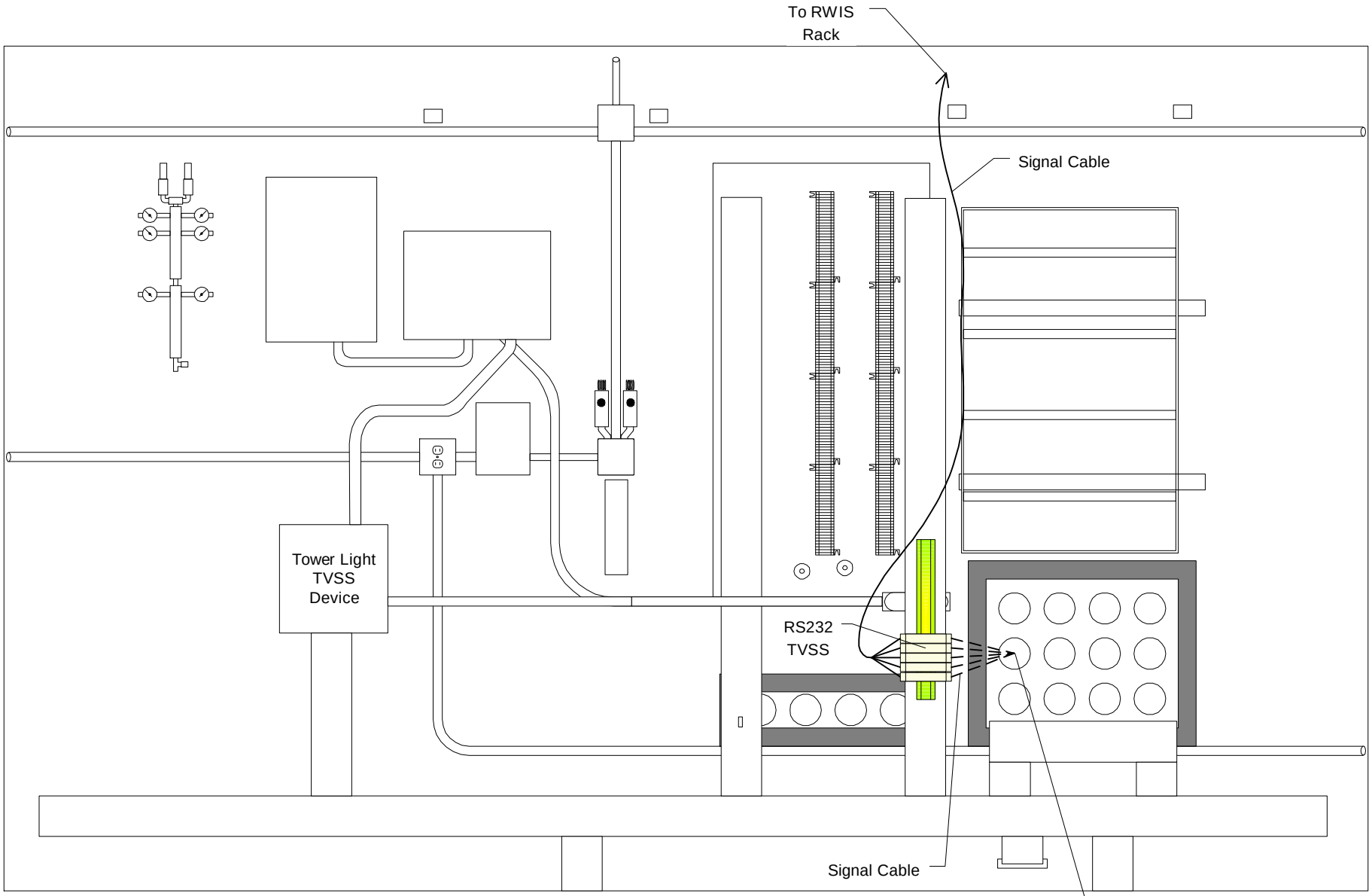
US41
November 11, 2002
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA33_US41_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" = 1'-0"



Legend

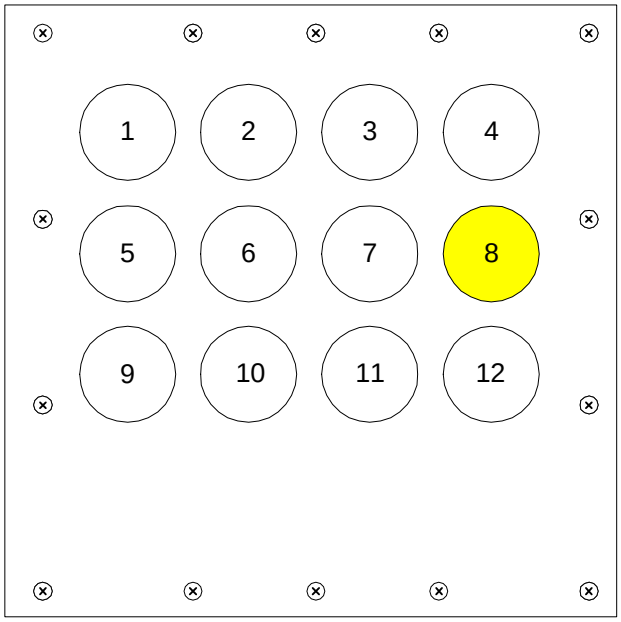
Installed by Universities

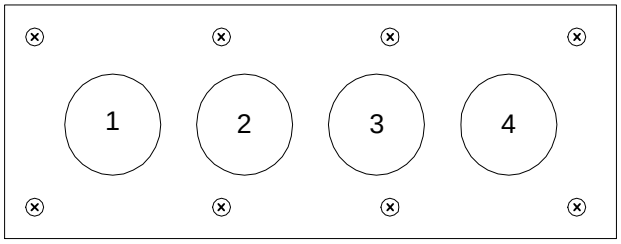
Installed by Contractor

Figure A-34
SR 222
Interior West Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA34_SR222_InteriorWestWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"



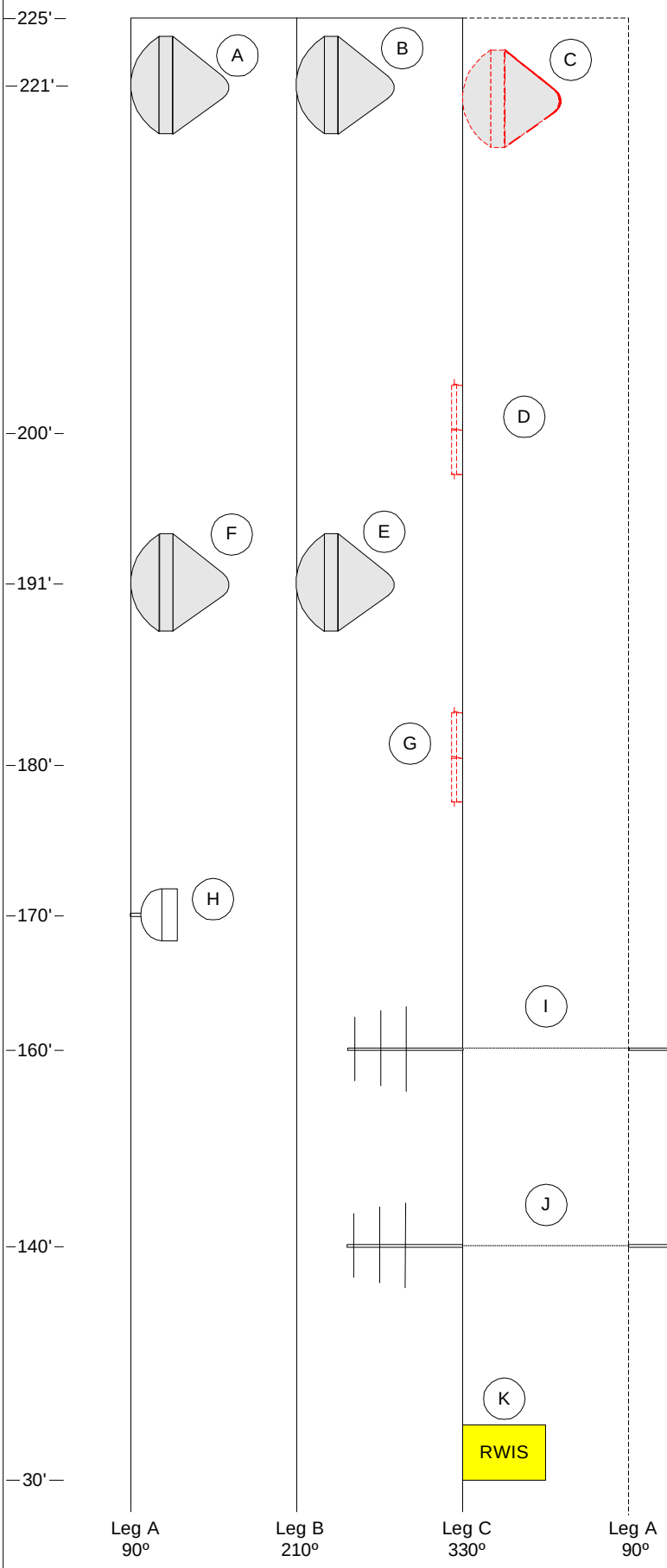


1.-4. Empty

1.-4. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
5.-7. Empty
8. RWIS SERIAL CABLES
9. Empty
10. RFS Cablewave Systems LCF 12-50J Cellflex coaxial
11. RFS Cablewave Systems LCF 12-50J Cellflex coaxial
12. RFS Cablewave Systems WE108 Flexwell Elliptical Waveguide

Figure A-35
SR222
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	PA8-65	A	221' (C.L.)	337.1	-	WE-65	
B	PA8-65	B	221' (C.L.)	148.3	-	WE-65	
C	(F.L.) 8' Dish	C	220' (C.L.)	-	-	-	
D	(F.L.) PD320	C	200' (C.L.)	-	-	7/8"	
E	PA8-65	B	191' (C.L.)	148.3	-	WE-65	
F	PA8-65	A	191' (C.L.)	337.1	-	WE-65	
G	(F.L.) PD320	C	180' (C.L.)	-	-	7/8"	
H	HP4-105A	A	170' (C.L.)	74.95	-	WE-108	
I	DB230-2	A	160' (C.L.)	330/ 150	2.72	1/2"	1/Rx
J	DB230-2	A	140' (C.L.)	330 150	2.72	1/2"	1/Tx
K	Weather Sensors	C	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061375
Tower Manufacturer	ROHN
Tower Model Number	SSVMW
Tower Serial Number	29767AE
Tower Light Controllers	N/A

Notes:
1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
F.L.	Future Load
WE-XX	RFS Cablwave Systems Elliptical Waveguide
7/8" ,1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
PA8-65	RFS Cablewave Systems Microwave Antenna
HP4-105A	Andrew Corporation Microwave Antenna
DB-XXX	Decibel Products Antenna
PD-320	Andrew Corporation Antenna
Tx	Transmit
Rx	Receive

Figure A-36
SR 222
Antenna Loading Diagram

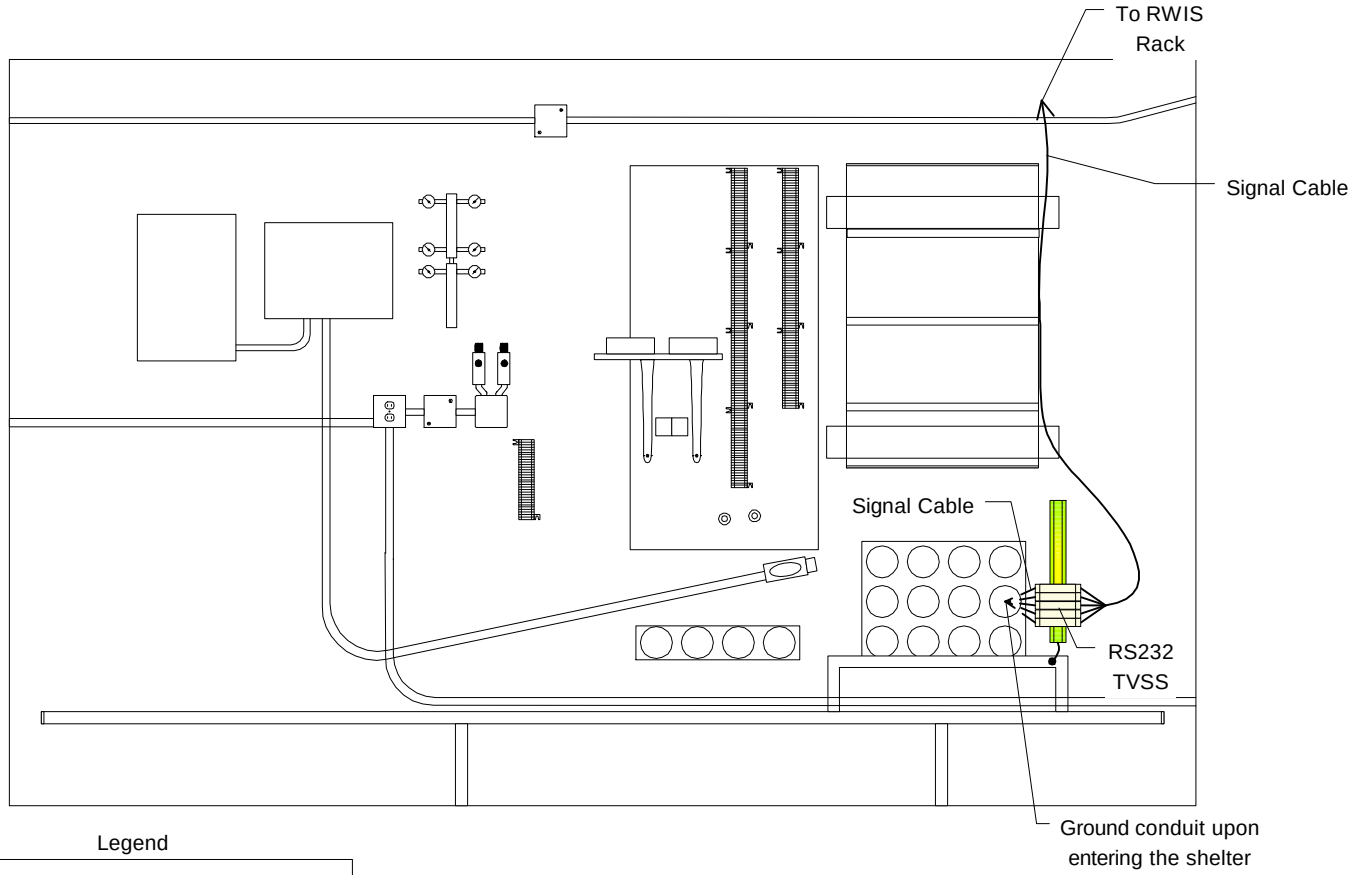
SR 222
October 30, 2002
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA36_SR222_AntennaLoadingDiagram.vsd
02/11/03

Scale: 1/2" = 1'-0"



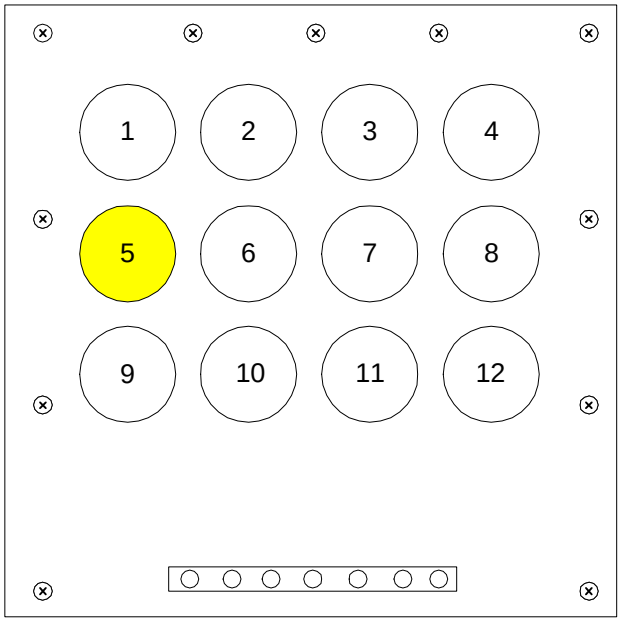
Legend

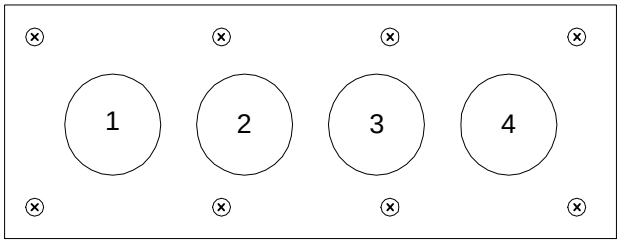
Installed by Universities

Installed by Contractor

Figure A-37
Sanderson
Interior West Wall

Scale: 1 1/2" = 1'-0"





1.-4. Empty

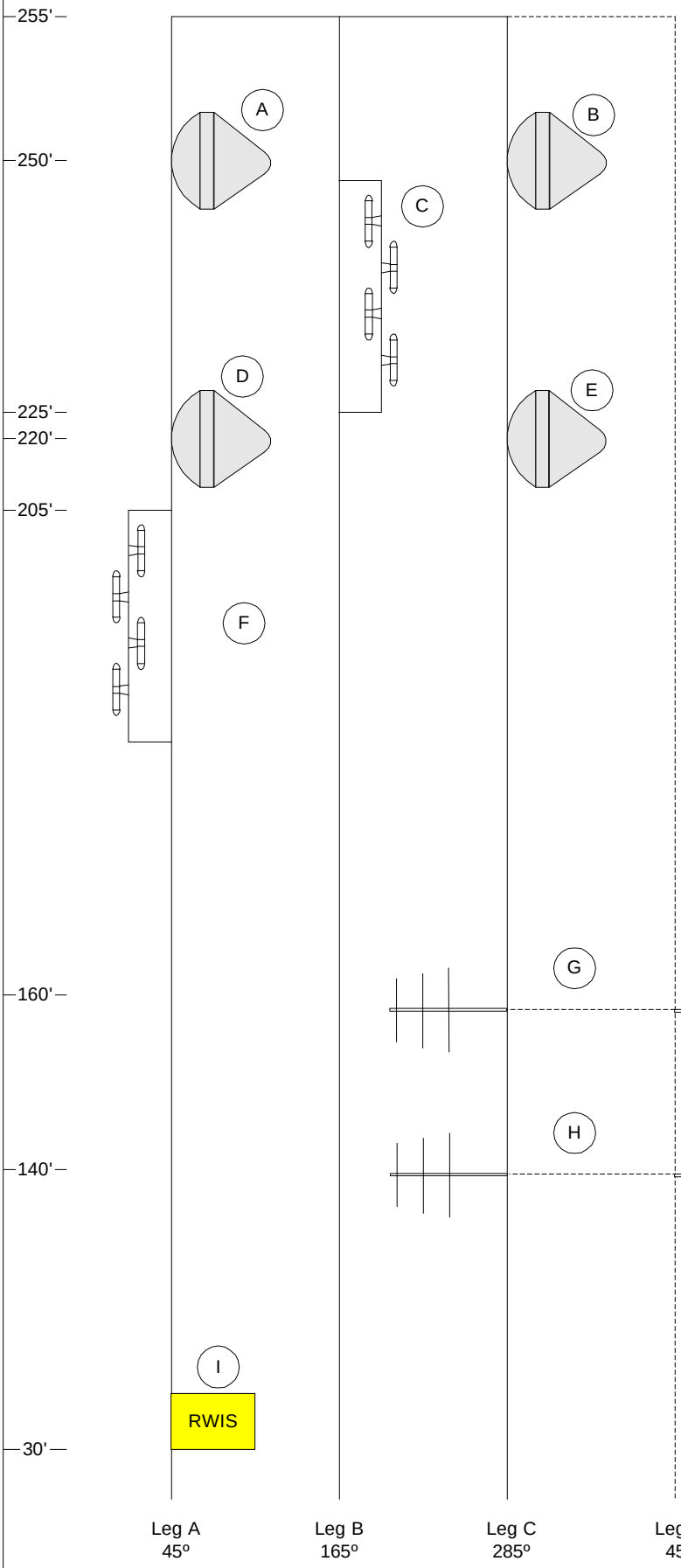
1. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Lake City DOT - Diversity)
2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Lake City DOT - Main)
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Baldwin DOT - Diversity)
4. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Baldwin DOT - Main)
5. RWIS SERIAL CABLES

6.-8. Empty

9. Andrew Corporation 1/2" LDF4-50A coaxial (Connected to Motorola 154.815 MHz FHP transmitter)
10. Andrew Corporation 7/8" VXL5-50 coaxial (Connected to Division of Forestry transmitter)
11. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (Connected to Glenayre 75.62 MHz transmitter on MAS Call Box Rack)
12. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (Connected to SigCom 72.88 MHz bas receiver on MAS Call Box Rack)

Figure A-38
Sanderson
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	PA8-65	A	250' (C.L.)	-	-	WE-65	
B	PA8-65	C	250' (C.L.)	-	-	WE-65	
C	DB-224	B	225' (Base)	-	3.15	7/8"	
D	PA8-65	A	220' (C.L.)	-	-	WE-65	
E	PA8-65	C	220' (C.L.)	-	-	WE-65	
F	DB-224	A	205' (Base)	-	3.15	7/8"	
G	DB230-2	A, C	160' (C.L.)	-	2.72	1/2"	1/Rx
H	DB230-2	A, C	140' (C.L.)	-	2.72	1/2"	1/Tx
I	Weather Sensors	A	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061370
Tower Manufacturer	ROHN
Tower Model Number	SSV
Tower Serial Number	29767AE
Tower Light Controllers	N/A

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
7/8" ,1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
PA8-65	RFS Cablewave Systems Microwave Antenna
DB-XXX	Decibel Products Antenna
Tx	Transmit
Rx	Receive

Figure A-39
Sanderson
Antenna Loading Diagram

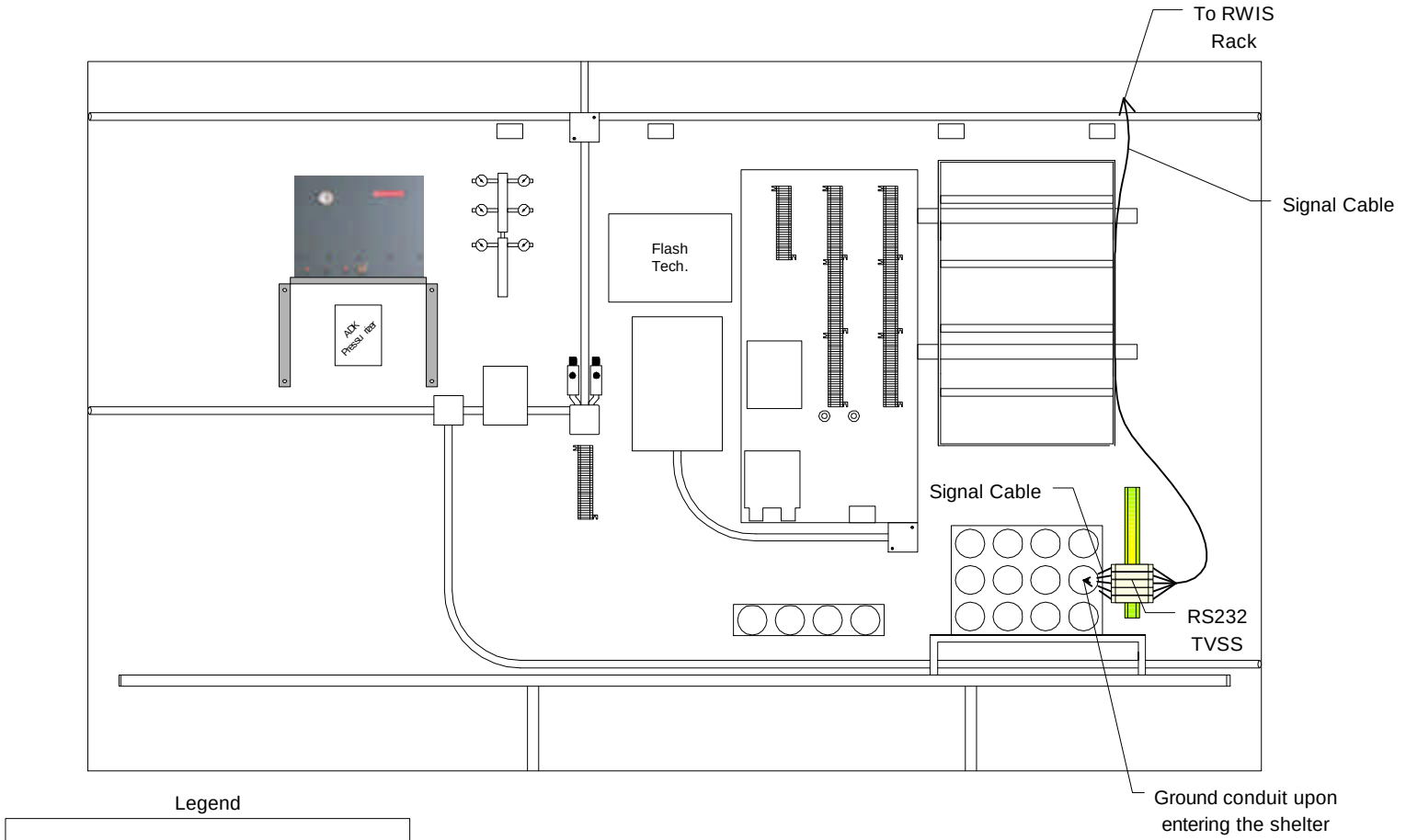
Sanderson
November 5, 2002
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA39_Sanderson_AntennaLoadingDiagram.vsd
02/11/03

Scale: 1/2" = 1'



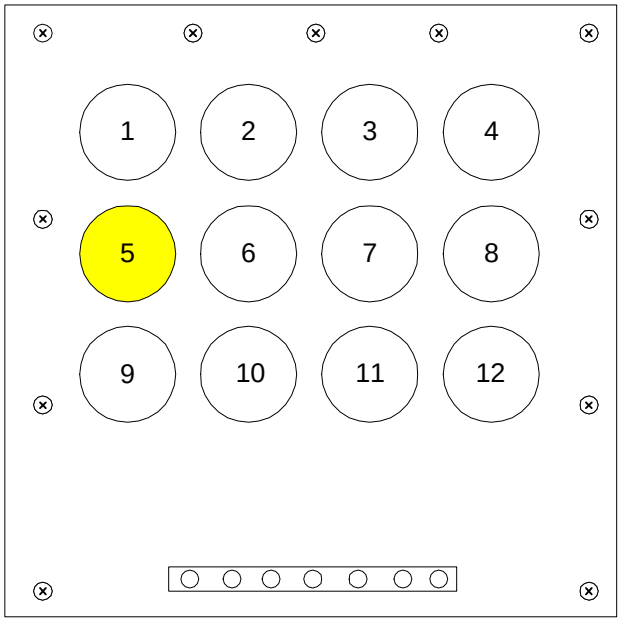
Legend

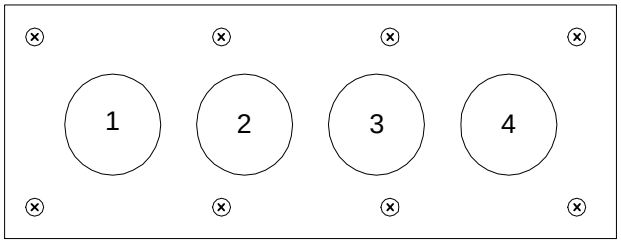
Installed by Universities

Installed by Contractor

Figure A-40
Baldwin DOT
Interior West Wall

Scale: 1 1/2" = 1'-0"



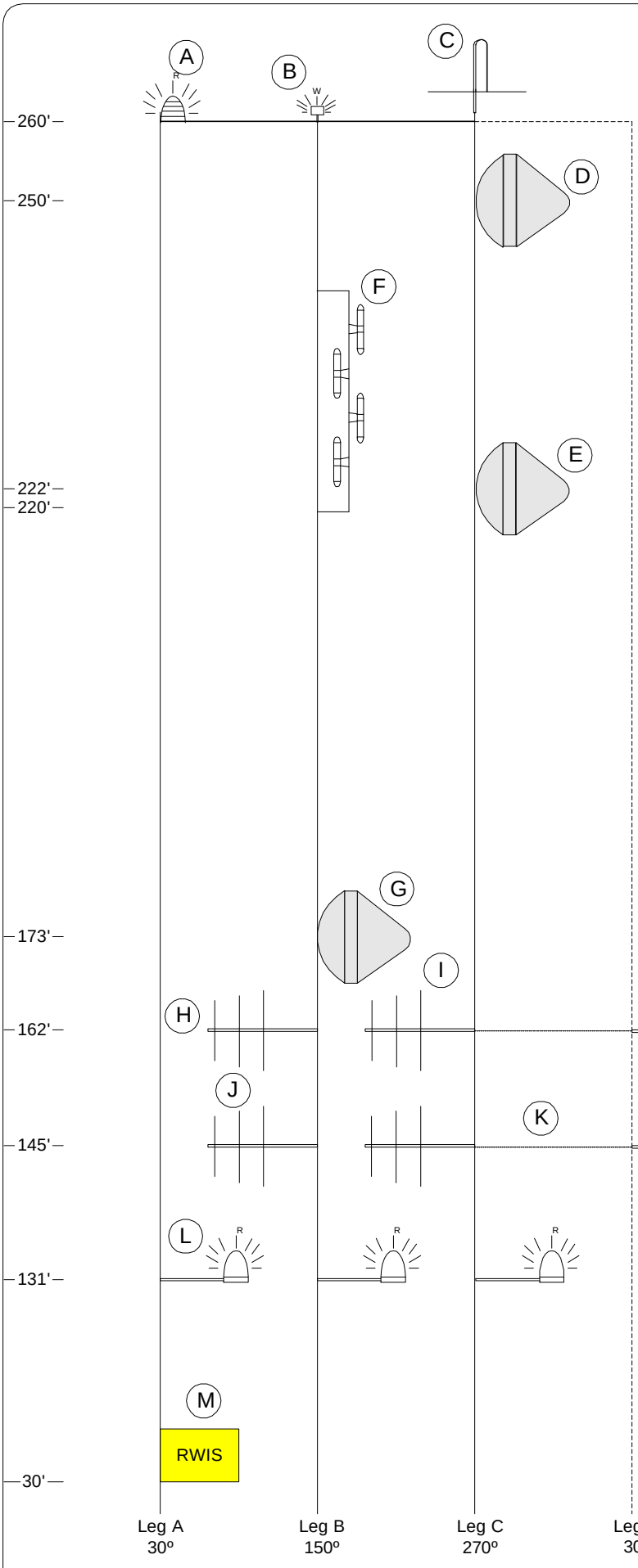


1. Empty
2. Times Microwave LMR600 coaxial
3.-4. Empty

1. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Sanderson - Diversity@230')
2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Sanderson - Main@250')
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide (Coordinate Jacksonville FHP@170')
4. Empty
5. RWIS SERIAL CABLES
6.-8. Empty
9. 2 - RFS Cablewave Systems FLC 12-50J Flexwell coaxials (75.62 MHz and 72.36 MHz)
10. Andrew Corporation 7/8" LDF5-50A
11. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (72.68 MHz)
12. RFS Cablewave Systems FLC 12-50J Flexwell coaxial (75.62 MHz)

Figure A-41
Baldwin DOT
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Beacon	C	261' (Base)	-	-	7/8"	
B	Strobe	A	260' (Base)	-	-	-	
C	DB-201	B	260' (Base)	-	0.8	-	
D	PA8-65	C	250' (C.L.)	256.4	-	WE-65	
E	PA8-65	C	222' (C.L.)	330	-	WE-65	
F	DB-224	B	220' (Base)	-	3.15	7/8"	
G	PA8-65	B	173' (C.L.)	90	-	WE-65	
H	DB-230	B	162' (C.L.)	255	1.36	1/2"	Rx
I	DB-230-2	A, C	162' (C.L.)	225 / 95	2.72	1/2"	1/Rx
J	DB-230	B	142' (C.L.)	225	1.36	1/2"	Tx
K	DB-230-2	A, C	142' (C.L.)	255 / 95	2.72	1/2"	1/Tx
L	Side Beacons	A, B, C	131' (Base)	-	-	-	-
M	Weather Sensors	A	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061371
Tower Manufacturer	Rohn
Tower Model Number	SSVMW
Tower Serial Number	N/A
Tower Light Controllers	N/A

Notes:
1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1)1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
7/8", 1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
PA8-65	RFS Cablewave Systems Microwave Antenna
PD-320	Andrew Corporation Antenna
DB-XXX	Decibel Products Antenna
Tx	Transmit
Rx	Receive

Figure A-42
Baldwin DOT
Antenna Loading Diagram

Baldwin DOT
August 27, 2002
Verified: YES

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA42_BaldwinDOT_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/8" = 1'-0"

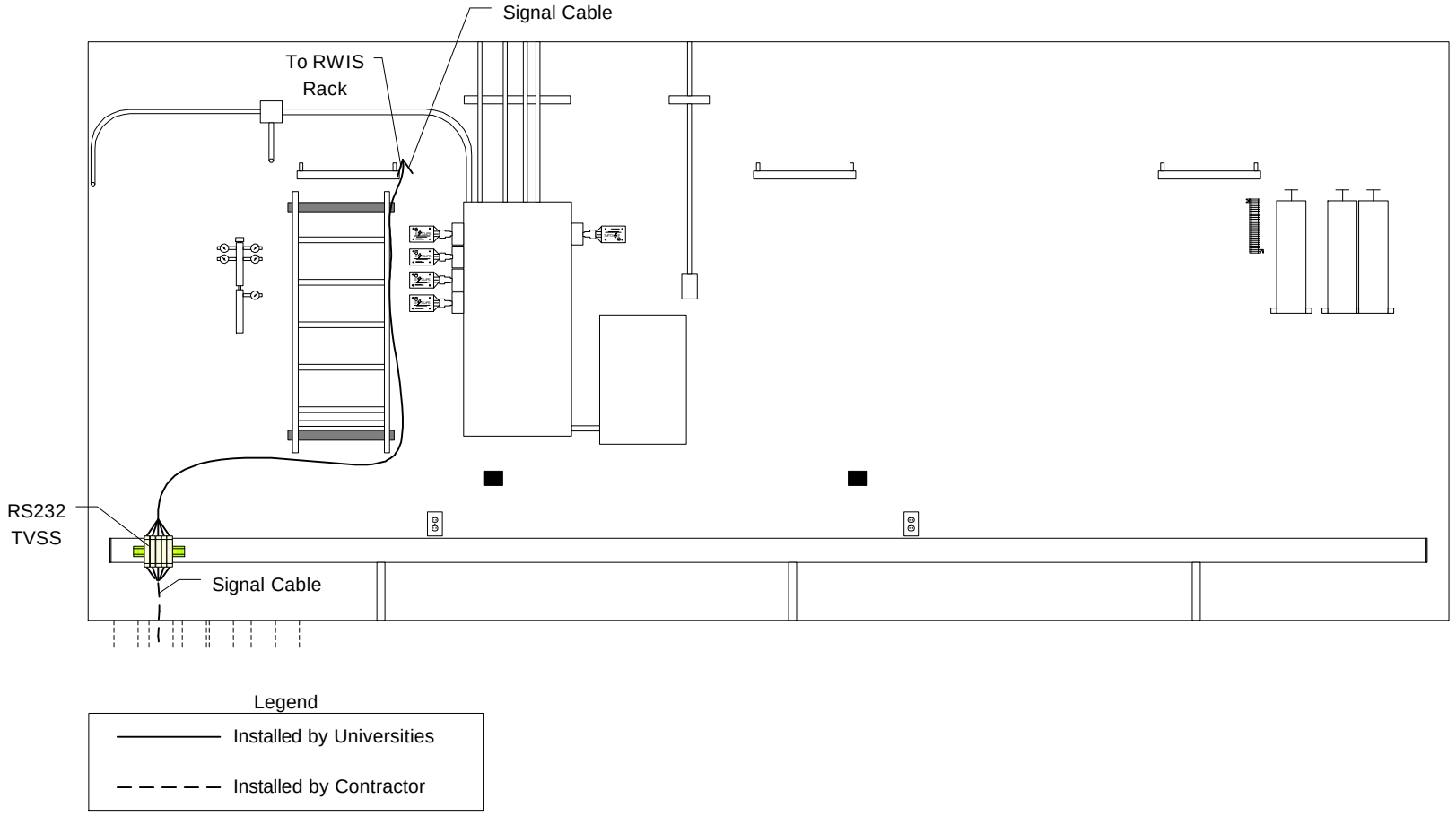
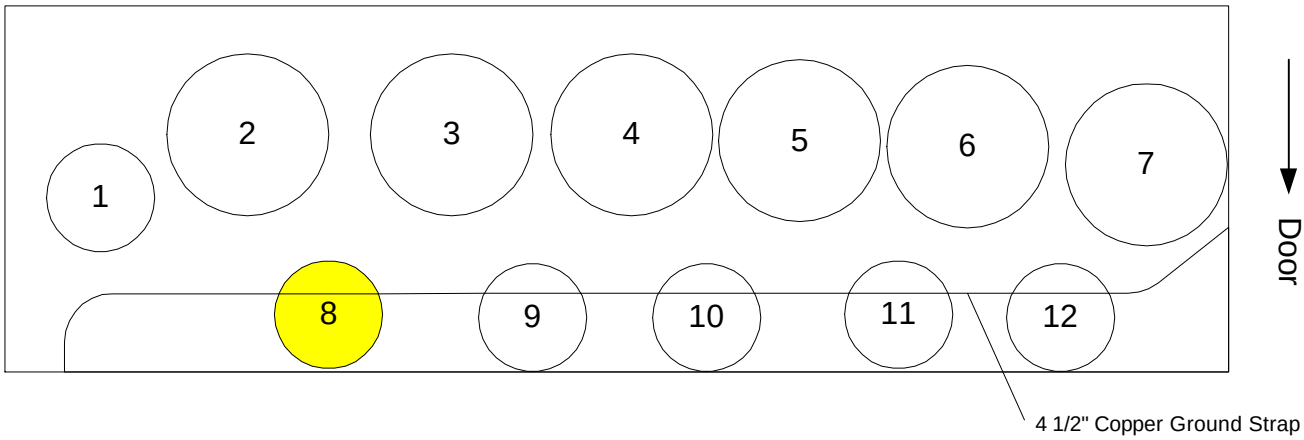


Figure A-43
Jacksonville FHP
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA43_JacksonvilleFHP_InteriorEastWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"



Interior View (Floor Entry Ports)

1. 1" Flex Conduit to Tower Light Controller
2. Empty
3. RFS Cablewave Systems Flexwell WE65
4. RFS Cablewave Systems Flexwell WE65
5. RFS Cablewave Systems Flexwell WE65
6. RFS Cablewave Systems Flexwell WE65
7. RFS Cablewave Systems Flexwell WE65
8. RWIS SERIAL CABLES
9. 45.22 MHz RFS Cablewave Systems Flexwell FLC 78-50 J Coaxial
10. 140' and 160' RFS Cablewave Systems Flexwell FLC 12-50 J Coaxial (2)

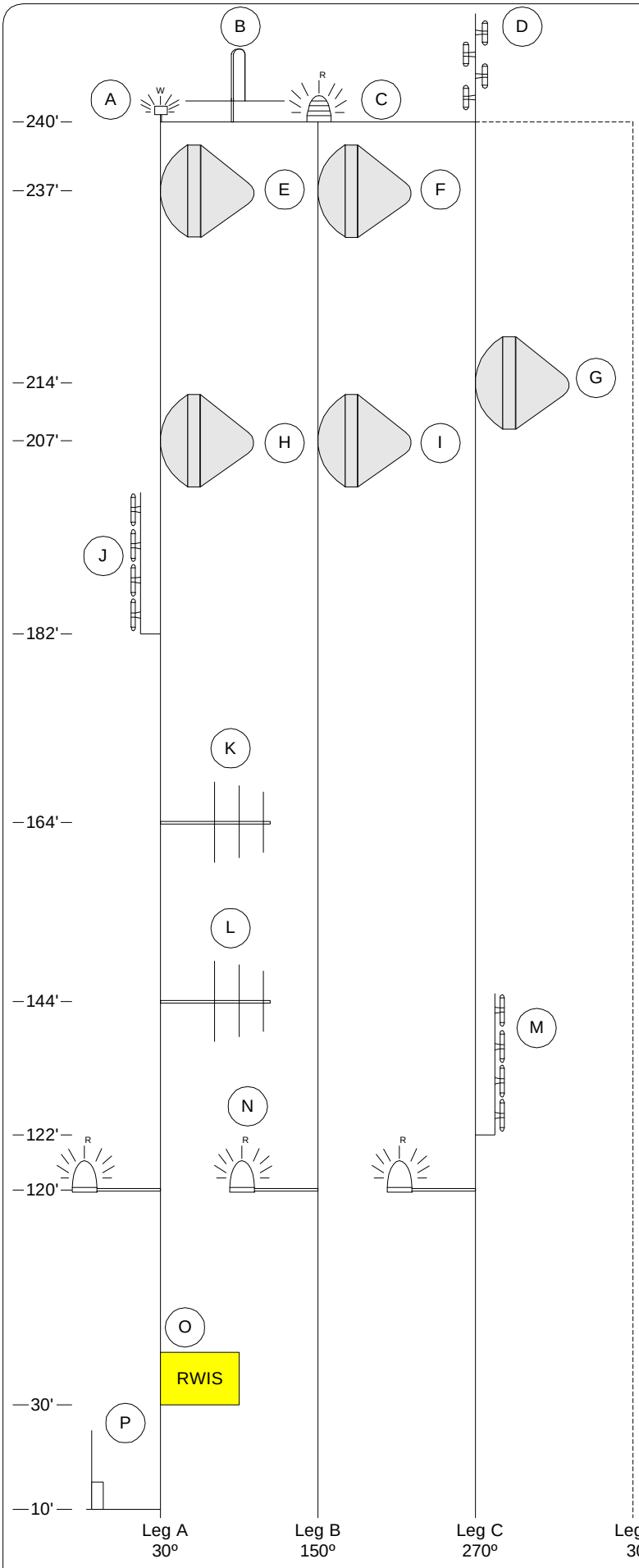
11a. RFS Cablewave Systems Flexwell 78-50 Coaxial

11b. 3/8" Tx Line to Johnson Radio (I on floor plan) and 2' High Antanna

12. 200' and 240' RFS Cablewave Systems Flexwell FLC 78-50 Coaxial (2)

Figure A-44
Jacksonville FHP
Entry Port Diagram

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Strobe	A	240' (Base)	-	-	-	
B	DB-201	-	240' (Base)	-	0.8	-	
C	Beacon	B	240' (Base)	-	-	-	
D	DB-224	C	240' (Base)	270	3.15	-	
E	PA8-65	A	237' (C.L.)	17.8	-	WE-65	
F	PA8-65	B	237' (C.L.)	131	-	WE-65	
G	PA8-65	C	214' (C.L.)	273	-	WE-65	
H	PA8-65	A	207' (C.L.)	17.8	-	WE-65	
I	PA8-65	B	207' (C.L.)	131	-	WE-65	
J	DB-224E	A	182' (Base)	30	3.15	-	
K	DB-230	A	164' (C.L.)	340	1.36	-	
L	DB-230	A	144' (C.L.)	340	1.36	-	
M	DB-224E	C	122' (Base)	270	3.15	-	
N	Side Beacons	A,B,C	120' (Base)	-	-	-	
O	Weather Sensors	A	30' (Base)	-	-	RS-232	1
P	2' High Antenna	A	10' (Base)	-	-	-	

FCC Tower Registration	1061376
Tower Manufacturer	ROHN
Tower Model Number	SSMW
Tower Serial Number	31249AE
Tower Light Controllers	N/A

Notes:

1) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
DB-XXX	Decibel Products Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna

Figure A-45
Jacksonville FHP
Antenna Loading Diagram

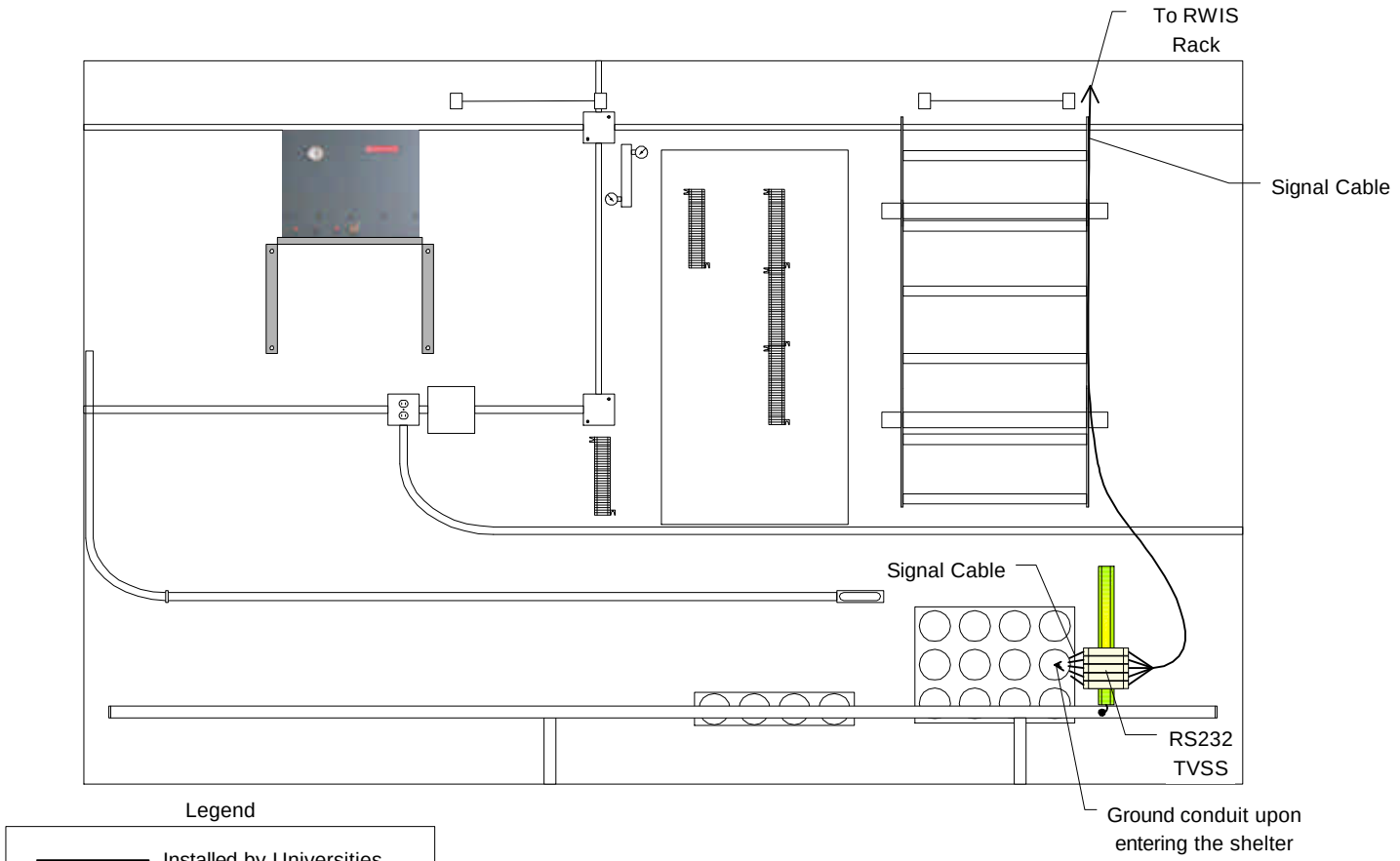
Jacksonville FHP
March 7, 2003
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA45_JacksonvilleFHP_AntennaLoadingDiagram.vsd
02/11/03

Scale: 1/2" = 1'-0"



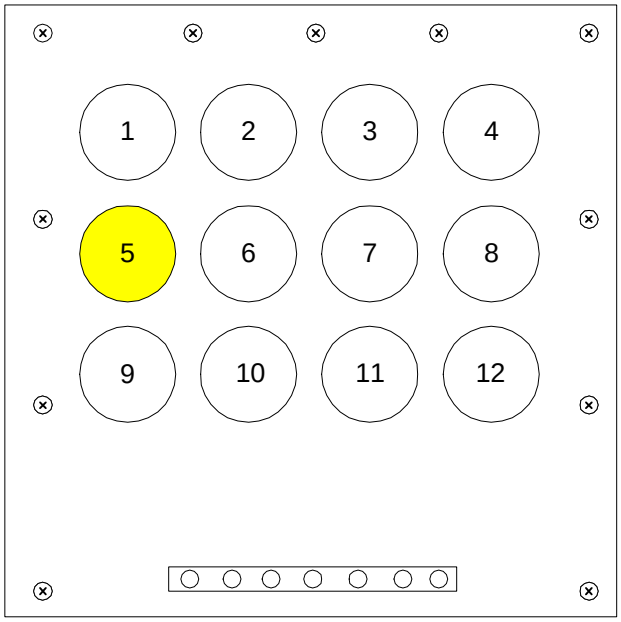
Legend

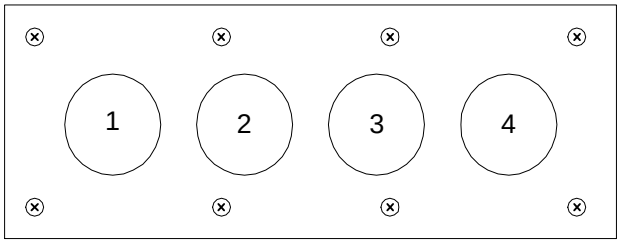
Installed by Universities

Installed by Contractor

Figure A-46
Yulee
Interior East Wall

Scale: 1 1/2" = 1'-0"



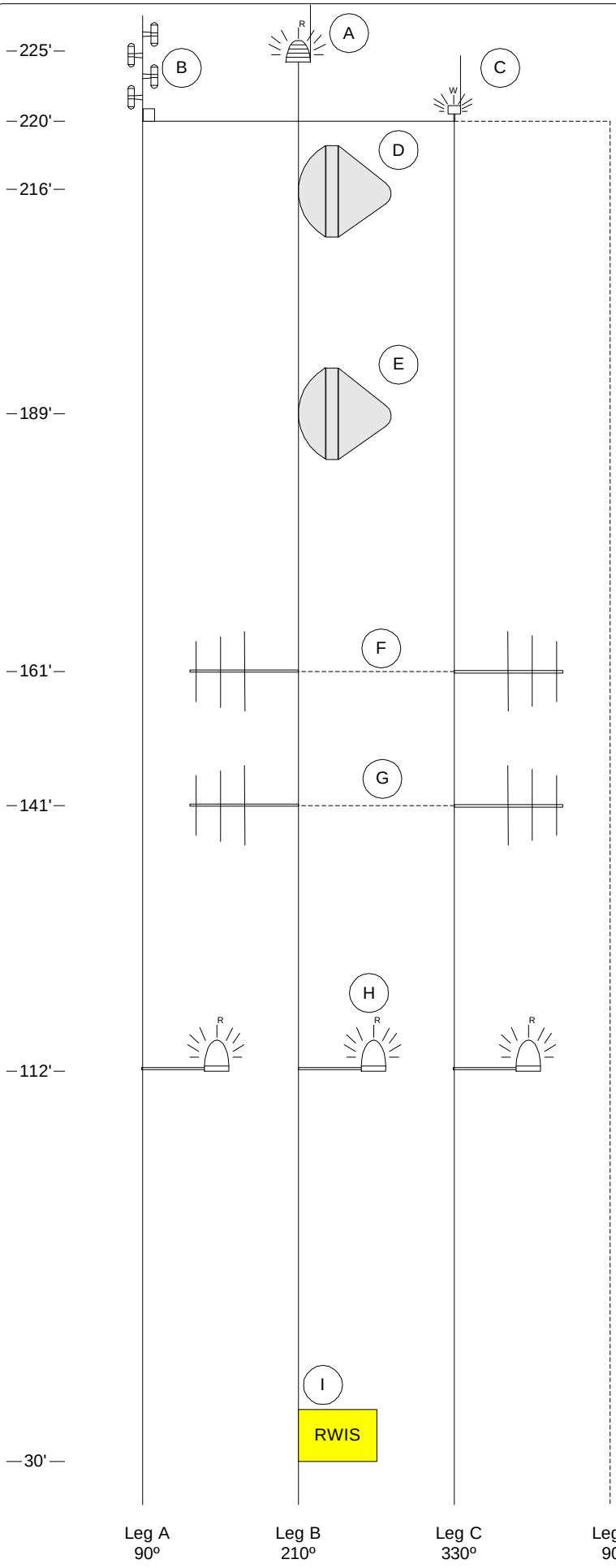


1. Andrew Heliax 1.25" LDF6-50 coaxial
2.-4. Empty

1.-2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
3.-4. Empty
5. RWIS SERIAL CABLES
6.-8. Empty
9.-11. RFS Cablewave Systems FLC 12-50J Flexwell coaxial
12. Empty

Figure A-47
Yulee
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Beacon	B	225' (Base)	-	-	-	
B	DB-224	A	220' (Base)	-	-	-	
C	Strobe	C	220' (Base)	-	-	-	
D	PA8-65	B	216' (C.L.)	190	-	WE-65	
E	PA8-65	B	189' (C.L.)	190	-	WE-65	
F	DB-230-2	B,C	161' (C.L.)	190/ 20	-	-	1/Rx
G	DB-230-2	B,C	141' (C.L.)	190/ 20	2.72	-	1/Tx
H	Side Beacons	A,B,C	112' (C.L.)	-	-	-	
I	Weather Sensors	B	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1060072
Tower Manufacturer	ROHN
Tower Model Number	SSVMW
Tower Serial Number	SSVMW
Tower Light Controllers	N/A

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.

C.L..	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
PA8-65	RFS Cablewave Systems Microwave Anrenna
PD-320	Andrew Corporation Antenna
DB-XXX	Decibel Products Antenna
Tx	Transmit
Rx	Receive

Figure A-48
Yulee
Antenna Loading Diagram

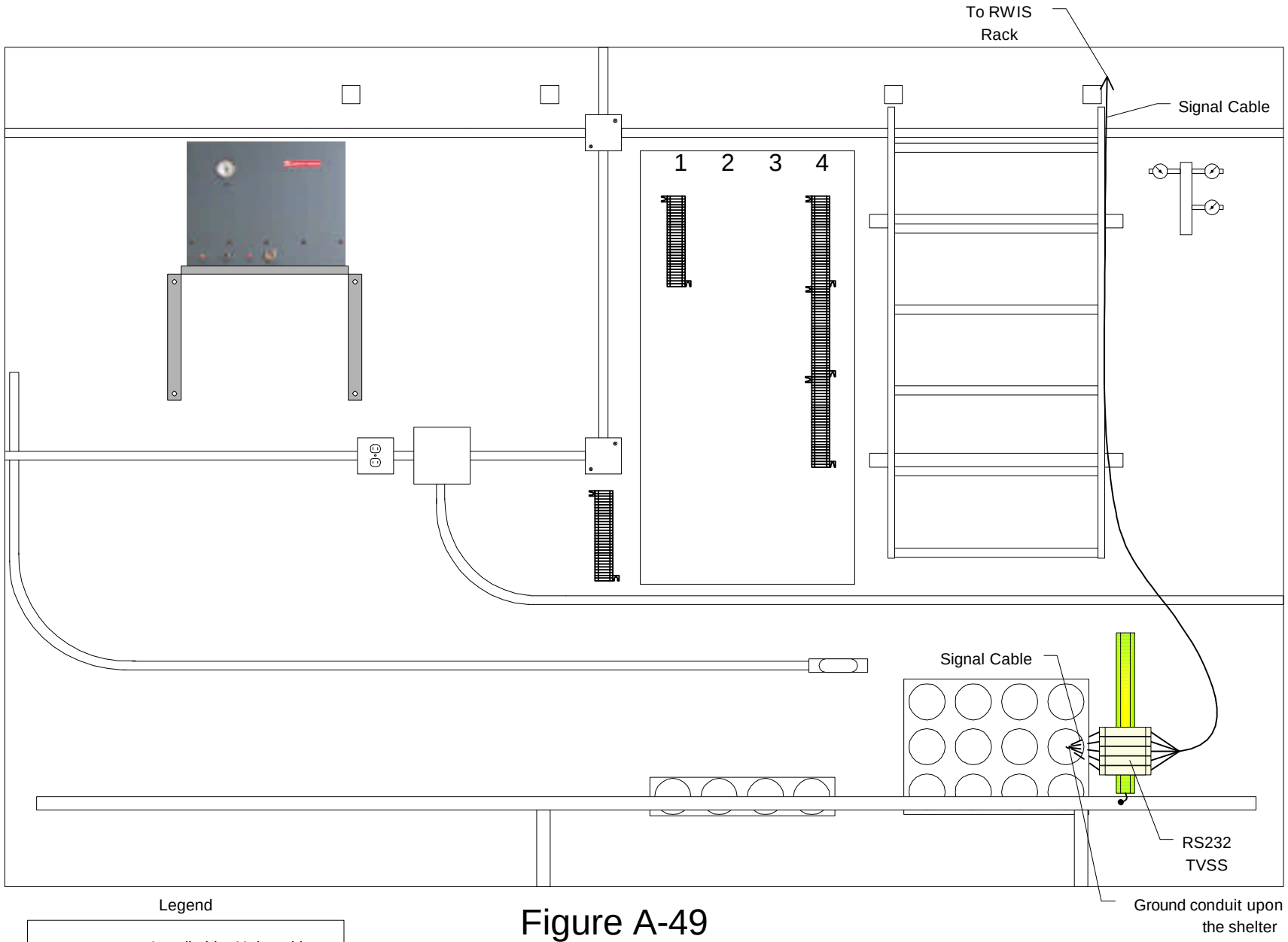
Yulee
October 25, 2002
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA48_Yulee_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" = 1'-0"



Legend

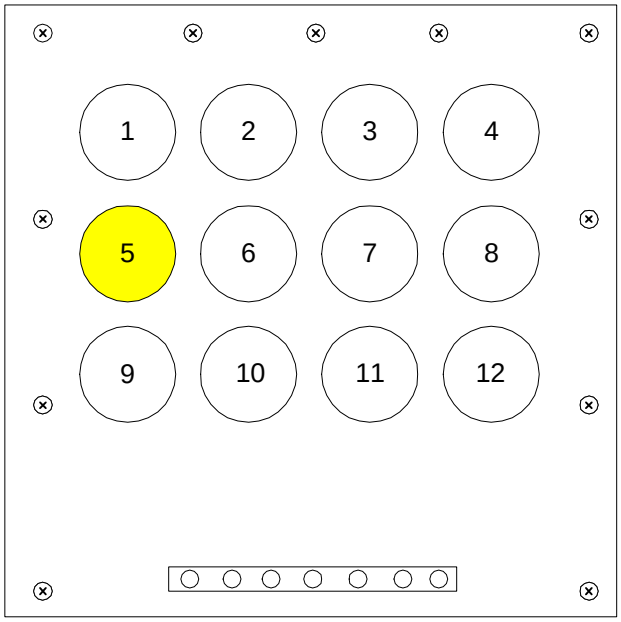
Installed by Universities

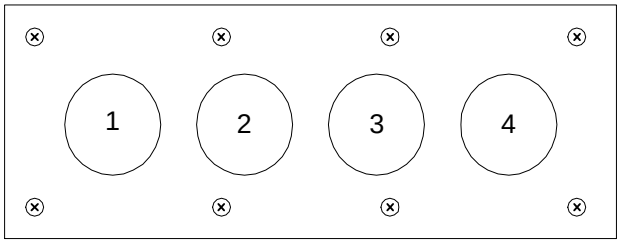
Installed by Contractor

Figure A-49
Saint Johns Rest Area
Interior East Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA49_StJohnsRestArea_InteriorEastWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"



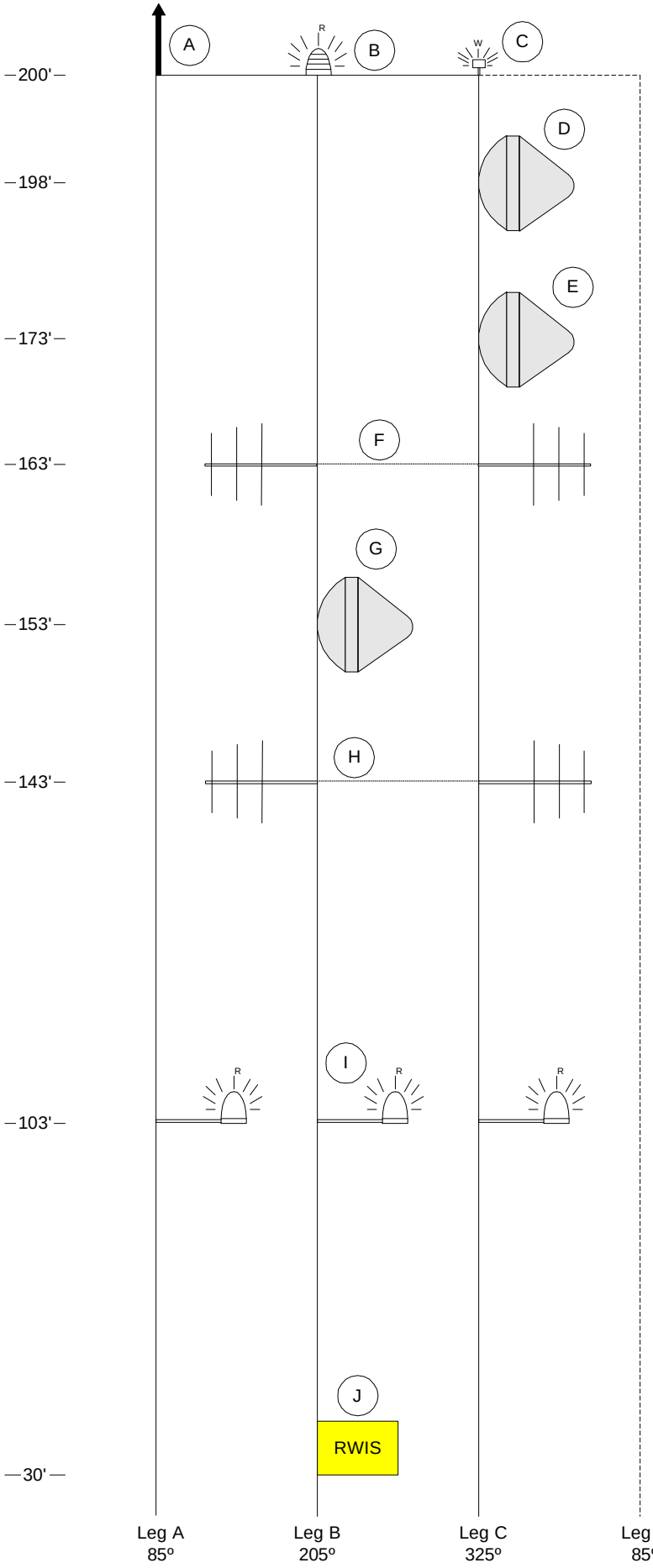


1. Andrew Heliax 1.25" LDF6-50 coaxial
2.-4. Empty

1. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
2. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
4. Empty
5. RWIS SERIAL CABLES
6.-8. Empty
9.-12. RFS Cablewave Systems S-FLC 12-50J Flexwell coaxial

Figure A-50
Saint Johns Rest Area
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Lightning Rod	A	200' (Base)	-	-	-	
B	Beacon	B	200' (Base)	-	-	-	
C	Strobe	C	200' (Base)	-	-	-	
D	PA8-65	C	198' (C.L.)	320	-	WE-65	
E	PA8-65	C	173' (C.L.)	320	-	WE-65	
F	DB-230-2	B, C	163' (C.L.)	160/ 325	2.72	1-1/4"	1
G	PA8-65	B	153' (C.L.)	155	-	WE-65	
H	DB-230-2	B, C	143' (C.L.)	160/ 325	2.72	1-1/4"	1
I	Side Beacons	A, B, C	103' (Base)	-	-	-	
J	Weather Sensors	B	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1060069
Tower Manufacturer	N/A
Tower Model Number	N/A
Tower Light Controllers	N/A

Notes:
1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1-1/4" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
1-1/4"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
PA8-65	RFS Cablewave Systems Microwave Antenna
DB-XXX	Decibel Products Antenna

Figure A-51
St. Johns Rest Area
Antenna Loading Diagram

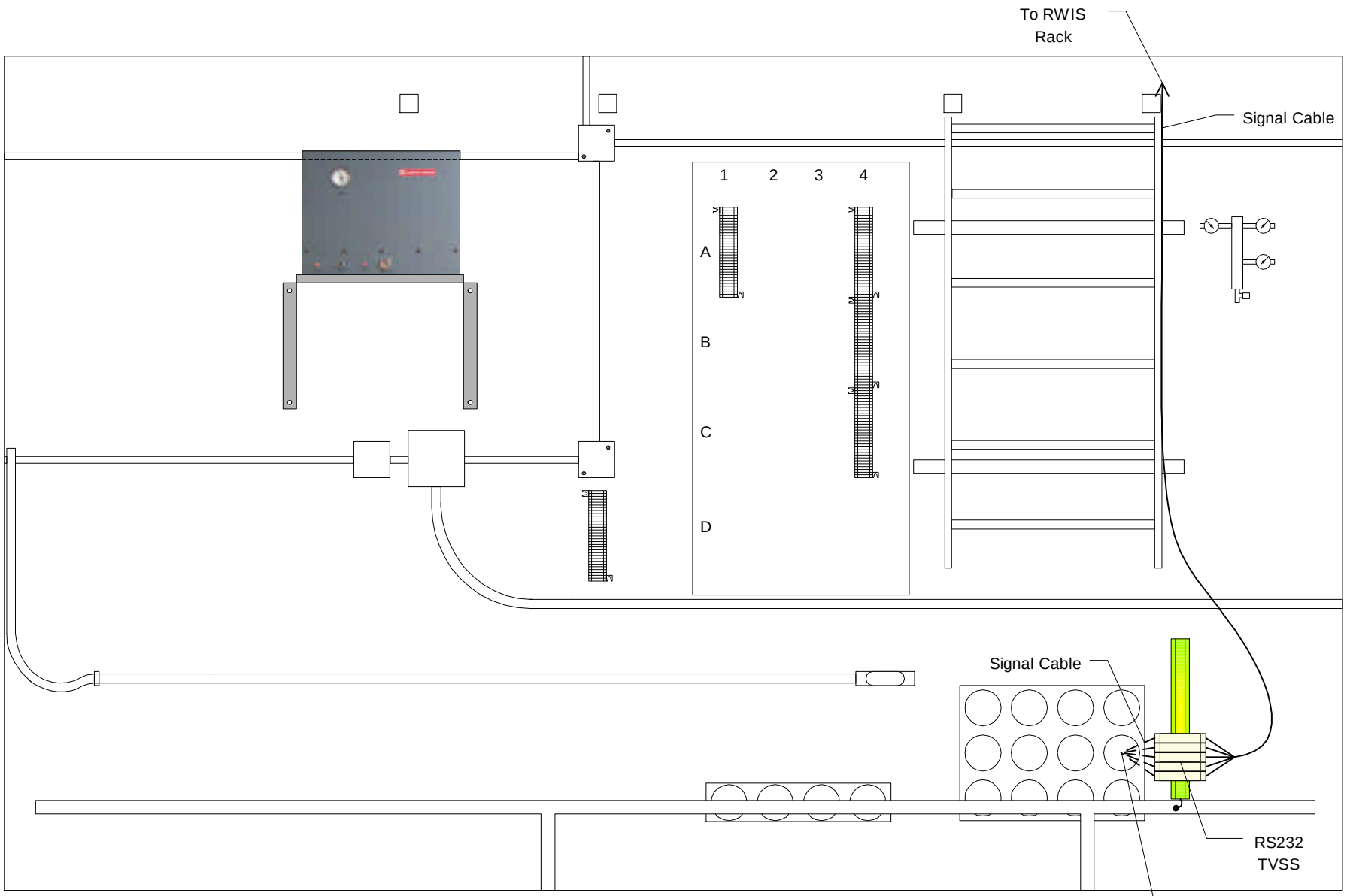
St. Johns Rest Area
July 24, 2002
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA51_StJohnsRestArea_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" : 1'



Legend

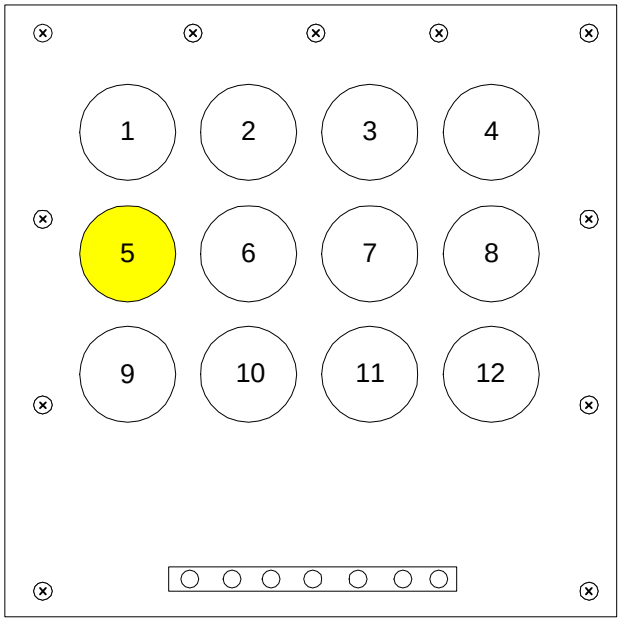
Installed by Universities

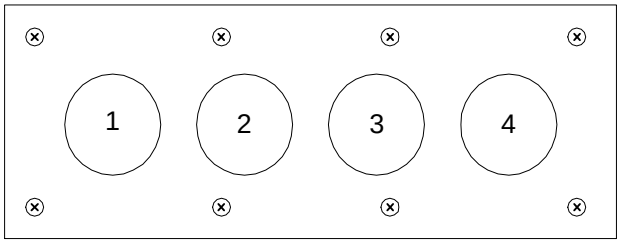
Installed by Contractor

Figure A-52
SR16
Interior South Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA52_SR16_InteriorSouthWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"



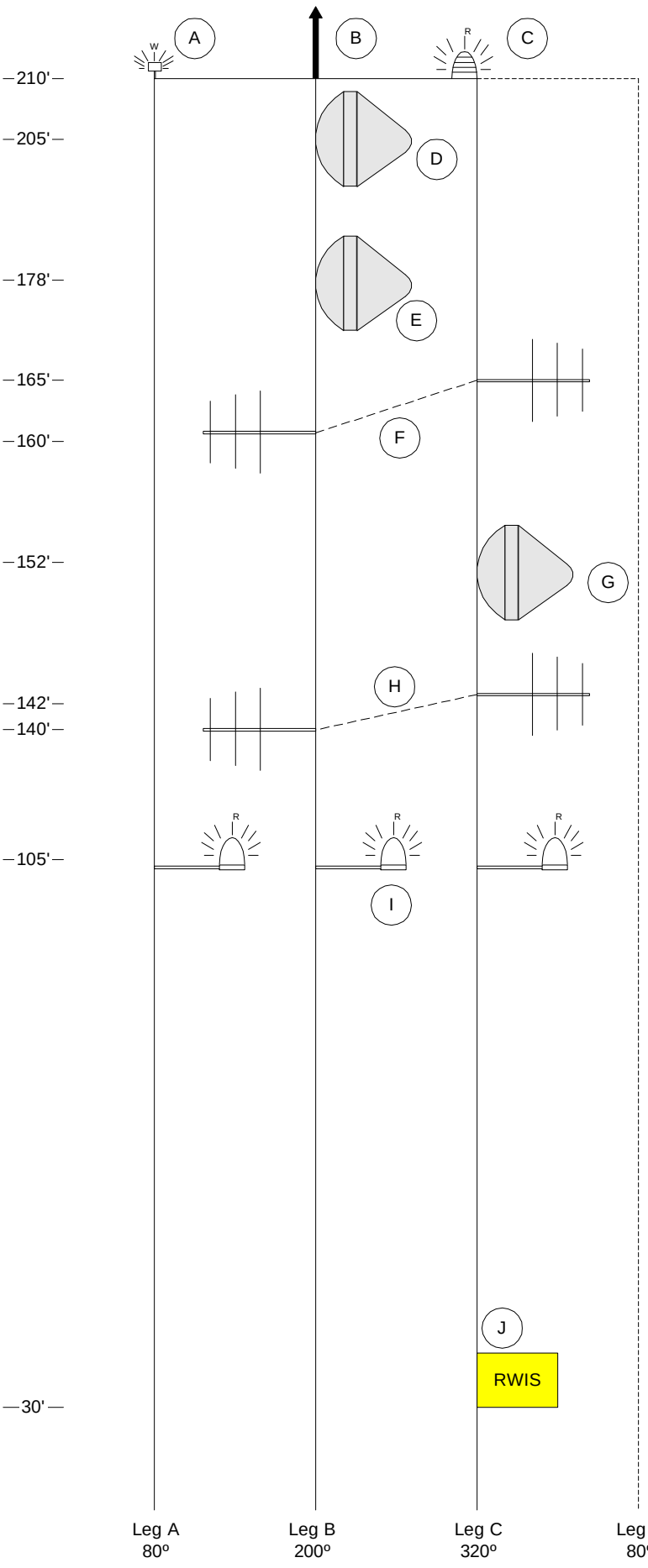


1.-4. Empty

1.-3. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
4. Empty
5. RWIS SERIAL CABLES
6.-8. Empty
9.-10. RFS Cablewave Systems S-FLC 12-50J Flexwell coaxial
11.-12. Empty

Figure A-53
SR16
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Strobe	A	210' (Base)	-	-	-	
B	Lightning Rod	B	210' (Base)	-	-	-	
C	Beacon	C	210' (Base)	-	-	-	
D	PA8-65	B	205' (C.L.)	156.6	-	WE-65	
E	PA8-65	B	178' (C.L.)	156.6	-	WE-65	
F	DB-230-2	C	165' 160'	-	2.72	-	1
G	PA8-65	C	152' (C.L.)	336.6	-	WE-65	
H	DB-230-2	C, B	142' 140'	-	2.72	-	1
I	Side Beacons	A, B, C	105' (Base)	-	-	-	
J	Weather Sensors	C	30' (Base)	-	-	RS-232	2

FCC Tower Registration	1061377
Tower Manufacturer	ROHN
Tower Model Number	SSVMW
Tower Serial Number	N/A
Tower Light Controllers	Dual Lighting

Notes:
1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
7/8" ,1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series
PA8-65	RFS Cablewave Systems Microwave Antenna
DB-XXX	Decibel Products Antenna

Figure A-54
SR 16
Antenna Loading Diagram

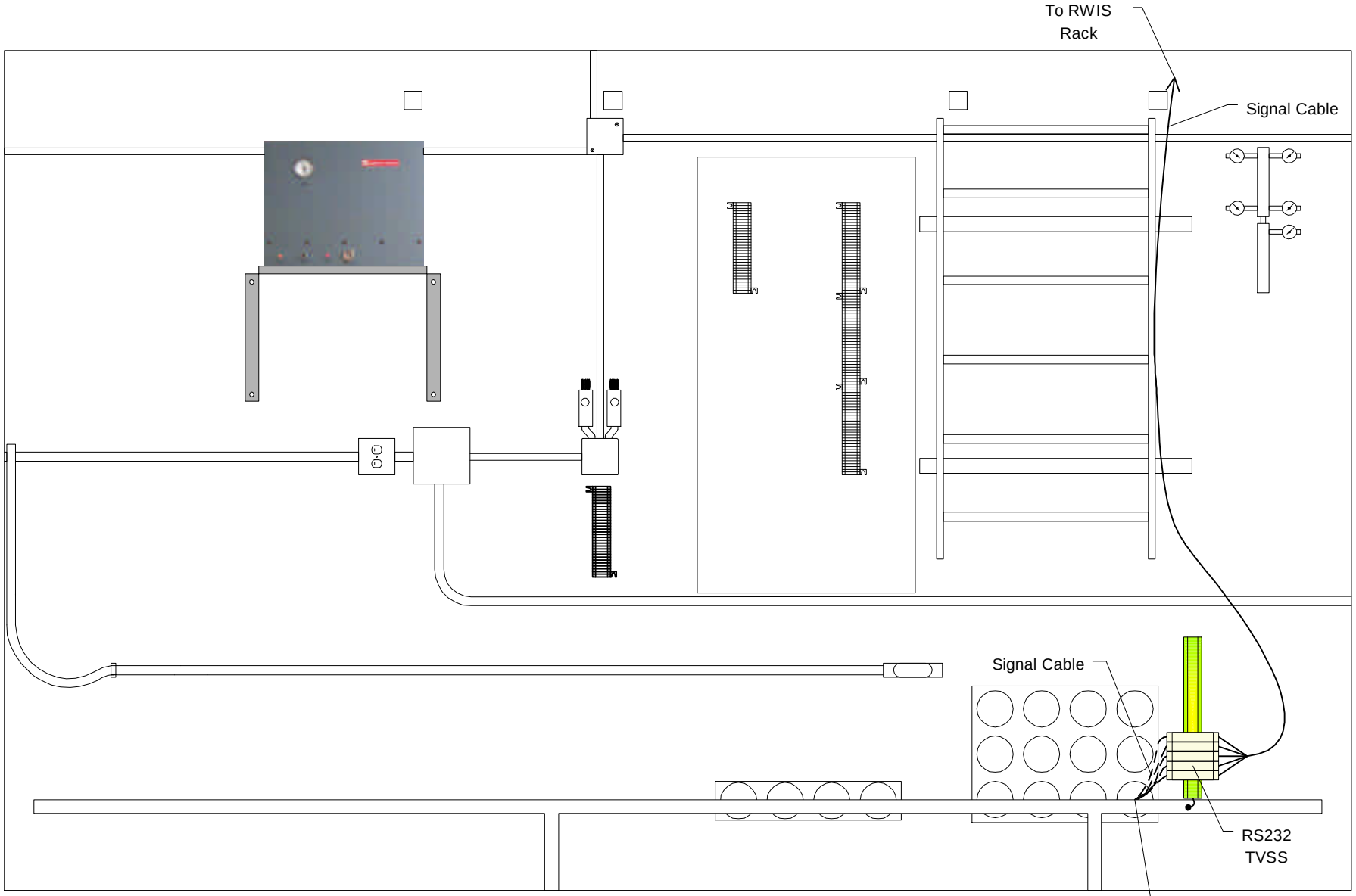
SR 16
October 30, 2002
Verified: Yes

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA54_SR16_AntennaLoadingDiagram.vsd
02/11/03

Scale: 3/4" = 1'-0"



Legend

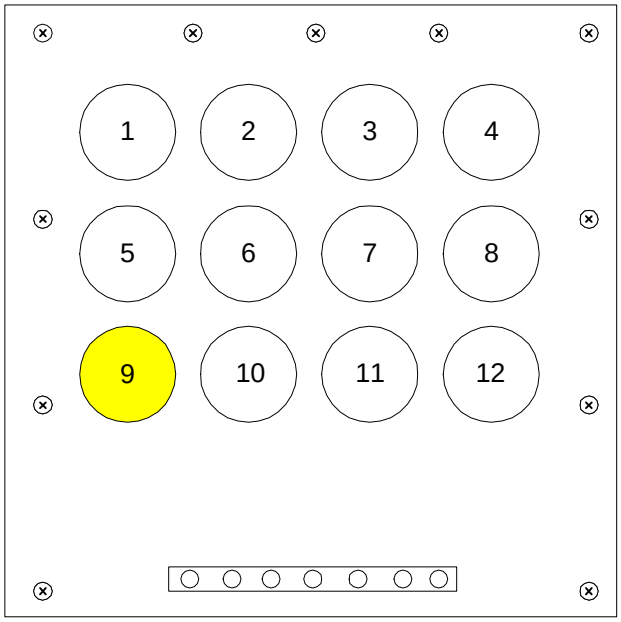
Installed by Universities

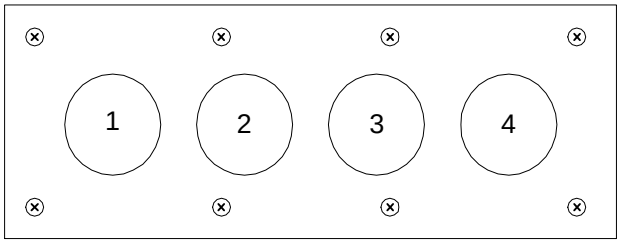
Installed by Contractor

Figure A-55
Gopher Ridge
Interior West Wall

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA55_GopherRidge_InteriorWestWall.vsd
02/11/03

Scale: 1 1/2" = 1'-0"



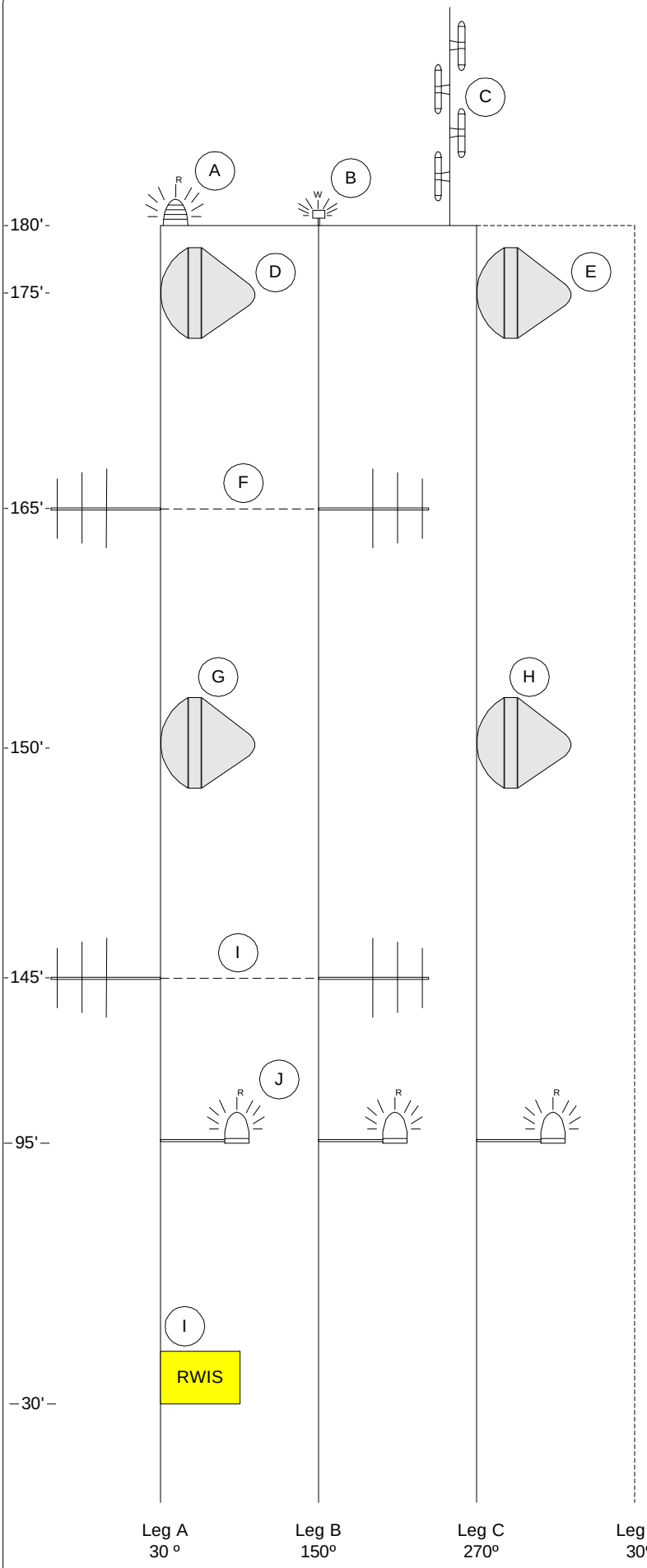


1.-4. Empty

1.-5. RFS Cablewave Systems WE65 Flexwell Elliptical Waveguide
6.-8. Empty
9. RWIS SERIAL CABLES
10.-12. RFS Cablewave Systems FLC 12-50J Flexwell coaxial

Figure A-56
Gopher Ridge
Entry Port Diagram
Exterior View

NOT TO SCALE



ID	Type	Leg	Elev.	Deg.	FPE	Tx. Line	Note
A	Beacon	A	180' (Base)	-	-	-	
B	Strobe	B	180' (Base)	-	-	-	
C	DB-224	C	180' (Base)	-	3.15	7/8"	
D	PA8-65	A	175' (C.L.)	338	-	WE-65	
E	PA8-65	C	175' (C.L.)	270	-	WE-65	
F	DB-230-2	A, B	145' (C.L.)	350/ 135	2.72	1/2"	1
G	PA8-65	A	150' (C.L.)	338	-	WE-65	
H	PA8-65	C	150' (C.L.)	270	-	WE-65	
I	DB-230-2	A, B	145' (C.L.)	350/ 150	2.72	1/2"	1
J	Side Beacons	A, B, C	95' (C.L.)	-	-	-	
I	Weather Sensor	A	30' (Base)	-	-	-	

FCC Tower Registration	1061378
Tower Manufacturer	ROHN
Tower Model Number	SSV
Tower Serial Number	31249AE
Tower Light Controllers	N/A

Notes:

1) This antenna is comprised of two (2) DB-230 antennas connected via a phasing harness to make the antenna array. The antennas are mounted on separate legs. One (1) 1/2" transmission line feeds this antenna array. The given F.P.E. is 2.72 for both antennas as a system.
2) Weather sensors to be installed as part of this project.

C.L.	Center Line of Antenna
DB-XXX	Decibel Products Antenna
PA8-65	RFS Cablewave Systems Microwave Antenna
WE-65	RFS Cablewave Systems Elliptical Waveguide
7/8", 1/2"	Andrew Corporation Foam Dielectric Transmission Line, LDF Series

Figure A-57
Gopher Ridge
Antenna Loading Diagram

Gopher Ridge
June 6, 2002
Verified: No

State of Florida
Department of Transportation

RCC Consultants, Inc.

TLITSSERVER:\\Personnel\KN962WA\Projects\MicMaint\RWISTowerSensorInstallation\FigureA57_GopherRidge_AntennaLoadingDiagram.vsd
02/11/03

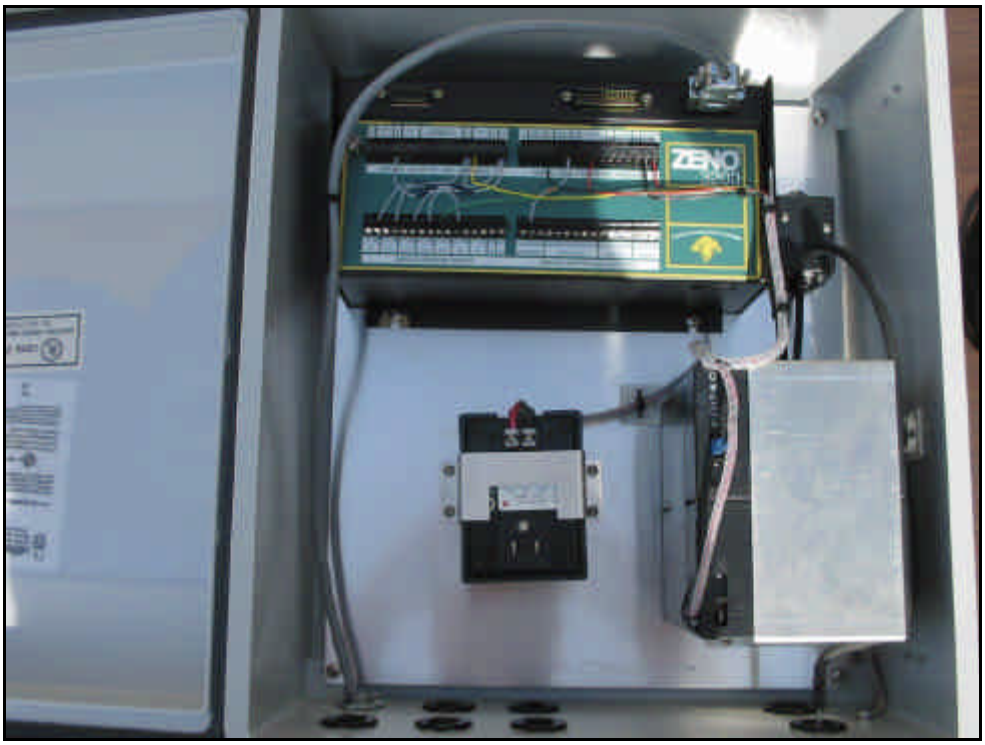
APPENDIX B

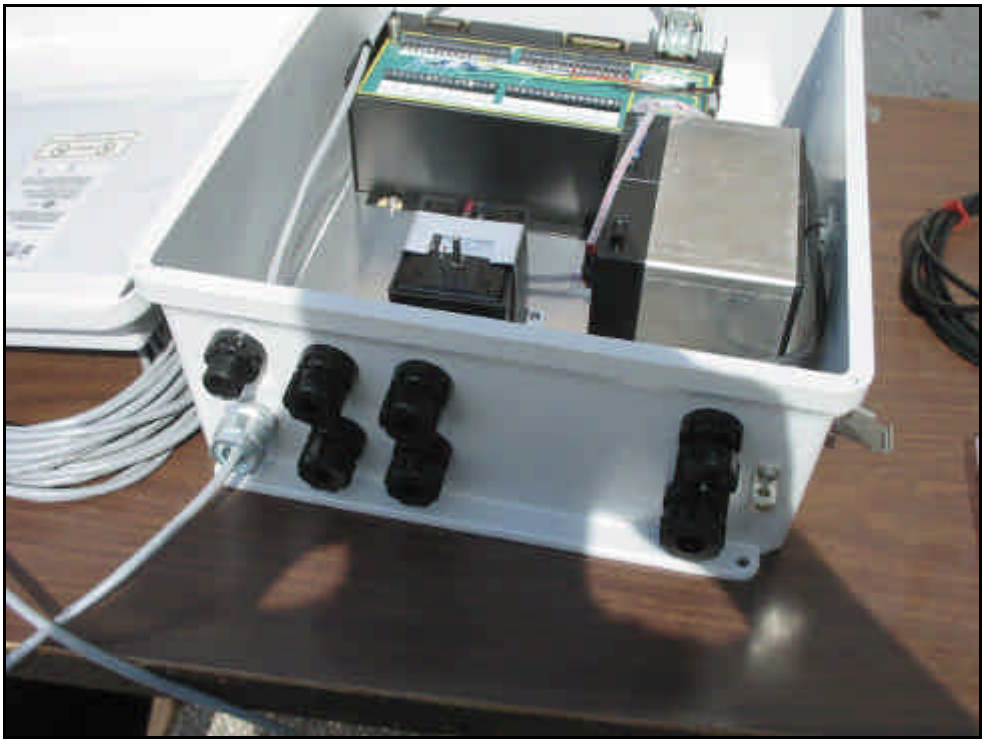
WEATHER SENSORS PHOTOS

ASPIRATOR
Coastal Environmental Systems
(Part Number: S1276Z)
(Temperature and Relative Humidity Sensors)

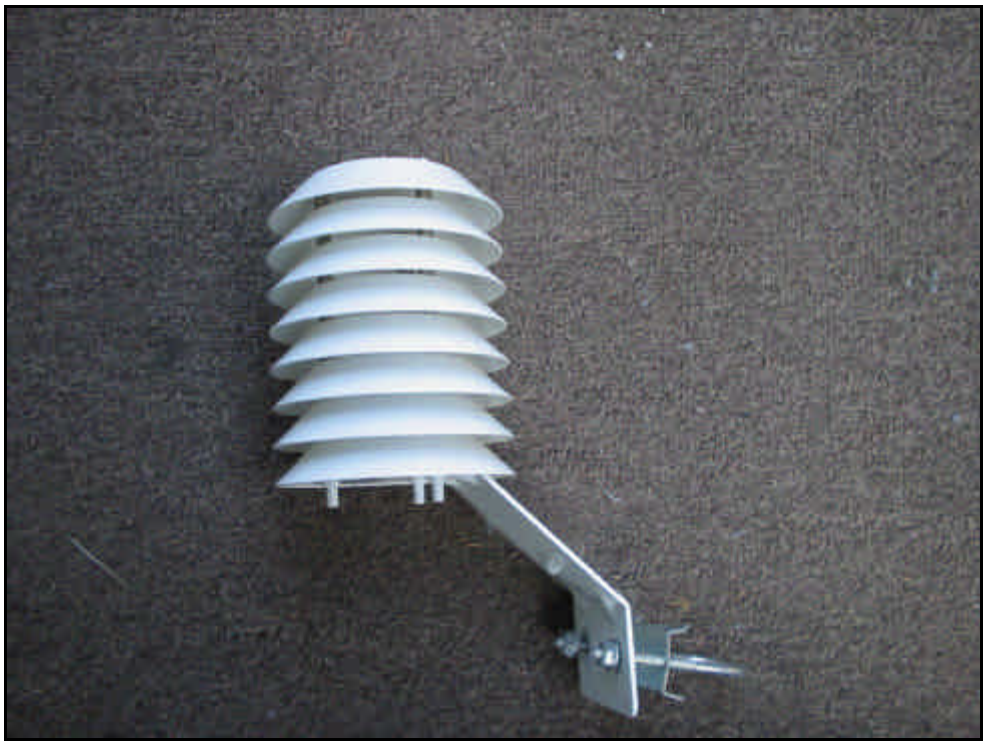
JUNCTION BOX

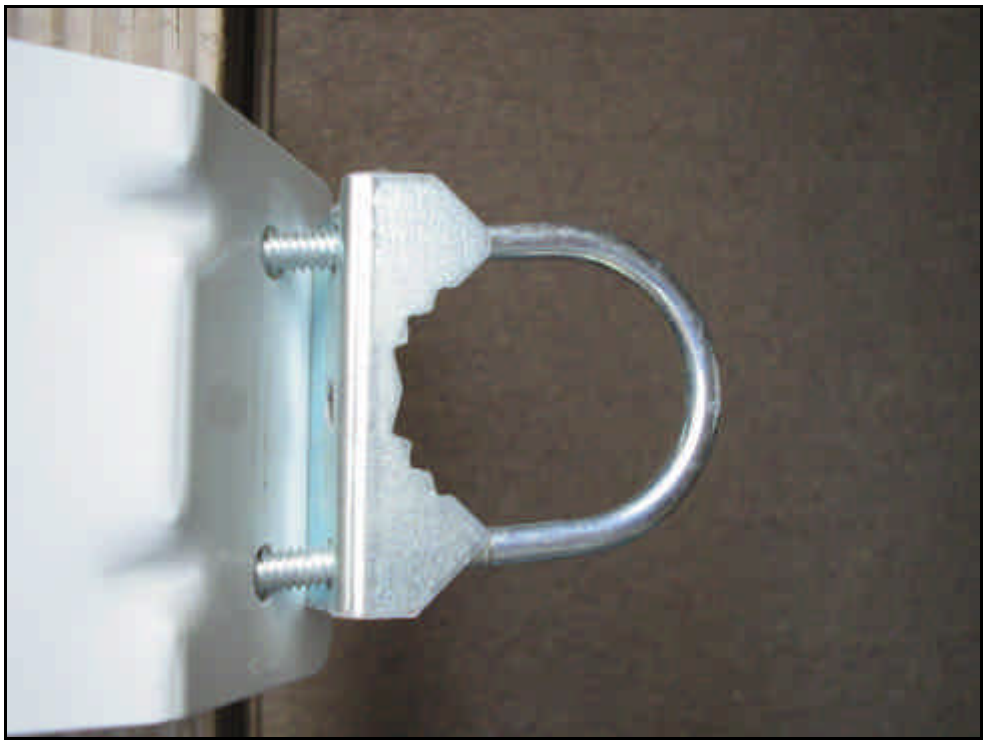
ANEMOMETER
Coastal Environmental Systems
(Part Number: S5777)



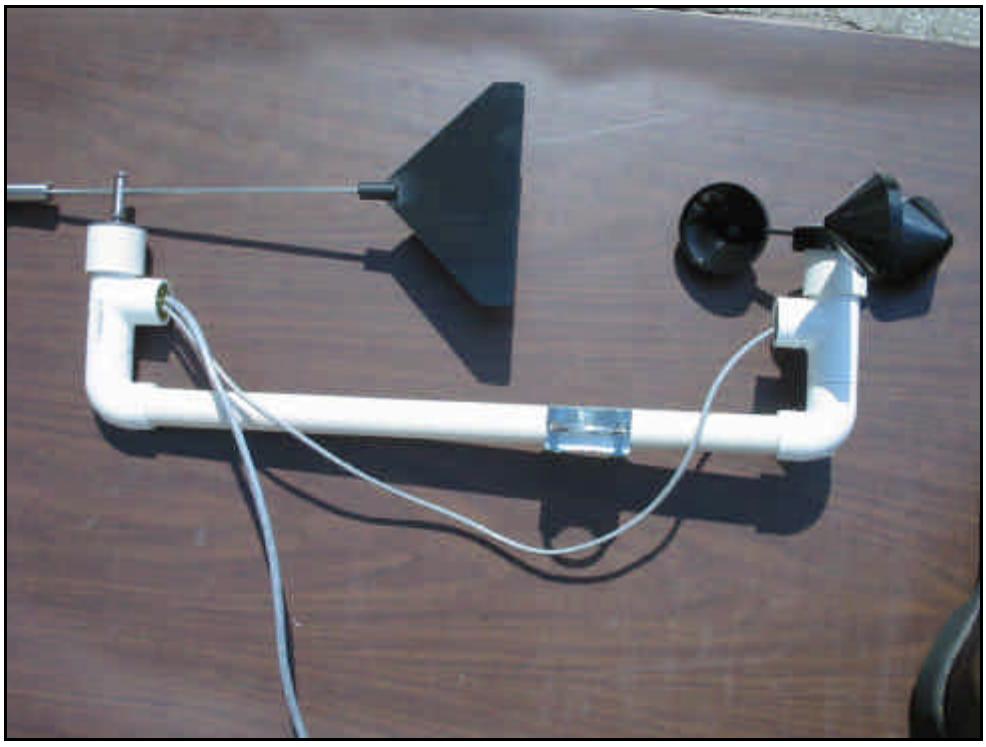


DATA LOGGER
Coastal Environmental Systems
(Part Number: Zeno 3200)
Inside Weatherproof Metallic Box

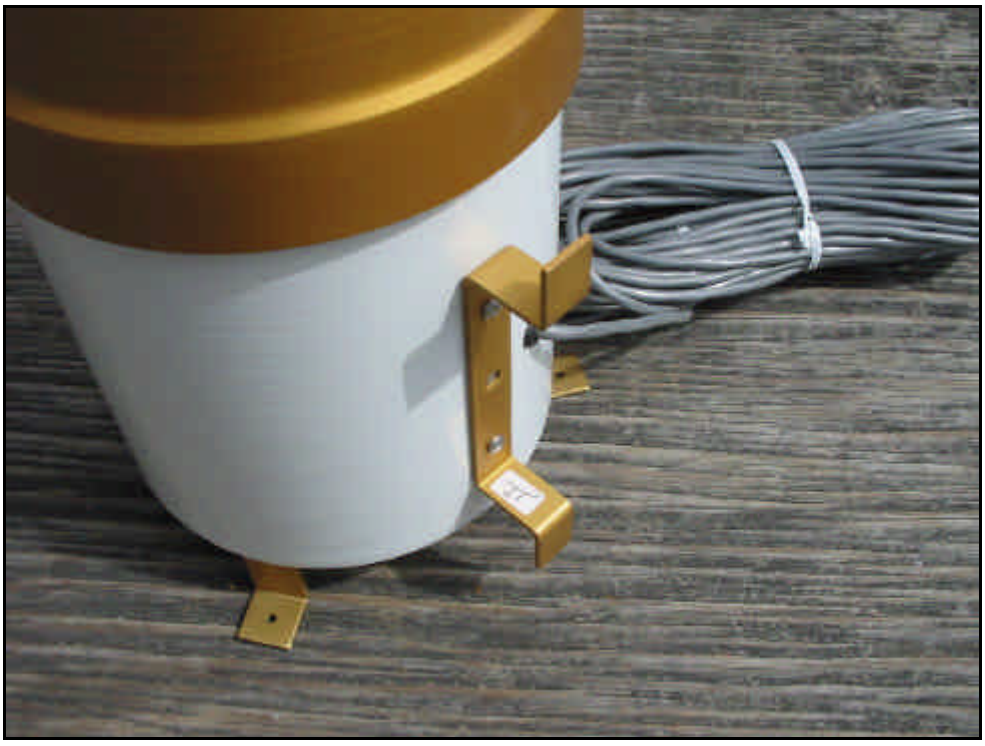




ASPIRATOR
Columbia Weather Systems
(Part Number: 82103)
(Temperature and Relative Humidity Sensors)



ANEMOMETER
Columbia Weather Systems
(Part Number: 8150-D-1)
Capricorn 2000 Kit



PRECIPITATION SENSOR
Columbia Weather Systems
(Part Number: 82300)