Sunair Electronics

A Global Leader in Design, Manufacture and Integration of Strategic Communications Systems

Focus Areas

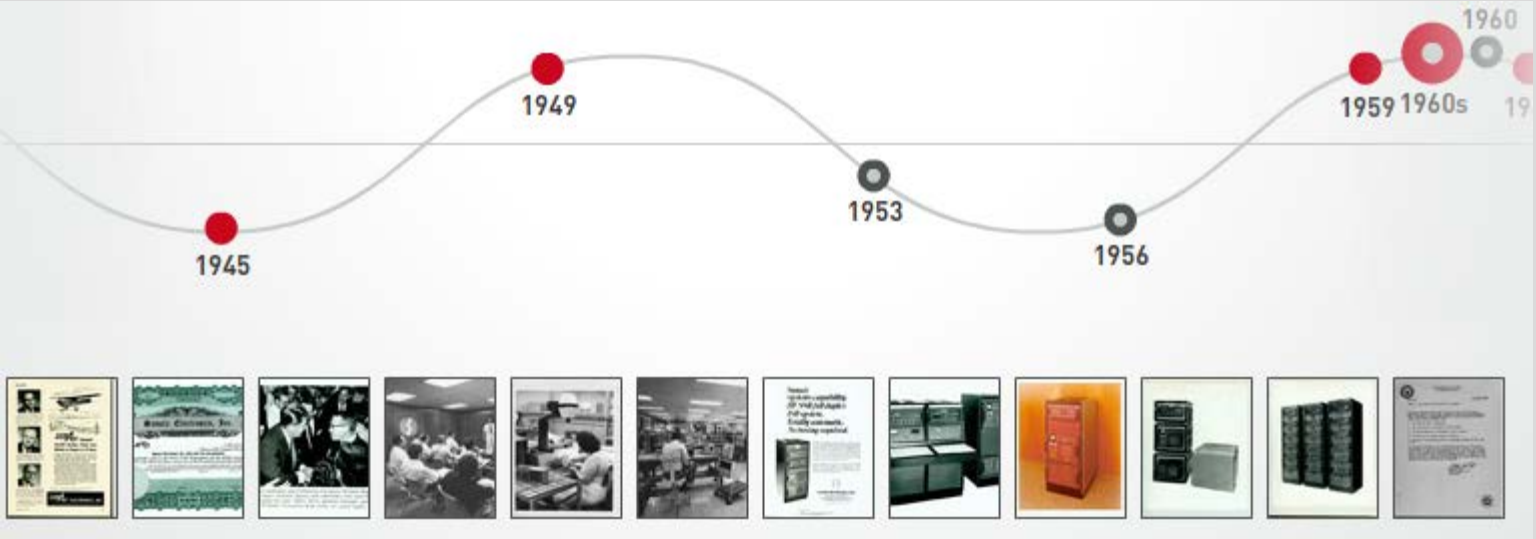
Strategic HF Systems

- 1 KW HF Systems

- 5 KW & 10 KW HF Systems

History

- 1956: Founded and began designing and manufacturing airborne & transportable HF radio systems
- 1960s: Released the notable ASB line of FAA / FCC approved aviation HF radios
- 1970s: Shifted focus to strategic HF radio systems with release of GSB line of HF radios
- 1990s: Released the 9000 Series HF product line
- 2000 – Present:
  - Evolved into turnkey systems supplier and integrator. Provider of tailored communications solutions.
  - Completing enhanced product development programs (e.g. T-10000A 10 Kilowatt Transmitter System)
  - Establishing Partnerships with leading communications firms around the globe



Global Presence

Throughout our history of leadership in the arena of strategic HF communications, Sunair equipment has made its way to all 7 continents and nearly 100 countries and has been widely adopted across all markets, including military, government, civil aviation, and commercial applications. Every hour of every day, our products proudly serve those around the world who protect us in air, on land, and on sea.

Sunair Capabilities

- Product engineering and manufacturing
- Systems engineering and integration
- Integrated logistics support

Product Engineering and Manufacturing

- State-of-the-art high frequency equipment for long-range voice and data communications
- Since 1956, successfully developed and deployed over 100 distinct products for digitally-controlled HF radio, peripheral modem, message handling, and frequency agile systems
- Engineered and assembled in the USA
- Designed for applications in C3 (command, control, and communications), fixed station, shelterized, transportable, vehicular, and shipboard environments

Systems Engineering and Integration

- Requisite technical knowledge to design and modify standard Sunair product to meet unique specifications and link HF with other means of communication
- Configurations may include an array of accessories and interfaces from security to data, facsimile, or others; may encompass fixed station, rapidly deployable hardware, or a combination
- Expertise in analyzing and incorporating multiple subsystems, interface protocols, network configurations, and database management tools

Integrated Logistics Support

- Site feasibility studies and site surveys
- Propagation studies, HF to Microwave
- Site planning, layout, and design to meet local standards
- Requirements allocations
- System integration and test support
- Antenna system design (HF, VHF, UHF, and Microwave)
- System installation and labor supervision
- Full documentation, work and as-built
- Acceptance testing (FAT, SAT, etc.) and commissioning services
- Operational and maintenance support
- On-the-job training
- Specialized training, at operational, maintenance, and/or component-level
- Contract engineering and technical support
- Sustaining engineering services and field updates
- Depot level maintenance support and repair services

Applications

- **Air**
  - Ground-to-air communications packages for airborne support, airspace security and air traffic control applications
- **Surface**
  - Ground-to-ground communications packages in fixed station, shelterized, transportable, and vehicular settings
- **Maritime**
  - Ship-to-shore communications packages for military, emergency management, disaster relief, and peacekeeping applications

Markets Served

- Military
  - Air forces, land forces, naval forces, joint forces
- Government / International Organizations
- Civil Aviation
- Commercial

High Frequency Products

- **HF Radios**
  - 9000 Series Transceivers
- **HF Power Amplifiers**
  - LPA-9500 (500 Watt) and LPA-9600 (1 Kilowatt)
- **High Power Strategic Transmitter Systems**
  - T-5000A (5 Kilowatt) and
  - T-10000A (10 Kilowatt)
- **HF Antenna Couplers**
  - CU-9125 (150 Watt) and CU-9150 (1 KW) Automatic Antenna Coupler
- **Accessories**
  - 9310D Series Remote Control Units, F-9800 Pre/Post-Selector, KY-9120 Line Interface Unit, PATHFINDER II Remote Control Software

Focus Area - 1

1 KW HF System

Block Diagram of Typical 1 KW HF System

F-9800
Pre/Post-Selector

Antenna

9000E Series
Transceiver

LPA-9600 1 KW
Power Amplifier

CU-9150
Antenna Coupler

Pathfinder/ RCU-
9310E

RT-9000E Series HF Transceiver Salient Features

- **Ethernet control** in addition to standard RS-232/422
- **VoIP** interface
- Internal remote control modem
- **Higher Data** capabilities improvement from 300 bps to **19.2kbps**
- Expanded channel capability of 1,000 versus 128
- Compatibility for BRASS (Broadcast & Ship-Shore) & GMDSS (Global Maritime Distress Safety System)

Optionality:

- Internal MIL-STD-188-141B **2G ALE**
- Internal STANAG 4538 **3G ALE**
- Internal **MIL-STD-188-110A/B HF data modem with rates up to 19.2 kbps**
- **Frequency hopping**

Key Features

- ✓ **Modes of operation:** ISB, USB, LSB, AM, FM, CW, and internal DATA modem option
- ✓ **Minimum Tunable Frequency Steps**: (1, 10, 100, 1k, 10k, 100k) Hz steps and 1 MHz step also
- ✓ **Frequency Stability:** $\pm$ 1 x 10^{-8}
- ✓ **Synthesizer lock:** 10 ms
- ✓ **Transmitter/ Receiver switching time:** Maximum 10 ms
- ✓ **Operates in the entire HF band from 1.5 to 30 MHz** – *(Note: 1.5 MHz allows better surface wave propagation in lower frequencies/ standard HF band followed by European & US standards)*
- ✓ **ECCM method:** Frequency Hopping (up to 10 times per sec)
- ✓ **Radio Support Functions over Ethernet:** Remote control, configuration, BITE, firmware update and data to/from internal HF modem through Ethernet port
- ✓ **Encryption:** Sunair HF systems can be integrated with existing Encryption units of the Armed Forces, if so desired

Key Features
(Cont'd.)

- ✓ **Prolonged operation:** 100% Continuous Transmit/ Receive Duty Cycle
- ✓ **Power Amplifier has forward and reflected power indicator.**
- ✓ **AC/ DC auto changeover with Power supply as an integral part of the Radio (No external adapters or power supply units are required)**
- ✓ **Antenna Tuning Unit/ Automatic Antenna Coupler is an integral component of the 1KW HF system**
- ✓ **Common Aerial Working (CAW):** Same antenna can be used for receive and transmit. Multiple radios on one antenna would require RX and/ or TX multi-coupler.
- ✓ **NVIS (Near Vertical Incidence Skywave):** solutions to cater to Navy's requirement of HF transmission being tracked by others.
- ✓ **Wideband/Broadband Antennas:** Wideband/Broadband Antennas that do not require an antenna coupler can be used.
- ✓ **BITE:** Fault isolated to module level with descriptive readout on front panel providing the health status of individual faulty module of the Radio as well as the power supply unit for ease of maintenance.

Key Features
(Cont'd.)

- ✓ **Marine Environment Protection:** Protective coatings are used on all metal, circuit cards are conformal coated and stainless steel hardware is used. The Antenna Coupler enclosure is weather proof, and a packet of silica gel is placed inside at manufacture. Inert gas is not needed.

- ✓ **Cooling arrangement**: Radios have internal fans that circulates air and also external fans on the heat sinks. The LPA has two fans to cool the amplifier modules, and two fans for the filter module. The CU-9150 has two internal fans to cool its elements. The Radio and Coupler are sealed with no external air blowing through the units. The LPA uses external air for cooling.

- ✓ **Internal Schematic of Power Amplifier:** LPA-9600 consists of four power amplifier modules, each with its own power supply. The outputs of these modules are combined to provide the 1 KW input to the harmonic filter, and effectively the four modules act as a single stage of amplification. There are no separate amplifiers for different frequencies, although the harmonic filter contains eight separate PC assemblies for eight frequency bands.
- ✓ **Command Control Unit:** Sunair equipment is compatible to interface with external command control communication systems. Examples of this are General Dynamics LONGARM, Lockheed Martin CSSR (Common Submarine Radio Room), Indra VCS, SITTI VCS, etc.

Higher Data Capabilities

- ✓ **Internal Data Modems** with a data rate of 19.2 kbps, conforming to MIL STD 110 A & B, STANAG 4539, 4285, 4529, 4415, 4481. Customized Naval Modem waveforms could be ported into Sunair Radios.
- ✓ **Enables the user to log key communication** parameters like SNR, BER, Channel parameters (Doppler offset, Doppler SPREAD, Multi-path spread, etc.)
- ✓ **Wide band HF: (Optional):** Data rate of 120 kbps could be achieved with a 24 kHz channel spacing for Strategic Defense applications. US Navy/NATO countries have been adapting to wide band HF.
- ✓ **Data can sent to the radio either through RS-232/422 or via Ethernet.** The internal HF data modem provides MIL-STD-188-110B and several STANAG waveforms. Up to 9.6 kbps in SSB and 19.2 kbps in ISB per 110B Appendix F - uses PSK or QAM modulation per the standard. The remote control modem is separate from the data modem and allows remote control via telephone lines/twisted pair.
- ✓ **HF Email and Messaging per STANAG 5066.** Automatic Routing, Prioritization of messages, Automatic Link Maintenance and Automatic Data Rate are key features.

Operational Certifications and Standards

Battle Space Awareness

- **TADIL-A/LINK 11 MIL-STD-188-203-1A/STANAG 5511:** compatible with external DTS (Data Terminal Set)
- NILE/LINK 22 STANAG 5522: compatible with external SNC (System Network Controller)
- Link Y Mk2: compatible with external CMS (Combat Management System)

Interoperable HF Data Link

- **Modem Waveform: MIL-STD-188-110A/B and Equivalent STANAGs** with internal or external Modems

Interoperable Messaging and Relay

- **STANAG-5066: Error Correction.** It also provides data transfer, email and ARQ operation. JITC Certified (Joint Interoperability Test Command certified). http://jitc.fhu.disa.mil/it/cert.html#5066

Interoperable Automatic Linking

- **Automatic Link Establishment (ALE): Internal Option. MIL-STD-188-141B 2G** (Interoperable with 1G MIL-STD-188-141A and FED-STD-1045A) and STANAG 4538 3G

Operational Certifications and Standards

Operational Conformance

- FCC Part 90: FCC Identifier XVKRT-9000;
- NTIA (National Telecommunications and Information Administration)

IMO Marine Standards

- Global Maritime Distress and Safety System (GMDSS)

EMI/EMC

- European CE Standard: 9000 Series, LPA-9600, and CU-9150: EN 300 373-2 v1.2.1, EN 301 843-5 v1.1.1, EN 60950; Notified Body: 1177
- MIL-STD-461: Compatible operation

DSP Signal Improvement

- LINCOMPEX – ITU-R-455-1/2 Improved Transmission System for HF Radiotelephone Circuits

Ground to Air

- International Civil Aviation Organization (ICAO), Aeronautical Telecommunications: Annex 10

Focus Area - 2

5 KW & 10 KW Strategic HF Systems

5 KW & 10 KW HF Systems

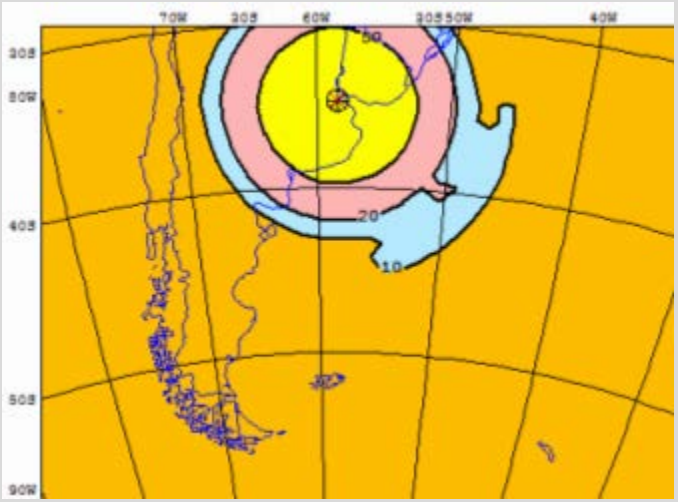
- Sunair 9000 series is part of a comprehensive product line offering solutions for demanding shipboard, transportable and fixed station radio communications systems featuring all HF modes including ISB for voice/data requirements. The 9000 series is supported by a complete line of RF power amplifiers, including 5kW and 10kW configurations

- 5kW and 10kW high power HF amplifier systems are designed to meet the demanding requirements in order to facilitate true hemispheric communications capabilities. 5kW and 10kW systems have been widely accepted and are deployed globally in a wide range of applications requiring theatre wide high power HF communications capabilities.

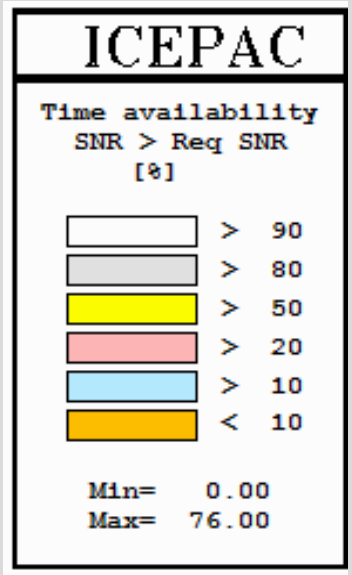
- Sunair's HF solutions are easily upgradeable and incorporate the latest Digital Signal Processing (DSP) technology in the radio synthesizer, IF and audio stages, thereby allowing this software-defined radio (SDR) to further integrate future performance and feature developments.

Propagation Study Demonstration

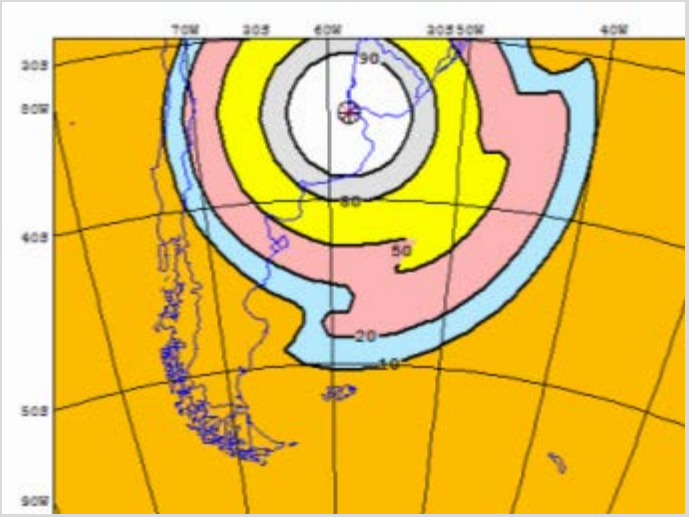
Low Power vs. High Power HF Coverage



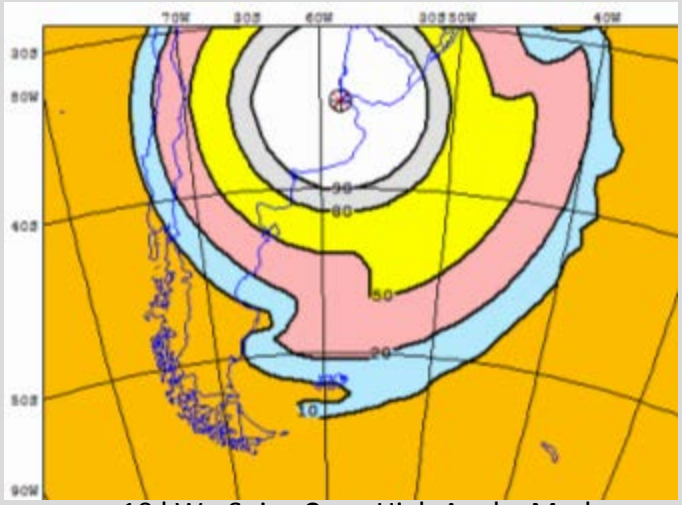
1 kW - Spira-Cone High Angle Mode



Reliability Scale



5 kW - Spira-Cone High Angle Mode



10 kW - Spira-Cone High Angle Mode

T-5000A – 5 KW HF Systems

T-5000A (includes T-9000D Exciter)

- **Frequency range: 1.5 – 30 MHz**
- **Power: 5000W CW**
- **Class: AB service**
- **Supply voltage: ~400V AC / 3 Phase**
- **Gain: Variable (Radio Drive)**
- **Efficiency: 25 ~ 35% Dependent on Freq.**
- **Temperature range: -20° – 55° C**
- **Max VSWR: 2:1 ~ roll back 3:1**

T-10000A – 10 KW HF Systems

T-10000A (includes T-9000D Exciter)

- **Frequency range: 1.5 – 30 MHz**
- **Power: 10,000W CW**
- **Class: AB service**
- **Supply voltage: ~400V AC / 3 Phase**
- **Gain: Variable (Radio Drive)**
- **Efficiency: 25 ~ 35% Dependent on Freq.**
- **Temperature range: -20° – 55° C**
- **Max VSWR: 2:1 ~ roll back 3:1**

T-5000A & T-10000A: Salient Features

- Designed around current 1 KW amplifier product (LPA-9600)
  - Thousands in use worldwide, workhorse amplifier design
  - Utilizes 4 & 8 IPA sub-modules (respectively for 5 & 10 KW), each de-rated to 1400 Watts
  - Classic push-pull, Class A power unit design, extremely reliable
- Modular construction, easy maintenance to unit, module or board level
  - No routine maintenance required, except air filters
  - Annual performance check and realignment recommended, but not required
- Ease of installation:
  - AC power
  - RF termination 7/8" or 1 5/8" rigid cable
  - Air source (7,000 CFM required)
  - Exhaust air (approximately 10 C rise)
- BITE reported through the T-9000D to local and remote control point
- Good VSWR performance, through 2:1 loads, beyond 3:1 graceful roll back
- Small footprint, minimum floor space

Typical Deployment: Brazil 5 KW & 10 KW HF System Overview

Site Locations:

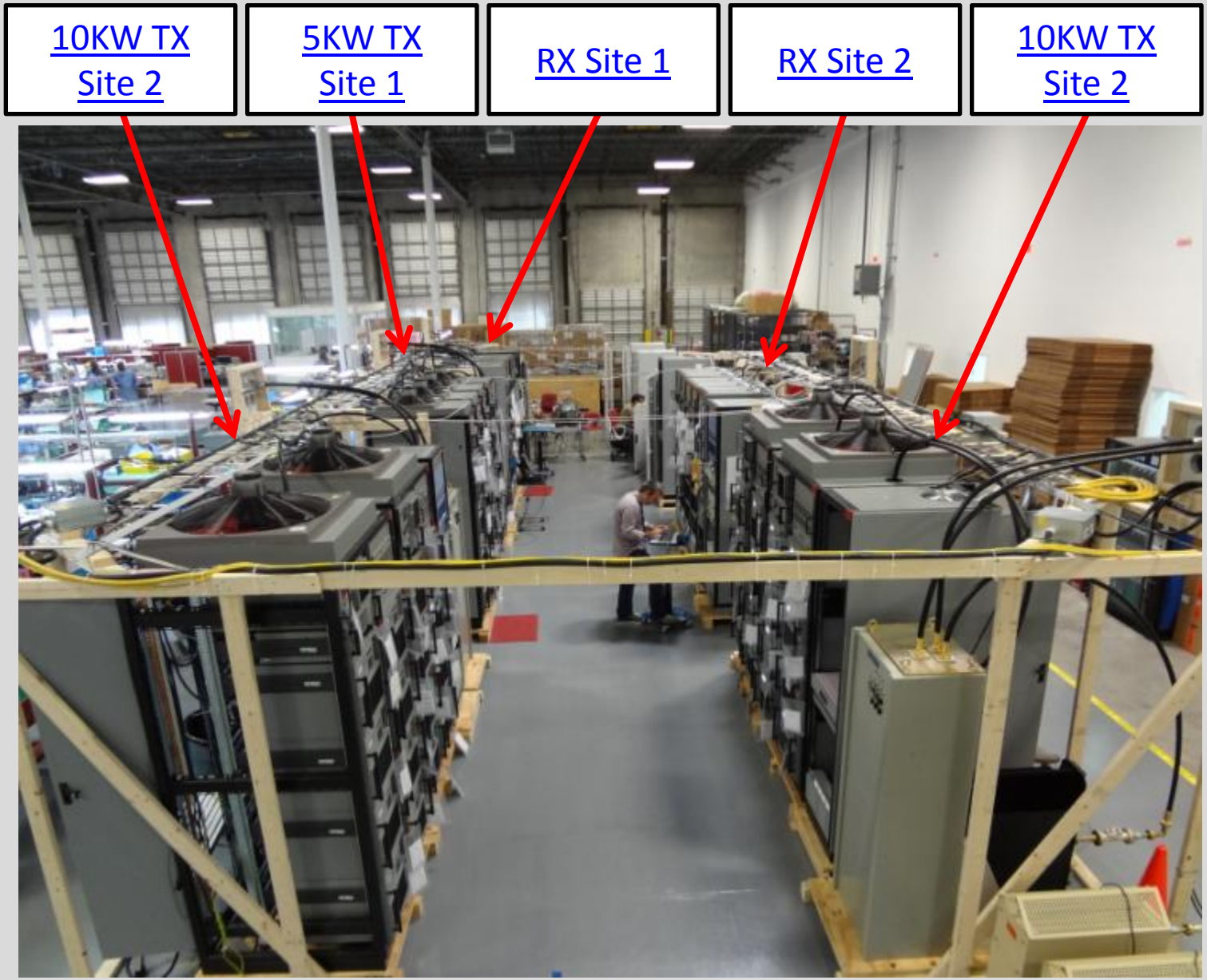
Belem - Split Site Sunair 5 KW

Rio de Janeiro - Split Site Sunair 10 KW

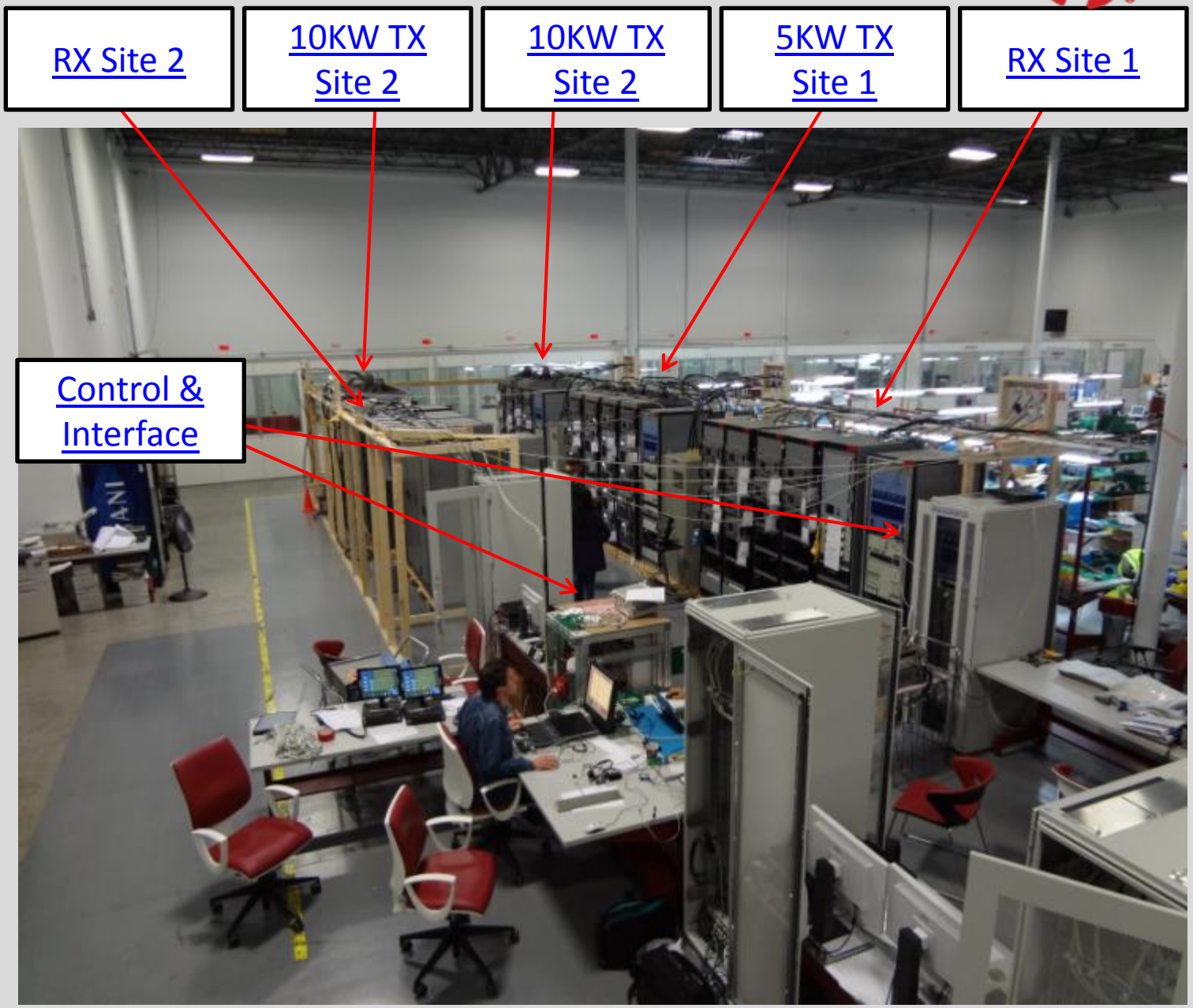
T-5000A 5KW HF Systems

T-10000A 10KW HF Systems

Pictorial View of 5 & 10 KW Systems



Pictorial View of 5 & 10 KW Systems



Selected Experience (Representative Programs)

US Marine Corps Tactical Air Operations Module (TAOM)

- Upgrade from 500W to 1 KW Systems
- Equipment: RT-9000 Transceivers, LPA-9600 1KW Amplifiers, F-9800 Pre-Selector/Post-Selectors
- Details: First two prototypes placed in High Mobility Multipurpose Wheeled Vehicles (HMMWV or Humvee)

US Coast Guard: Replacement of AN/URC-116V HF Equipment

- Details: Delivery of several hundred HF Systems from 2000 – 2006 in two basic configurations: 1) 125W Transceiver and 2) 1 KW Transceiver, with FSK Modems, Data Link Modems, and Fax Options

Selected Experience (Systems)

Brazilian Commission for Aerospace Control (CISCEA), High Power HF Upgrade

- In the process of designing and supplying High Power HF ISB/SSB Data Link Systems across multiple locations in Brazil as an upgrade to the network built for the Amazon Surveillance System SIVAM (Sistema de Vigilância da Amazônia)

NATO/Spanish Air Force, High Power Link 11 Systems

- Designed and supplied eight High Power HF ISB/SSB Data Link Systems across multiple locations in Spain as a functional segment of a broad air communications network

Selected Experience (Systems) Ctd.

International Civil Aviation Authority (ICAO), ATC System

- Designed and supplied a long-range Air Traffic Control system in Argentina, as part of a modernization program led by ICAO

North Africa Air Surveillance System

- Designed and supplied nine Shelterized HF/ISB Full Duplex systems as a functional segment of a border air surveillance radio network

Thank You!

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