

Education: BS, Engineering Physics (1988) - Oklahoma Christian Univ. of Science & Arts
BS, Electrical Engineering (1989) - Oklahoma Christian Univ. of Science & Arts

Registration: Professional Engineer, Electrical - State of Washington (1994)
Professional Engineer, Electrical - State of Alaska (1995)

Summary of Experience:

Mr. Lockwood is an electrical engineer with more than 28 years of experience in the field of telecommunications engineering. He specializes in the development of systems design and specifications, preparing interference analysis and documentation, conducting antenna and radio propagation analysis, inspecting telecommunications facilities, and the construction of radio facilities. His background includes extensive project management in the design and construction of communications facilities from low frequencies to microwave frequencies. Work has been performed for clients ranging from various private and public commercial ventures to all levels of governments from cities to the federal governments. Mr. Lockwood has provided expert testimony in land use hearings and law suits involving telecommunications engineering.

Low Frequency (LF) and Medium Wave (MW - AM Radio) and High Frequency (HF - Shortwave) Experience:

International Broadcasting Bureau, Poro Point, Philippines: MW Antenna Frequency Change: For this project, Mr. Lockwood performed all of the antenna computer modeling analyses in the field that were used in the tuneup of the revised antenna pattern. This project, with the operation of one antenna pattern of the Poro Point site on 1170 kHz rather than the 1143 kHz normal operation of the station, required substantial analytical activity at the site. This efficient design and adjustment activity took place in a few days. He also assisted the Poro Point station staff in re-tuning the antenna monitoring equipment, and in putting the station's former MW transmitter back into operation on the revised frequency for the tests.

International Broadcasting Bureau, Delano, CA; Morocco Relay Station, Tangier, Morocco; Sao Tome Relay Station, Island of Sao Tome, West Africa; Tinang Relay Station Philippines; Botswana Relay Station, Selebi-Phikwe, Botswana, Sri Lanka Relay Station, Sri Lanka, Udon Relay Station, Thailand, Rasom MW Relay Station Thailand: Maximum Permissible Exposure (MPE) evaluation. Mr. Lockwood measured and characterized non-ionizing electromagnetic radiation from high power MW and high power HF Rhombic and Curtain antennas at these sites. He was responsible for the on-site inspection of the antennas and measurements, and for production of the final report. This project also included the development of an RF Safety Plan and on-site training of station personnel.

Harris Corporation and International Broadcasting Bureau, Pol-e-Charkhi, Afghanistan, Design, Implementation and Commissioning of two MW Antennas: Mr. Lockwood was a project engineer working under a contract with Harris Corporation for the International Broadcasting Bureau to install two 400 kW MW stations on an existing antenna system that was built by Radio Moscow in 1983 and was destroyed by Allied bombing in 2002. dLR and H & D engineer David Pinion inspected the damaged facility. Paul Leonard constructed a NEC model and designed the appropriate replacement systems to make this facility work. Engineers David Pinion and Stephen Lockwood traveled to Afghanistan to install and commission the antenna system components and to oversee the complete system integration. This project not only included RF engineering but also STL Microwave analysis and extensive analysis and adjustment of Soviet-built electrical distribution systems.

USCG, Kodiak AK, NAVTEX Antenna System: As project engineer, Mr. Lockwood designed, built, and installed an antenna matching unit for the MW Coast Guard navigation facility (NAVTEX 518 kHz) on Kodiak Island using an ELF antenna system that was abandoned by the US Navy. The system was being structurally upgraded, which caused significant changes in the electrical characteristics of the antenna system. A new antenna matching network was designed, built, and installed to insure reliable and efficient operation of this antenna system.

USCG, Nome, AK, LORAN Analysis: H & D provided a comprehensive analysis of the potential for AM interference from the proposed US Coast Guard LORAN transmitting station (LORSTA) to be located near Nome, Alaska. Of specific interest is the potential for interference to the two existing AM broadcast stations in Nome, and the potential for interference to consumer electronics equipment in the vicinity of the proposed Nome LORSTA. The analysis contained in this report was prepared as a prudent measure to evaluate the potential for any interference between the proposed LORSTA, and the two existing AM facilities, and to assure that the proposed LORSTA can operate without objectionable interference to consumer electronics devices. This included a presentation of the analysis to the radio station staff and USCG staff.

USCG, Saint Paul, AK: H & D provided inspection, analysis and design for tower lighting repairs on the LORAN tower on Saint Paul Island.

USCG, George, WA: H & D provided inspection, analysis and design for tower lighting repairs on the LORAN tower in George, WA. This project included working with the tower lighting manufacture and repair contractor to return the tower lighting to operating condition.

KTCT, San Mateo, CA: On this project Mr. Lockwood was responsible for the allocation engineering analysis, including extensive field measurements to determine actual ground conductivity, and signal strength contour distances for major changes in the antenna pattern on 1050 kHz. He was also responsible for the allocation engineering for the move from its original transmitter site to a new site for an existing 1290 kHz station (KHSL Chico, CA) to the 1060 (KXOC Chico, CA) site to allow the termination of operation on 1060 kHz, which in turn allowed the substantial improvement of KTCT 1050 kHz operation. Upon FCC approval, Mr. Lockwood was responsible for the preparation of all design and direct supervision of all field engineering for the changes, including rebuilding the 1060 kHz antenna system to accommodate 1290 kHz operation, tuning, field testing, and commissioning and licensing for the resulting 1290 operation on the former 1060 kHz site.

KEEN/KSJX Implementation, San Jose, CA: Mr. Lockwood completed analysis, allocation studies, FCC application preparation, and feed system design for operation of KEEN (1370 kHz) on the existing KSJX antenna site (1500 kHz). This project, which resulted in the diplexed operation of both stations from the former KSJX site, required a very extensive analysis of the allocation conditions for KEEN to minimize any reduction in coverage of the San Jose metropolitan area, as well as maintenance of the very restrictive limits on the licensed operation of KSJX. The resulting operation provided continued high service quality to the San Jose metropolitan area by both stations.

Multicultural Broadcasting, Blaine, WA: KVRI/KARI Implementation: Mr. Lockwood completed analysis, allocation studies, FCC application preparation, and feed system design and installation for operation of KVRI (1600 kHz) on the existing KARI antenna site (550 kHz). This project, which resulted in the diplexed operation of both stations from KARI site, required a very extensive analysis of the allocation conditions for KVRI to maximize coverage for the Vancouver, BC metropolitan area, as well as maintenance of the very restrictive limits on the licensed operation of KARI. The resulting operation provided continued high service quality to the Vancouver metropolitan area by both stations. This included daytime and nighttime patterns for both stations. KARI is licensed to operate at 5 kW daytime and 2.5 kW nighttime, and KVRI is licensed to operate at 50 kW daytime and 10 kW nighttime. Mr. Lockwood was responsible for tuning, field testing, and commissioning and licensing of these radio stations. This project also involved mitigation of blanketing interference and investigation of alleged receiver image interference between KVRI 1600 kHz and CBU 600 kHz. This investigation included extensive receiver testing, investigations, and negotiations between Industry Canada and the FCC.

Sandusky Broadcasting, Seattle, WA: KIXI Daytime Antenna System Improvement: Mr. Lockwood completed analysis, allocation studies, FCC application preparation, and feed system design and installation for operation of KIXI (880 kHz). This project resulted in improved daytime coverage for KIXI, which is licensed to Mercer Island, WA and Seattle, WA. This project included a rebuild and acceptance testing of the antenna system components. KIXI is licensed to operate at 50 kW daytime and 10 kW nighttime. Mr. Lockwood was responsible for tuning, field testing, and commissioning and licensing of this radio station.

Sandusky Broadcasting, Seattle, WA: KKNW Daytime Antenna System Improvement: Mr. Lockwood completed analysis, allocation studies, FCC application preparation, and feed system design and installation for operation of KKNW (1150 kHz). This project resulted in improved daytime and nighttime coverage for KKNW, which is licensed to Mercer Island, WA and Seattle, WA. This project included a rebuild and acceptance testing of the antenna system components. KKNW is licensed to operate at 10 kW daytime and 6 kW nighttime. Mr. Lockwood was responsible for tuning, field testing, and commissioning and licensing of this radio station.

KJR, Clear Channel, Seattle, WA: H&D was engaged to implement a plan to diplex its operation with KGNW at a site on Vashon Island, which had also been designed and implemented by H&D. Mr. Lockwood made measurements on the existing KGNW antenna system and assisted in prepared designs for the feed system and filtering design. Because Vashon Island is the site of seven AM stations, six of them operating at 50 kW, the filtering system was relatively elaborate. After all land use permits were obtained and some modifications of design were negotiated with the original user of the site, KGNW, H & D supervised tune-up and the performance verification "proof of performance" measurements for FCC licensing and provided additional analysis and recommendations for modest modifications of the filtering system installation to meet the stringent FCC emission mask requirements.

WKOX, 1200 kHz, WRCA, 1330 kHz & WUNR, 1600 kHz, Clear Channel, Beasley and Champion Broadcasting, Boston, MA. Mr. Lockwood has provided engineering analysis, allocation studies, system design, and FCC application preparation, for these three stations and station owners. This project proposes to triplex these three station at the existing WUNR site in Newton, MA. This project provides an power increase for all three stations on a common 5 antenna elements (towers) directional antenna system which was optimal directional antenna design to provide the best coverage that was available for each station. Other engineering support for this project has included assistance in the local land use process which has involved preparation of written expert testimony. Mr. Lockwood has worked closely with the station personnel, station attorneys a team of other expert witness to prepare an environmental impact statement (EIS). Mr. Lockwood was

responsible for the section of the EIS that detailed radio frequency exposure issues and radio frequency interference. The feed system for this facility was designed as a joint operation between H & D and du Treil, Lundin & Rackley and is considered as one of the most complicated MW antenna system. Mr. Lockwood continues to serve a project manager for this project. This facility is being scheduled to be completed summer 2008.

City of Bellevue, WA: Hatfield & Dawson were retained by the city to provide a report on the history and background information of the MW stations in the Mercer Slough, which is now a city park. This report addressed why this area was chosen for these facilities and was to assist the City of Bellevue in management of the property leases and to develop guidelines and procedures for the maintenance practices necessary to allow the tenants to properly operate the facilities. This involved a thorough investigation in the archives of the City of Bellevue, King County, the FCC, the radio stations, and Hatfield & Dawson to develop a concise history of these facilities.

US Navy, Space and Naval Warfare Systems Command (SPAWAR) San Diego, CA: SPAWAR has undertaken a rigorous analysis of the technical characteristics of various transmitting systems used by U.S.SOCOM (U.S. Special Operations Command). Hatfield & Dawson was engaged by SPAWAR to devise testing procedures for the medium wave psychology operations transmitting antennas, select a suitable military facility to use for these tests, and obtain special temporary authority from the FCC to operate the equipment on MF broadcast frequencies. We recommended various test procedures, evaluated several military sites for the tests, selected the Naval Air Facility at El Centro for the tests, obtained the FCC license, assisted in organizing the equipment setup process, and conducted the tests. Mr. Lockwood served as test manager for these tests, which included close-in measurements of magnetic fields and careful documentation of input power and antenna impedance, are very similar to the types of tests conducted for high power MF radiation hazard evaluation. The tests also included analysis of radiation hazard and Hazard of Electromagnetic Radiation to Ordnance (HERO) and Hazards of Electromagnetic Radiation to Personnel (HERP) considerations.

Corporation for Public Broadcasting (CPB), Nationwide; The dTR/H&D Joint Venture was retained to make antenna impedance bandwidth measurements on the participating CPB qualified AM stations prior to their transition to digital broadcasting. The Joint Venture's task was to provide a knowledge base for public radio AM station for the transition to digital broadcasting. They made site visits to 53 public radio stations (from Puerto Rico to the Bearing Sea), each of which consisted of a general inspection of the facilities, measurement and analysis regarding the suitability of the existing antenna system for IBOC transmission, and follow-on preparation of a report providing recommendations for improving that station's antenna/transmission facilities to achieve acceptable

IBOC performance. During the project, measurements were made on each station's antenna system as necessary for evaluating its expected HD-Radio performance. The measurement data were analyzed to determine whether the performance met the iBiquity "desired characteristics" and also to determine what value of phase shift might be added to optimize the presentation of the load impedance at the final amplifier of an assumed transmitter. The Joint Venture determined whether or not each antenna system functioned as well as iBiquity would like it to and how to make the most of the situation in all cases that were not obviously hopeless. Mr. Lockwood served a project manager and made measurements on all 11 of the Alaska CPB stations.

Alaska Public Broadcasting, Inc (APB), Anchorage, AK: As follow on the CPB project Mr. Lockwood designed, install and performed acceptance testing on new antenna systems for 7 of the Alaska Public Radio that were designed to use the HD-IBOC system. This included stations in: Kotzebue, Fort Yukon, McGrath, Dillingham, Homer, Valdez and Unalakleet. There are four stations that are still to be completed with this project.

Rockwell, Dallas, TX: As a contractor for Rockwell H & D was retained to provide analysis on Aerostat Antennas (antennas suspended by helium blimps). These antennas are used by a foreign navy for broadcasting in the 20 kHz and 150 kHz range. H & D provided extensive analysis computer modeling of these antennas and antenna feed system. Mr. Lockwood was responsible for modeling the feed systems using SPICE for failure analysis and general operation.

BBC Broadcasting, KRPI, Ferndale, WA: Mr. Lockwood prepared an engineering report that was filed with the FCC in response to the Informal Objection filed by the Residents Against High Power Radio Interference. This Objection was filed against KRPI's FCC license during the renewal period. Our engineering statement resulted in a successful renewal of the KRPI license.

S-R Broadcasting, KRKO Everett, WA; Mr. Lockwood completed analysis, allocation studies, FCC application preparation for a new facility for KRKO and a proposed new facility. This project, which resulted in the diplexed operation of both stations from a new site, required a very extensive analysis of the allocation conditions for both radio stations to maximize coverage of Snohomish County and surrounding metropolitan areas. The resulting operation will provided high service quality to the South Snohomish County and Everett areas by both stations. This included daytime and nighttime patterns for both stations. This increased the power of KRKO from 5 kW to 50 kW. This project has required extensive assistance in the land use process and expert testimony in a number of hearing before land use agencies on all topics of radio engineering.

Entercom, WROC, Rochester, NY: For WROC Mr. Lockwood provided measurements and analysis of the existing antenna system for use in diplexing WHIC on the same facility.

Alaska Broadcast Communications, KJNO, Juneau, AK: Mr. Lockwood performed antenna feed system adjustment for this facility.

Clear Channel, KHHO, Tacoma, WA: Mr. Lockwood produced an Allocation Study, Antenna design and FCC Application for the nighttime operation of this facility.

Baybridge Communications, KDIA, Vallejo, CA; Mr. Lockwood tuned-up the diplexed installation with KDIA and KNEW and associated FCC showings.

Alaska - Juneau Communication, KINY, Juneau, AK: Mr. Lockwood made radio frequency exposure measurements for this facility which includes AM, FM and TV antennas on the same support structure.

Seattle Streaming Media, KXLJ, Juneau, AK: H & D Engineers tuned-up the diplexed installation with KINY and KXLJ and associated FCC showings.

Mid-America Energy & Putbrese Communications, KWKY, Des Moines, IA: For Mid-America Energy Mr. Lockwood analyzed and tuned and inspected de-tuning apparatus on power lines and an electrical substation installation within 1 mile of the 4 tower MW station. The power lines were designed and de-tuned to minimize effect on the MW station's antenna pattern with a partial proof of performance completed on KWKY. A new daytime antenna pattern with a power increase was designed for KWKY with associated FCC applications.

Citadel Communication, KKOB, Albuquerque, NM: After the 50 year old KKOB antenna was damage by a strike by a misguided hot air balloon Mr. Lockwood provided engineer support for tower section replacement and associated FCC showings. Also, an analysis of the feed system for HD-IBOC digital radio.

Citadel Communications, KKHO, Reno, NV: Mr. Lockwood conducted antenna system analysis and design for the KKHO antenna system.

Entravision Communications, KLOK, San Jose, CA: Mr. Lockwood provided measurements and analysis of the existing antenna system and a design to make the KLOK antenna system compatible with HD-IBOC digital radio.

Cox Radio, WHIO, Dayton, OH: Mr. Lockwood provided measurements and analysis of the existing antenna system and a design to make the WHIO antenna system compatible with HD-IBOC digital radio.

Citadel Communicates, KTUC & KCUB, Tucson, AZ: Mr. Lockwood provided measurements and analysis of the existing antenna system and adjusted the antenna system compatible with HD-IBOC digital radio.

Citadel Communicates, KBOI, Boise, ID: Mr. Lockwood provided measurements and analysis of the existing antenna system and provided modifications and adjustments to the antenna system to make it compatible with HD-IBOC digital radio.

Citadel Communicates, WJR, Detroit, MI: Mr. Lockwood provided measurements and analysis of the existing antenna system and adjusted the antenna system compatible with HD-IBOC digital radio.

Disney Radio, WFDF, Detroit, MI: Mr. Lockwood provided measurements and analysis of the existing antenna system and adjusted the antenna system compatible with HD-IBOC digital radio.

Disney Radio, KKDZ, Seattle, WA: H & D Engineers provided designed, install and performed acceptance testing new antenna system and adjusted the antenna system compatible with HD-IBOC digital radio.

University of Washington, KUOW, Tumwater, WA: Mr. Lockwood provided measurements and analysis of the existing antenna system and a design to make the KUOS antenna system compatible with HD-IBOC digital radio.

Multicultural, KLIB, Roseville, CA: Mr. Lockwood provided a new design for the antenna phasing system for this facility.

Harris Corporation, Radio 9, Sao Paulo, Brasil; H & D was retained by Harris to design and install a high power antenna tuning unit (ATU) for a directional antenna system. This system operates at 100 kW into a two tower directional array. This antenna array has a very high impedance with only one driven tower. Mr. Lockwood was a project engineer and assisted in the installation and measurements of this system.

Radio PanAmericana, Sao Paulo, Brasil; Mr. Lockwood was a project engineer on an installation of a two tower directional antenna system. This project involved tune-up and acceptance testing.

Family Radio, Radio Disney, KARR/KKDZ, Kirkland, WA: This diplexed facility was destroyed by fire. H & D was retained to rebuild this facility. Mr. Lockwood has provided measurements, design and project management to replace this facility as soon as possible. There are six antennas at this facility with three antenna patterns.

US Oil, Tacoma, WA: When a 50 kW AM station placed a new directional antenna system one half mile from the US Oil refining and oil transportation facility US Oil retained Hatfield & Dawson to consult on radio frequency safety issues. Mr. Lockwood provided extensive measurements, analysis, engineering reports and technical negotiations on behalf of US Oil with the radio station licensee and the USCG. These reports deal with the radio frequency ignition to hydrocarbons and setting a level that was acceptable to the FCC and the USCG. A settlement was reached between the radio station and US Oil.

Due Diligence Inspections: Mr. Lockwood inspected broadcast radio facilities in: Bozeman, MT; Billings, MT; Boise, ID; Ontario, OR; Baker City, OR; LaGrande, OR; Prineville, OR; Bend, OR; Ketchum, ID; Hailey, ID; Twin Falls, ID; Mountain Home, ID; Medford, OR; Reno, NV; Honolulu, HI; and other locations. These inspections were to determine if these facilities were operating in accordance with the FCC rules, and to ascertain the suitability of the broadcast equipment.

Allocation Studies and FCC Applications: Engineering services have been done for numerous clients for the moving and upgrading of broadcast facilities. These services have been performed in AM, FM, and TV.

VHF/UHF (FM Radio and TV) Experience:

Consulting, Minneapolis, MN: IDS Building Auxiliary FM Facilities: This facility provided back-up facilities for 11 FM facilities licensed to the Minneapolis/Saint Paul metropolitan area. This system combines 11 high power FM stations in a master antenna system. Mr. Lockwood was responsible for field testing, and commissioning and licensing of these radio stations. This included extensive intermodulation testing and Non-Ionizing Electromagnetic Radiation (NIER) modeling and testing.

Ratelco, Seattle, WA: Cougar Mountain Combined FM Facilities: This facility provided main facilities for four FM facilities licensed to the Seattle metropolitan area. This system combines four high power FM stations in a master antenna system. Mr. Lockwood was responsible for field

testing, and commissioning and licensing of these radio stations. This included extensive intermodulation testing and NIER modeling and testing.

American Radio Systems, Portland, OR: Sullivan Tower Combined FM Facilities: This facility provided main facilities for four FM facilities licensed to the Portland metropolitan area. This system combines four high power FM stations in a master antenna system. Mr. Lockwood was responsible for field testing, and commissioning and licensing of these radio stations. This included intermodulation testing.

CBS Infinity, Seattle, WA: Tiger Mountain Combined FM Facilities: This facility provided main facilities for three FM facilities licensed to the Seattle metropolitan area. This system combines three high power FM stations in a master antenna system. Mr. Lockwood was responsible for field testing, and commissioning and licensing of these radio stations. This included intermodulation testing.

Horizon Broadcasting, Bend, OR: KQAK/KWPK FM Facilities: This facility provided main facilities for two FM facilities licensed to Bend, Oregon. This system combines two high power FM stations in a master antenna system. Mr. Lockwood was responsible for field testing, and commissioning and licensing of these radio stations. This included extensive intermodulation testing and NIER modeling and testing.

Clear Channel Communications, Anchorage, AK: KYMG FM: This facility provided main facilities for KYMG facilities licensed to Anchorage. This is a directional antenna system to protect the FCC's monitoring station. Mr. Lockwood was responsible for installation, field testing, and commissioning and licensing of this radio station. This included antenna testing and measurement of field strength at the FCC monitoring station.

Eastern Washington DTV Channel Allocations Caucus, Spokane, WA: This project was to prepare a Petition For Reconsideration to MM Docket No. 87-268 Sixth Report and Order DTV Table of Allotments. This included extensive propagation analysis to re-allocate the DTV channel assignments for Eastern Washington. This plan corrected some of the problems with the FCC allotment plan such as: removing first adjacent channel allocations that were assigned to different sites; and changing channels for ease of implementation. This reassignment was accepted by the FCC, and has provided a reduction in potential interference and assured greater replication of existing NTSC service by the DTV facilities.

Central Wyoming College, Riverton, WY: For Wyoming Public TV: We investigated the options for migration to DTV for both the full power facilities and translators throughout the state of Wyoming. WYOPTV currently operates two full service TV stations and 22 translator facilities. Our report included a discussion of the digital TV conversion process, an analysis of the existing facilities, a critique of WYOPTV's quest for universal service in Wyoming, a comparison to other comparable western states' public TV facilities, digital programming distribution options, cost analysis and recommendations. This project also included a preliminary microwave distribution system that includes program and data distribution between all of the institutions of higher learning in Wyoming. This proposed microwave system design provides 3 x DS3 capacity among nine institutions of higher learning, 22 translators facilities with 48 communications sites. Where possible, this design used existing WYOPTV facilities and existing communications sites. This project included presentation of our findings to the Public TV Adversary Board and the College Board. Our final report was used for a funding request from the State Legislature.

Fireweed Communications, Anchorage, AK: KYES-TV: Antenna inspection and expert testimony for legal dispute with landlord regarding antenna move. Mr. Lockwood provided an engineering report detailing the damage to the KYES antenna system that was a result of an antenna move by the landlord of the KYES antenna site. This resulted in a settlement in favor of KYES.

Viacom, Seattle, WA: KSTW-TV: Antenna measurements and NIER measurements. Measurements were made to verify the integrity of the antenna systems on both the existing Channel 11 (RCA TW-9A 11R) auxiliary antenna and the newly installed DTV (Dielectric TLP-8B) antenna. NIER measurements were made to assist with local zoning requirements.

Maxson Young Associates, Inc. (insurance adjusters): Sutro Tower, San Francisco, CA: Hatfield & Dawson investigated the failure of a 6 1/8" Transmission Line. This involved a document review, interview of various parties, a site visit, and the preparation of an engineering report.

Citadel Communications, Spokane, WA: KDRK FM: Measurement of NIER and intermodulation testing.

New Northwest Broadcasters, Anchorage, AK: KFAT FM: NIER measurements at the Eagle's Nest transmitter site.

NIER measurements at: Mica Peak, Spokane, WA; Cougar Mountain, Seattle, WA; Tiger Mountain, Seattle, WA; Pike's Peak, Walla Walla, WA; San Jose, CA; Eagle's Nest, Anchorage,

AK; Snow King, Jackson, WY; Sawtell Butte, Island Park, ID; Slide Mountain, Reno, NV; and others.

Land Mobile and Microwave Experience:

Washington State Patrol and Washington State Department of Transportation, Olympia, WA: This project was to provide these state agencies with Site Standard for Joint Use of Radio Communications Sites. The purpose of this standard was to assure that all new sites and retrofits comply with generally accepted industry standards. These standards included: safety standards for tower rigging and safety devices; grounding standards; auxiliary power systems; installation of equipment racks, cabinets, and cable runways; and internal wiring and termination.

State of California, Department of General Service Telecommunication Division, Sacramento, CA: This project prepared a complete set of revised microwave equipment system standards and specifications for master planning for the State's Public Safety Microwave System. The effort necessitated determining system performance requirements, which required familiarity with existing equipment configuration and system layout of microwave links in operation by the state, and assessing potential future service needs.

TetraTech/KCM, Anacortes, WA: Mr. Lockwood produced an analysis of the potential for interference between several proposed wireless telecommunications facilities and the existing and proposed high band VHF (150 MHz), UHF (450 MHz), 800 MHz, and 900 MHz facilities at the Puget Sound Energy Communications Site at Mount Erie in Anacortes, Washington. The existing and proposed facilities at the site include two-way radio systems, paging, and microwave relay systems. The intermodulation analysis was done as a prudent measure to evaluate the potential for any new interference to either the existing or proposed facilities at the Mount Erie site or to the proposed wireless facilities, and to assure that all transmission systems at the site can operate in close proximity without detrimental effects to any of the radio systems operating at the site. This project also involved an analysis of the human exposure to electro-magnetic fields and the specification of a ground system for the site.

MediaFLO, Santa Monica, CA: For MediaFLO Mr. Lockwood provided a presentation to the Santa Monica citizens advisory board on the proposed MediaFLO facility and the Radio Frequency exposure issues.

Central Kitsap School District, Silverdale, WA: Performed topography analysis, system design, site selection, field inspection, path loss calculations, and specification design for a 9-hop microwave

communications system for the district. The system included three passive reflectors and was designed to transmit telephone, data, and video.

US Navy, Keyport, WA: As Project Engineer, Mr. Lockwood provided procurement specifications for microwave radio communications for the US Navy, Undersea Warfare Engineering Station at Keyport, WA. The project included topography analysis, system design, and path loss calculations for a 3-hop microwave communication system. This project included preparation of complete specifications for a digital microwave system. This system extends from Maynard Peak, WA, to north of Vancouver Island, Canada.

City of Kent, WA: Project Engineer for topography analysis, system design, and path loss calculations for a high-reliability microwave link for the City of Kent, WA, between the jail and courthouse. The design enabled the City to perform arraignment hearings without the cost of transporting prisoners to and from the courthouse.

Washington State Patrol, Bellevue, WA: Project Engineer for topography analysis, system design, and path loss calculations for high-reliability microwave links between Washington State Patrol facilities in Everett, WA, and Little Mountain near Mount Vernon, WA.

Idaho National Engineering Labs, East Butte, ID: Project Engineer for acceptance testing to provide independent confirmation of the shielding effectiveness of the communications building at the Idaho National Engineering Labs in East Butte, ID. The project also involved inspection of the design and installation of the lightning and RF ground system at this site.

Performed calculations and measurements of non-ionizing radiation (NIER): This has been done for numerous facilities at single and multiple-use communications sites to demonstrate compliance with federal and local standards for environmental impact. These studies have been used for Land Use applications. Clients included US West, AT&T, Sprint, Nextel, GTE, and others.

City of Seattle, WA: NIER Calculations, measurements, and general radio system consulting for the Northeast Radio Tower Project, a Public Safety Radio System Tower.

Snohomish Emergency Radio System, Everett, WA: NIER Calculation and general radio system consulting for the Snohomish Emergency Radio System a Public Safety Radio System Tower.

PacifiCorp, Portland, OR: RF Safety and Site Evaluation Training: Mr. Lockwood provided RF safety training to all of the PacifiCorp radio system technicians. Mr. Lockwood developed course

work that was tailored to the types of RF systems that PacifiCorp operates. PacifiCorp is a major electrical utility in the western United States, and operates more than 200 electronics communications sites. Additional training in site evaluations was provided to the communications supervisors. This included a database analysis of all of the facilities. With this analysis it was determined that there were no PacifiCorp facilities that exceed the FCC RF exposure guidelines. This saved the time and travel to measure and analyze these facilities on an individual basis.

GCI, Prudhoe Bay, AK: GCI, who is the communications contractor for British Petroleum's North Slope facilities, contracted with North Slope Telecommunication, Inc. (NSTI) to evaluate the NIER environment of the microwave and land mobile antennas. This project included documenting and identifying all transmitting antennas at all of the BP communications facilities (towers and buildings) on the North Slope. Mr. Lockwood was responsible for training the NSTI personnel in the necessary evaluation techniques and measurement practices, monitored their performance, certified their data, and signed the inspection drawings.

On an ongoing basis Mr. Lockwood has provided RF safety training to all of the Puget Sound Energy (PSE) radio system technicians. He developed course work that was tailored to the types of RF systems that PSE operates. PSE is a producer and distributor of electrical power in Western Washington and operates an extensive system of two-way radio communications systems and a Supervisory Control and Data Acquisition (SCADA) system that is interconnected throughout Western Washington using an extensive microwave radio system among a large number of electronic communications sites.

Other Related Experience:

World Christian Broadcasting, Anchor Point, AK: KNLS: Installation and Operating Engineer for a high-power shortwave station. This facility operated at 100 kW, broadcasting to Asia and the Far East from Anchor Point, AK.

Radio Free Europe/Radio Liberty & Voice of America, Beersheba, Israel: International Broadcast System: Engineer for US Government project. Prepared and reviewed system specifications and contracting for a shortwave radio transmitting facility, including equipment buildings, inter-site communications (telephone, two-way radio), and electromagnetic compatibility for the Israeli Defense forces facilities in Beersheba, Israel.

Professional Activities:

- C The Institute of Electrical and Electronics Engineers, Inc. (IEEE) - Senior Member - Communications and Broadcast Technologies Societies
- C Association of Federal Communications Consulting Engineers (AFCCE) - Board Member
- C The Society of Broadcast Engineers (SBE) - Member - Certified Professional Broadcast Engineer (CBPE) - Certified AM Directional Specialist (AMD) - Vice Chairman Chapter16 Seattle
- C Amateur Radio License - K7SSL
- C FCC General Radiotelephone Operator License

Continuing Education Courses:

- C Cold Regions Engineering Short Course, Jan 20-24, 1995, University of Washington
- C Antennas: Principals, Design and Measurement, May 14-17 1996, National Consortium for Engineering Education
- C IEEE Broadcast Symposium, Digital Television Tutorial, October 1995
- C Harris DX50 Transmitter Education Program, December 7-11, 1998, Harris Corporation
- C Spectrum Analysis Course, May 2-5, 2000, JMS Consulting
- C Digital Microwave Radio Engineering, September 19-21 2000, Harris Corporation
- C 1999 National Electrical Code, March 2001, National Technology Transfer, Inc
- C AM/FM Antenna Certification Workshop, September 2001, September 2002, September 2003, and September 2005 National Association of Broadcasters
- C In Band On Channel (IBOC) Educational Seminar September 2002 - Harris Corporation
- C IEEE Broadcast Symposium - Digital Radio Tutorial October 2002
- C NAB Technical Workshop - September 2005
- C Digital Television (HD, 8-VSB) Transmission Seminar - Gary Sgrignoli, Meintel, Sgrignoli, & Wallace, October 2005