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)
Professional Engineer, Electrical - State of Wyoming (2010)

Certifications: Project Management Professional Certification (PMP) (2016) - Project Management Institute
Certified Professional Broadcast Engineer (CPBE) - Society of Broadcast Engineers
AM Directional Antenna Specialist (AMD) - Society of Broadcast Engineers

Summary of Experience:
Mr. Lockwood is an Electrical engineer with more than 35 years of experience in the field of telecommunications engineering. He specializes in the development of systems design and specifications, preparing interference analyses 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. He has performed work for clients ranging from various private and public commercial ventures to all levels of government, from cities to the Federal government. 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 tune-up 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, Udorn Relay Station, Thailand, Rasom MW Relay Station Thailand, Lampertheim, Biblis and Ismaning Relay Stations, Germany: 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. With fellow engineer David Pinion, Mr. 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. This antenna system uses an ELF antenna system that was abandoned by the US Navy. This antenna 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, Kodiak AK, and Point Reyes, CA, HF Antenna System: As project engineer Mr. Lockwood provided commission measurements and reports on a replacement HF receiving 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 was 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: 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 (now KZSF) to minimize any reduction in coverage of the San Jose metropolitan area, as well as maintenance of the very reactive limits on the licensed operation of KSJX. The resulting operation provided continued high service quality to the San Jose metropolitan area by both stations (1992-1993). This facility was destroyed by a car fire in 2011 and was rebuilt summer of 2012. Both stations were licensed by the FCC under the Moment Method proof rules. In 2017 KLOK was triplexed on this site H&D engineers provided project direction, analysis and commissioning for this triplex.

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 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 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 provided engineering analysis, allocation studies, system design, and FCC application preparation for these three stations and station owners. This project triplexed these three stations at the existing WURN site in Newton, MA. This project provides a power increase for all three stations on a common five5 antenna elements (towers) directional antenna system. This was the 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, and 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 systems in the world.

City of Bellevue, WA: H&D was 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. Mr. Lockwood produced a report that 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. These 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. Mr. Lockwood served as project manager and made measurements on all 11 of the Alaska CPB stations. dTR/H&D 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.

Alaska Public Broadcasting, Inc (APB), Anchorage, AK: As follow-up on the CPB project, Mr. Lockwood designed, installed, and performed acceptance testing on new antenna systems for eight of the Alaska Public Radio stations that were designed to use the HD-IBOC system. This included stations in: Kotzebue, Fort Yukon, McGrath, Dillingham, Homer, Valdez, Sand Point, and Unalakleet.

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. In 2009 an application was made to move this facility to Point Roberts, WA.

S-R Broadcasting, KRKO Everett, WA: Mr. Lockwood completed analysis, allocation studies, and FCC application preparation for a new facility for KRKO (1380 kHz), and a proposed new 50 kW facility on 1520 kHz. 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 be 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 hearings before land use agencies on all topics of radio engineering. This facility was rebuilt in 2010 after being destroyed by an act of domestic terrorism is in 2008.

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 that which includes AM, FM, and TV antennas on the same support structure.

Cumulus Media, Los Angeles, CA: Mr. Lockwood was project manager for the move of KABC from its historical site in the Century City area of Los Angeles to a site triplexed with KWKW and

KFOX in the Crenshaw district. This allowed for the more efficient use of land for the owners of these stations.

Cumulus Media, Dallas, TX: Mr. Lockwood was project engineer for the diplexing of KTCT and KLIF allowing more efficient use of land for the owners of these stations.

Blow Up Media and Calvary Chapel Honolulu, HI. Mr. Lockwood was project manager for the move and installation for diplexed antenna system for KHKA and KLHT. This facility was moved to make way for the light rail system in Honolulu. This included the installation of a solar array above the ground system of the radio station. This project included assistance in the land use process and electromagnetic compatibility measurements and analysis of the FCC monitoring stations.

Seattle Streaming Media, KXLJ, Juneau, AK: As part of a team of H&D engineers Mr. Lockwood 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 one1 mile of the 4 four-tower MW station. The power lines were designed and de-tuned to minimize the 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. This facility was proofed under the 2008 FCC Method of Moment Proof-of-Performance Rules.

Citadel Communication, KKOB, Albuquerque, NM: After the 50-year-old KKOB antenna was damage by a misguided hot air balloon, Mr. Lockwood provided engineering support for tower section replacement and associated FCC showings. He also performed 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. Also, a study was completed to determine the effects of a proposed power line nearby 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 to be 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, *WYOS, Binghamton, NY*: Mr. Lockwood provided analysis of the existing antenna system and provided modifications and adjustments to the antenna system to license this facility using the Method of Moment Proof-of-Performance Rules.

Citadel Communicates, WJR, Detroit, MI: Mr. Lockwood provided measurements and analysis of the existing antenna system and adjusted the antenna system to be compatible with HD-IBOC digital radio. Mr. Lockwood also oversaw the installation of the FloTV antenna on the auxiliary tower of the WJR antenna system.

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

Disney Radio, KKDZ, Seattle, WA: As part of a team of H&D engineers Mr. Lockwood provided designed, installed and performed acceptance testing new antenna system, and adjusted the antenna system to be compatible with HD-IBOC digital radio.

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

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, Brazil: Mr. Lockwood was a project engineer on an installation of a two-tower directional antenna system. This project involved tune-up and acceptance testing.

Bechtel, Frederick MD: Hatfield & Dawson was retained to consult in the construction process of a 620-megawatt combined cycle natural gas-fired power station in Hayward, California which was located within 300 meters of two 50 kW AM radio station. The proximity of the radio station caused potentially lethal radio frequency currents to be present on the construction cranes. As part of the project Mr. Lockwood provided on-site support for the in-house safety team. Measurements, analysis, safety plans, safety procedures and safety training were developed to provide a safe working environment during the construction process. Mr. Lockwood was on-call to provide support as need. This project also included extensive tests and analysis of Radio Frequency Interference (RFI) and the power plants electronic systems. During the startup process Mr. Lockwood was on call to mitigate any RFI issues that arose. The issues of RF Safety and RFI were solved with minimal disruption to the construction schedule and the power plant is now on-line.

US Oil, Tacoma, WA and ConocoPhillips - Polar Tankers Division, Houston, TX: 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 of hydrocarbons, and setting a level that was acceptable to the FCC and the USCG. A settlement was reached between the ratio station and US Oil.

DFW Midstream Service, Dallas, Texas: H&D provided analysis of the hazards of placing a natural gas drilling operation on the site of the MW broadcast station KLIF. This report provided measurements and modeling of the interaction between the MW antenna system and the drilling rig. A draft safety plan was provided to DWF Midstream to assure that this exploration could proceed with a facility that complied with the safety standards. This work was performed by Mr. Lockwood.

PacificCorp, Roy, UT: Mr. Lockwood provided assistance in analysis of a proposed high voltage transmission line near a directional MW station. This included design of a transmission line that would mitigate the interaction between the AM station and the power line. This project was abandoned due to the inability to secure right-of-way for the whole transmission line.

Puget Sound Energy, Pacific, WA: Mr. Lockwood provided assistance in analysis of a proposed high voltage transmission line near a directional MW station. This included design of a transmission line that would mitigate the interaction between the AM station and the power line.

Tillamook Peoples Power, Tillamook, OR: Mr. Lockwood provided analysis of a proposed high voltage transmission line near a directional MW station. This included design of a transmission line that would mitigate the interaction between the AM station and the power line.

City of Emeryville, CA: Working for the City, Mr. Lockwood provided analysis of a proposed high-density residential complex that was being developed near two MW stations. This was part of the analysis of the city for zoning and permitting purposes.

Mission Critical Partners for Oregon Department of Transportation, Portland, OR: Mr. Lockwood provided analysis of a proposed highway construction near two directional MW station. This included analysis of all new bridges, light standards, traffic lights and signs to demonstrate minimal interaction between these structures and the MW stations.

Massachusetts Clean Energy Center, New Bedford MA: Mr. Lockwood provided assistance in analysis of a proposed port facility that would be used to assemble wind turbines for deployment in the Nantucket Sound. This facility was located within 300 meters of an existing MW and VHF FM broadcast stations. This included an analysis of options to relocate the broadcast facilities from the port area.

Broadcast Wind under contract to NEXTera, Amarillo, TX: Mr. Lockwood provided assistance in analysis of existing and proposed wind turbines that were being deployed within three km of the

MW station KGNC. This study investigated the interaction between the wind turbines and the existing directional antenna system.

Nautel, LTD, Turkish Radio and Television Corporation Antalya, Mersin and Trabzon, Turkey: Mr. Lockwood visited the MW radio stations in these cities and made measurements on the antenna systems. at these stations He and prepared reports and recommendations for the installation of new transmitters. These stations had antenna systems that were installed in the mid-1960s that operated at 300 kW into two directional antenna systems and one non-directional antenna system.

FloTV, US: H&D assisted FloTV with installation of TV channel 55 transmission systems throughout the US, specializing in installation of these facilities on MW antenna systems. Mr. Lockwood provided help with installations on WLW, Cincinnati, OH; WJR, Detroit, MI; and WOBM Lakewood, NJ.

Moment Method Proof of Performances: Mr. Lockwood performed the measurements and/or analysis of the proof of performances on a number of Medium Wave Directional Antenna systems using the 2008 FCC rules. These stations include: KWKY, 1150 kHz, Des Moines, IA;: KHTS, 1220 kHz, Canyon Country, CA; KPUG, 1170 kHz, Bellingham, WA; KJNO, 630 kHz, Juneau, AK; KGMS, 940 kHz, Tucson, AZ; KGNC, 710 kHz, Amarillo, TX; KPTK, 1090 kHz, Seattle, WA; KQRR, 1130 kHz, Mount Angel, OR; WYOS, 1360 kHz, Binghamton, NY; KKSN, 910 kHz, Vancouver, WA: KFXX, 1080 kHz Portland, OR; KSJX, 1500 kHz, San Jose, CA; KZSF, 1370 kHz, San Jose, CA; WRCA, 1330 kHz, Watertown, MA; WXKS, 1200 kHz, Newton, MA; WUNR, 1600 kHz, Brookline, MA; KPAM, 860 kHz, Vancouver, WA and KCRV, 1570 kHz, Lodi, CA.

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:

Empire State Building – Hanson Engineers, New York City: As project engineer Mr. Lockwood provided analysis of system specifications and proposal review for the replacement of the auxiliary FM antenna system atop of the Empire State Building. This facility is a combined antenna system for 19 FM stations. H&D engineers provided factory acceptance testing and analysis to assure that the radio frequency exposure on the observation deck did not exceed the FCC guidelines.

Comsulting, 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 stations 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.

American Tower Systems Cougar Mountain FM Facility, Seattle, WA: Combined FM Facilities: This facility provided main facilities for eleven FM stations licensed to the Seattle metropolitan area. This system combines these high-power FM stations in a master antenna system. Mr.

Lockwood was responsible for field testing, and commissioning and licensing of the new FM station KMAQ on this facility. This included intermodulation testing.

Mason County PUD #3, Shelton, WA. For the PUD Mr. Lockwood has provide RF exposure measurements, analysis, safety plan and RF safety training. The PUD owns a tower that is host to various broadcast and land mobile services. H&D also provided the PUD with design and licensing of three microwave paths in Mason County.

SAGA Communications, Bellingham WA: H&D engineer provide acceptance testing and intermodulation measurement of low power three FM station combiner. This project involved the changing of the channel for one station with filter tuning.

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, 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: Mr. Lockwood prepared 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: Mr. Lockwood 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 programing distribution options, cost analysis, and recommendations. This project also included a preliminary microwave distribution system that includes program and data distribution among 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, and 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.

University of Montana, Missoula, MT: For Montana Public Radio Hatfield & Dawson was retained to provide engineering assistance in dealing with the US Forest Service the Landlord for the transmitter site used by KUKL in Kalispell. This project required an Intermodulation Study and Noise Floor Analysis and a report used to amend the Forest Service site plan to allow the operation of KUKL. As part of this project Mr. Lockwood also measured the occupied bandwidth other the other station KPJH, and KUFL.

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 by Mr. Lockwood 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 (Dielecc TLP-8B) antenna. NIER measurements were made to assist with local zoning requirements.

Maxson Young Associates, Inc. (insurance adjusters): Sutro Tower, San Francisco, CA: Mr. Lockwood 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: Mr. Lockwood performed MNIER measurements and intermodulation testing.

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

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 provide an engineering study as a Follow-on Test and Evaluation (FOT&E) effort on the FM and TV broadcast transmission components of the Fly Away Broadcasting System (FABS). This work involved extensive TV and FM transmitter and antenna testing and modeling. We provided a report with recommendations for ongoing improvements in these systems. Mr. Lockwood was the System Test Manager for this project.

KFFV(DT), Seattle, WA: Mr. Lockwood tuned a UHF TV Antenna for use on Channel 44 that was designed for Channel 34.

Vulcan Wireless, Seattle, WA: Vulcan Wireless was the successful bidder for an allocation of broadband spectrum (Auction 73, Block A, 728-734 MHz, EA170 Seattle-Tacoma, EA167 Portland-Salem). Mr. Lockwood worked as a project manager for the implementation of the first phase build-out. This involved management of site selection, site acquisition, installation and testing. This spectrum was sold to T-Mobile and the sites were decommission.

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; Deer Point, Boise, ID; Aldrich Mt, John Day, OR; Meadow Lakes, CA; Owens Mt. CA; and others.

Land Mobile and Microwave Experience:

Washington State Patrol, Olympia, WA: H&D performed a statewide system coverage analysis that involved 36 separate subsystems with portions in different frequency bands and mixtures of both narrowband analog, P25, and P25 phase 2 trunking radio systems. The project consisted of extensive measurement and propagation analysis all of which were performed under an aggressive schedule required to meet a legislative deadline. For this project Mr. Lockwood was assistant project manager.

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. Mr. Lockwood was the project engineer for this project.

TriMet, Portland, OR: As a project engineer Mr. Lockwood provided coverage verification measurements along all of TriMet's light rail routes to confirm adequate belt level portable radio coverage from the new TriMet 700 MHz P25 trunked radio system for maintenance of way personnel, who maintain the right of way for the light rail system. RSSI, Bit Error Rate ("BER") and Modulation Fidelity measurements along each light rail line using an Anritsu S412E analyzer and an antenna mounted on a ground plane at belt level on a cart in the center of a light rail vehicle. In areas where RSSI and or BER values were marginal or inadequate, additional measurements were made on foot along the right-or-way. Based on these measurements and additional fill-in repeater site was added in Hillsboro to supplement coverage along a segment of right of way in that area.

Metropolitan Water District of Southern California, Los Angeles, CA: H&D provided an assessment of the existing desert system, and is in the process of producing a complete design, including detailed specifications for a replacement system for the 27 desert microwave paths. Critical elements of the project include support for Teleprotection, multi-path IP/MPLS capability, capacity requirements that may impact network configuration, and availability of Federal Communication Commission radio spectrum, all of which is being addressed in our analysis and specifications. Mr. Lockwood served as assistant project manger for this project.

Community Transit, Snohomish County, WA: As assistant manager and project engineer H&D provided project management and administrative functions when the Project Manager was not available. Performed extensive testing of Verizon and AT&T cellular coverage and network throughput along all of Community Transit's bus routes throughout Snohomish County and King County, Washington to support Community Transit's migration to commercial cellular service for its transit CAD/AVL data and to support the development of an RFP for a new voice wireless system using voice over IP over the commercial cellular network.

Sound Transit, Seattle, WA: Mr. Lockwood was assistant project manager for Eastlink and Northlink Segments: Provided project management and coordination with Sound Transit for the development and implementation of an 800 MHz radio coverage system for the stations and tunnel segments in the East Link and North Link light rail alignments. Provided Electromagnetic

Compatibly (EMC) engineering analysis of the impact of a new Sound Transit station and parking garage structure in South Bellevue, Washington (part of the new East Link light rail alignment) on nearby AM broadcast directional antenna systems. H&D provided specifications for the electronic system that would be installed in the transit station to assure minimal radio frequency interference to these systems.

Alaska Department of Transportation, Anchorage, AK: H&D engineers provided radio system a siting study, concept design, and cost estimate for a public safety radio repeater tower to connect Anchorage Wide Area Radio Network (AWARN) / State of Alaska Land Mobile Radio (ALMR) and Airport public safety bands. The scope of work included the development of coverage requirements, propagation modeling and analysis, site selection, microwave path analysis, FAA airspace analysis and coordination, tower specification, structural engineering (subcontractor), radio equipment shelter specifications, power and backup power specifications, drawing, and bid ready documentation. Mr. Lockwood was assistant project manager for this project.

State of California, Department of General Service Telecommunication Division, Sacramento, CA: Mr. Lockwood 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, WA. 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.

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

FloTV, Venture, CA: For FloTV, Mr. Lockwood provided RF exposure measurements at the American Tower site at Hall Canyon radio facility.

Central Kitsap School District, Silverdale, WA: Performed topography analysis, system design, site selection, field inspection, path loss calculations, and specification design for a nine-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 three-3-hop microwave communication system. This project also 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.

Calculations and Measurements of Non-Ionizing Electromagnetic 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.

AT&T Mobility, Ketchikan, Wrangle, & Petersburg, AK: Performed NIER and intermodulation calculations along with facilities measurement and review and design to provide co-location between cellular and both AM and FM broadcast facilities. Facilities measurement, review, and design to provide co-location between cellular and both AM and FM broadcast facilities.

GCI Communication Corp., McGrath, AK: Facilities design and tune-up to provide co-location between cellular and broadcast station KSKO.

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

Seattle City Light, Seattle, WA: NIER Calculations for the City Light communications facilities.

Snohomish Emergency Radio System, Everett, WA: NIER calculation and general radio system consulting for this 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. He 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., He monitored their performance, certified their data, and signed the inspection drawings.

Puget Sound Energy (PSE) RF Safety Training: 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 disruptor 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.

City of Bellevue, Bellevue, WA: RF safety training to all of the city of Bellevue Radio System Technicians, Water Department, City Hall maintenance and other workers. Mr. Lockwood developed course work that was tailored to the types of RF systems that are on City property. The City uses Public Safety Radio System and has a number of tenants on both their buildings and water tanks. This work included RF exposure measurements on all these City facilities.

Mason County PUD#3, Shelton, WA: RF exposure measurement were made on the PUD's communications tower which is used by a number of other users. A RF Safety Plan was developed for work at the site. Mr. Lockwood provided RF safety training to all of the PUD's radio system technicians and department heads.

FM Radio and LTE: There have been electromagnetic compatibility problems between LTE system and existing broadcast FM facilities. These have typically involved the higher harmonics of the FM facility being received by the LTE system. Hatfield & Dawson has been involved in the following markets: Anchorage, AK, Fairbanks, AK, Coos Bay, OR and Grand Coolee, WA and worked with and for both the broadcasters and cellular carriers.

LTE and Public Safety: Verizon received interference from the King County Public Safety Radio system. These system electromagnetic compatibility problems between LTE system and Public Safety System.

Public Meetings & Expert Witness: Mr. Lockwood had provided expert testimony in quasi-judicial land use hearings and neighborhood meeting for various wireless and broadcast providers and in several legal actions.

Electro-Magnetic Compatibility (EMC) and Other Projects:
White-Leasure Development Company, Mt. Vernon, WA: For this project H&D engineers provided an electromagnetic shielding design and analysis of the construction of a fuel station

on the adjacent property to a 10 kW AM station. The analysis included considerations for radio frequency arcs and the combustible hydrocarbons fuels and radio frequency interference to point-of-sale electronics and other electronic systems.

Seattle City Light, Seattle, WA: As a subcontractor to Power Engineers H&D was retained to calculate the measure power frequency Electro-Magnetic Fields (EMF) for the construction of a new substation. This information was used for the preparation of an Environmental Impact study.
Various Locations: Mr. Lockwood had been retained by several individuals to measure power line frequency fields at home and business locations.

Cassidian/EADS for the National Security Shield, Al Arish, Qatar: Mr. Lockwood provided an analysis of Electro-Magnetic Compatibility (EMC) between a radar surveillance system was constructed nearby a 2,000 kW MW station. This required one site visit and system measurements. A mitigation report was provided along with meeting with the Coast Guard of Qatar. All problems were solved.

Cascade Design, Seattle, WA: Cascade Design is a manufacture of outdoor goods and uses 27 MHz heat sealers in the process. On two occasions H&D has assisted Cascade with interference complacent from Wireless carriers and Public Safety agencies about perceived interference. In both of these situations Cascade was accused of having equipment that was causing interference. Both of these situations were resolved by providing the complacent an education in the FCC rules.

Bridgeview United Methodist Church, Norman, OK: When the Church constructed a new building adjacent to the radio station WWLS, 640 kHz Mr. Lockwood was retained to design shielding for the building and consult on the mitigation of Radio Frequency Interference (RFI) in the public address systems and other electronics used for the Church.

Virginia Mason Medical Center, Seattle, WA: H&D was retained to help understand an intermittent interference problem that was occurring in the Electrophysiology Lab. An extensive Electro-Magnetic Compatibility (EMC) study along with extensive measurement were performed to determine if additional electromagnetic shielding was needed in a new lab space that we being constructed.

Camp Humphreys, Pyeongtaek, South Korea: H&D was retained as a subcontractor for an antenna replacement project for the base American Forces Radio and Television Service (AFRTS). As part of this project Mr. Lockwood designed Electromagnetic Shielding for various buildings associated with this upgrade.

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, and two-way radio), and electromagnetic compatibility for the Israeli Defense forces facilities in Beersheba, Israel.

Professional Activities:

- The Institute of Electrical and Electronics Engineers, Inc. (IEEE) - Senior Member - Communications and Broadcast Technologies Societies
- Association of Federal Communications Consulting Engineers (AFCCE) - Board Member 2006-2011 - Vice President 2009-2010 - President 2010-2011
- National Council of Examiners for Engineering and Surveying (NCEES) - Professional Engineering Record
- The Society of Broadcast Engineers (SBE) - Member - Certified Professional Broadcast Engineer (CBPE) - Certified AM Directional Specialist (AMD) - Chairman Chapter16 Seattle 2001-2002
- Association of Public Radio Engineers (APRE) - Member
- Project Management Institute (PMI) - Member
- Amateur Radio License - K7SSL
- FCC General Radiotelephone Operator License

Study Groups

- National Science Foundation (NSF) - 2010 Enhancing Access to the Radio Spectrum (EARS). This NSF initiative came as a response from the FCC's National Broadband Plan, released in March 2010. This multi-disciplinary, invitation- only workshop focused on studying how more users can benefit from a greater range of wireless applications and services in a fixed amount of bandwidth. This group included experts from scientific, engineering, economic, public policy, and regulatory issues communities, and produced a set of recommendations for research topics to expand access to wireless services and more efficiently use the available spectrum.

  http://www.nsf.gov/mps/ast/nsf_ears_workshop_2010_final_report.pdf

Continuing Education Courses:

- Cold Regions Engineering Short Course, Jan 20-24, 1995, University of Washington
- Antennas: Principals, Design, and Measurement, May 14-17 1996, National Consortium for Engineering Education
- IEEE Broadcast Symposium, Digital Television Tutorial, October 1995
- Harris DX50 Transmitter Education Program, December 7-11, 1998, Harris Corporation
- Spectrum Analysis Course, May 2-5, 2000, JMS Consulting
- Digital Microwave Radio Engineering, September 19-21, 2000, Harris Corporation

- 1999 National Electrical Code, March 2001, National Technology Transfer, Inc
- AM/FM Antenna Certification Workshop, September 2001, September 2002, September 2003, and September 2005, National Association of Broadcasters
- In Band on Channel (IBOC) Educational Seminar, September 2002, - Harris Corporation
- IEEE Broadcast Symposium - Digital Radio Tutorial, October 2002
- Digital Television (HD, 8-VSB) Transmission Seminar - Gary Sgrignoli, Mintel, Sgrignoli, & Wallace, October 2005

Published Papers:

- Dalke, J.A..; Lockwood, S.S.: Co-locating AM Transmitter Facilities with Cellular Monopole Towers, 2020 NAB BEC Proceedings,

- Lockwood, S.S.; Cox, B.L.: New Tools to Co-Locate Wireless Facilities with AM Antenna, Broadcasting, 2014 NAB BEC Proceedings

- Dalke, J.A; Lockwood, S.S,

- Lockwood, S.S.; Jones, C.T.; Folkert, M.W: Review and Analysis of Medium Wave Directional Antenna Sample Systems, Broadcasting, IEEE Transactions, Dec. 2009, Volume: 55, Issue: 4, pages: 693 - 704

- Dawson, B.F.; Lockwood, S.S.: Revisiting medium-wave ground-system requirements, Antennas and Propagation Magazine, IEEE Aug. 2008, Volume: 50, Issue: 4, pages: 111 - 114

- Hatfield, J.B.; Lockwood, S.S.; Strickland, R.R.: RFR Fads and Fallacies, 2006 NAB BEC Proceedings, pages 263-27