Maine Medical Center
MaineHealth

# Sound Measurement Plan

## Bramhall Campus Helipad Operations

**December 21, 2018**
***Revised June 19, 2019***

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## About this Plan

This Sound Measurement Plan defines a plan by which sound will be measured after MMC's helipad is relocated, how post-move sound will be compared to prior sound measurements, and establishes a plan for mitigating impacts to surrounding properties using an appropriate national standard. This plan meets the requirements established in a condition of approval for MMC's East Tower expansion project approved by the City of Portland Planning Board on March 27, 2018. The condition states:

> *That within nine months of the date of this site plan approval the applicant shall submit a "Sound Measurement Plan" for review and approval by the Planning Authority, for assessing the actual changes in sound impacts on nearby properties between the helipad operating at the existing site and at the new location, including criteria for mitigation where such impacts are severe based on appropriate national standards. The "Sound Measurement Plan" is required in the event that the predicted sound levels are incorrect, and it shall be approved and implemented at least two months before the helipad is relocated.*

The following experts in hospital-helicopter operations and sound engineering were consulted in the creation of this Sound Management Plan:

- Norman R. Dotti, P.E., P.P a Principal at Russel Acoustics, LLC, a nationally recognized sound and vibration-engineering firm.
- Thomas Judge, CCT-P, the Executive Director of LifeFlight of Maine.

More information on the qualifications of the consultants listed above is available in Appendix 1: Consultant Qualifications**Error! Reference source not found.**

It is important to note that no national standard or best-practice exists to measure the noise impact from helicopter operations associated with a hospital on adjacent residential properties exists. The standard selected in this Sound Management Plan is the most applicable and widely-used sound measurement standard available for this situation.

## Background of Helipads:

### *History of Helipads at MMC*

In 2001, MMC began the planning and approval phase of adding a helipad to its facilities. Beginning operations in December 2007, MMC's helipad is used by LifeFlight of Maine to provide quicker, lifesaving access to emergency medical care for patients in Maine. Although MMC is Northern New England's only tertiary care hospital, it was the last of three top-level trauma centers in Maine to gain approval for the use of a helipad. Previously, critically ill patients flew to New Hampshire, Boston, or the Portland Jetport followed by a 15-minute ambulance ride to MMC. A ground-ambulance ride in addition to an air-ambulance ride wastes valuable lifesaving time and is not considered best practice. The addition of a helipad addressed a longstanding unmet need for best practice air-ambulance services of Southeastern Maine's most critically ill patients.

### *Anticipated Growth in Use*

Currently, there are 450 flights per year (~1.2 per day) and MMC estimates volume to grow to 750 per year (~2.1 per day) in the next five years. Approximately 2-3 times per month there are concurrent flights into MMC that require the landed aircraft to depart from MMC and relocate to the airport, leaving behind its medical crew and equipment, while waiting for a second aircraft to land and dispatch patients and crews. Once the second aircraft has departed, the first aircraft flies back to MMC, picks up its crew and leaves.

When patient trips overlap, there can be as many as eight individual helicopter trips (four in-bound, four out-bound). As a result of these eight additional helicopter trips, unnecessary noise is created in surrounding neighborhoods, which could be at the root of noise complaints.

MMC's recently approved project to replace the existing helipad and add another pad will reduce the number of individual flights generated by the helipad-to-jetport shuffling required in today's environment.

## Standards for Aircraft Sound:

### *National Standards*

MMC consulted with Russell Acoustics principal, Norman R. Dotti, P.E., P.P. to identify an appropriate national standard to develop this Sound Management Plan.

Aircraft sound in the U.S. is governed by the Federal Aviation Administration (FAA). The metric used exclusively for assessing sound by them is the Day-Night Average Sound Level, abbreviated Ldn or DNL (the two terms are used interchangeably). Ldn/DNL is used by major Federal agencies (U.S. Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Energy (DOE), The U.S. Department of Defense (DOD), and others) and internationally in the assessment of potential noise impacts as a result of aerial vehicle operation (planes and helicopters). Additionally, the FAA regulates sound levels produced by all aircraft manufactured and certified for use in the U.S. to reduce noise impact on people to an acceptable limit before they even take flight. These regulations have produced quieter modern aircraft, which currently use MMC's helipad and are considered industry standard.

A 2011 report for the Volpe National Transportation Systems Center (DOT/FAA/AEE/2011-03) stated "The Day-Night Average Sound Level, DNL, is the cornerstone of aviation noise impact analysis in the United States."

The Day-Night Sound Level considers not only how loud a particular aircraft or helicopter event (landing or takeoff) is but also how long the sound is present, how many events occur over time, and whether the events occur during daytime or at night.

MASSPORT, the Massachusetts Port Authority, which administers multiple airports and other transportation venues in the state, defines the Day-Night Sound Level thusly:

> ***Ldn:*** *The Day-night Average Sound Level (Ldn) is the level of noise expressed (in decibels) as a 24-hour [logarithmic] average. Nighttime noise, between the hours of 10:00 p.m. and 7:00 a.m. is weighted; that is, given an additional 10 decibels to compensate for sleep interference and other disruptions caused by nighttime noise. An annual average of DNLs is used by the Federal Aviation Administration to describe airport noise exposure.*

DNL / Ldn can be calculated as follows

$$L_{dn} = 10 \log (1 / 24 (15 (10^{L_d/10}) + 9 (10^{((L_n + 10)/10)}))$$

where

$L_{dn}$ = day-night sound level ($dB_A$)

$L_d$ = daytime equivalent sound level ($dB_A$)

$L_n$ = nighttime equivalent sound level ($dB_A$)

Whether one considers this a "standard" or a "guideline", the use of DNL comes from 14 C.F.R. Part 150, issued in 1981 to implement portions of Title I of the Airport Safety and Noise Act to address land use compatibility. Thus, it is a Federal Regulation. Rather than doing a purely "paper" study of the helicopter sound, we will be measuring the actual sounds from the helicopters, determining the contribution from each "event" where the levels are above ambient, and calculating the DNL at the different locations for the hospital's helicopter operations. As of the revision date of this plan, 14 C.F.R. Part 150 specifies 65 Db or DNL as being the threshold for residential land use compatibility.

### *Local Standards*

The City Code of Portland, Maine regulates noise levels in Chapter 14, pertaining to Land Use.

Chapter 14, pertaining to Land Use, regulates sound by city zone, with an upper limit of sixty (60) decibels on the A Scale for standard operations. Importantly, regulations pertaining to the measurement of sound levels exclude the sound generated from emergencies and critical, lifesaving emergency warning signal devices, such as emergency vehicles (fire trucks, police vehicles, ambulances, and air ambulances):

> ***Sec. 14-221.1. External effects. Every use in the B-3, B-3b and B-3c zones shall be subject to the following requirements:***
> *(b) Noise: The level of sound, measured by a sound level meter with frequency weighting network (manufactured according to standards prescribed by the American National Standards Institute, Inc.), inherently and recurrently within the B-3 and B-3b zones shall not exceed fifty-five (55) decibels on the A scale between the hours of 9:00 p.m. and 7:00 a.m., and sixty (60) decibels on the A scale between 7:00 a.m. and 9:00 p.m. at the boundaries of any lot nor within publicly accessible pedestrian open space, except for sound from construction activities, sound from traffic on public streets, sound from temporary activities such as festivals, and sound created as a result of, or relating to, an emergency, including sound from emergency warning signal devices.*

Helicopter operations associated with MMC's helipad are related to the *emergency* care of patients; therefore, local sound regulations do not apply.

## Location of Sound Devices

As part of the Sound Management Plan, MMC will capture sound level measurements around the hospital and along the flight path to provide accurate measurements of any potential impact from the operation of LifeFlight of Maine helicopters.

Further, to facilitate comparisons with previous testing, we will compare the new sound measurements with the previous report. Sound measurements of both the ambient sounds (i.e., without any helicopter contributions) and sound when a MMC helicopter is flying will be measured. This necessitates duplicating, as much as possible, where the measurements were previously made and the type of comparison (maximum sound levels). If the measurement locations are changed from previous studies, these comparisons cannot be made.

There is no "standard" or formula for selecting sound measurement locations for these evaluations. The principal concern is what residents hear, day and night, in areas in the vicinity of helicopter operations into and out of the hospital. Previously, several monitors were located close to the hospital and the rest spread further out into the community to bracket a good range of residences. Measurements near a highway, in business areas or at the hospital itself are of little or no use. The locations chosen for the first study were used again for the second study so relative comparisons can be made.

## Comparison of Historic Data is Challenging:

Direct comparison to historical data is not appropriate due to both known and unknown variables contributing to Portland's neighborhood ambient sound levels and sound generated by helicopter flights to and from the hospital. From 2003 to 2017, there was almost a universal increase in ambient sound levels in all but two sound measurement locations. Many of these increases were substantial in nature and moved the ambient baseline higher. However, with the assistance of Russell Acoustics, MMC will provide comparisons of the data from this study to historical studies with the stipulation that a true comparison is impossible to provide given the unknown variable changes that have resulted from 2003 to 2017 to the future.

## Plan for Validation:

### *Pad Operations:*

MMC contracted Russell Acoustics to measure the ambient sound levels of the hospital and surrounding neighborhoods for two 24-hour period using the sound measurement locations illustrated in Appendix 2: Sound Measurement Locations. These measurements will show the average sound levels in decibels (dBA) on an average day in the areas surrounding the hospital as a baseline as well as the loudest 5-second and 1-minute Leq sound measurements for the ambient sounds and the helicopter tests. Previous sound level measurements from Life Flight of Maine flights did not include CP-10 and cannot be compared to future studies where CP-10 is included. Any comparisons to previous studies must exclude CP-10. A direct comparison is not possible because CP-10 was not included in previous studies. DNL from helicopter flights will be calculated using the formula listed above using actual flight data, as per the appropriate national FAA standards. Reports on future sound measurement studies will include summary tables similar to those previously shared with the City of Portland and included as Appendix 4: Sound Measurement Summary Tables.

### *Helicopter Test Flights:*

MMC will partner with LifeFlight of Maine, coordinating and measuring four helicopter approaches and departures to roughly the location of MMC's helipad on the Congress St employee garage and the helipad on MMC's East Tower. The helicopter will hover over the landing pad for approximately 30 seconds, the time it takes to descend, land, and takeoff to give an accurate measurement of the noisiest portion of helicopter operations. The test flights will use all three approved flight paths to MMC to provide sound data for analysis and comparison. For reference, the flight paths that were approved as part of MMC's Institutional Development Plan by the City of Portland Planning Board in 2017 are available in Appendix 3: Flight Paths. Flight paths 1 and 2 were established in MMC's original contract zone in 2005 that was repealed in 2017 and replicated in MMC's Institutional Development Plan in 2017. Also in 2017, flight path 3 was added as a secondary route in case of high winds. The GPS coordinates of test flights and weather conditions for the duration of the sound study will be recorded.

*Continuing Operations:*

MMC will retain its phone and email hotline for neighborhood complaints and will, working with the City of Portland Planning Department, address appropriate neighborhood sound issues as stipulated by the IDP.

*Sound Mitigation:*

MMC will pay for the installation costs associated with the installation of soundproofing improvements, except in lieu of central air conditioning. MMC will also pay for the installation of ventilation improvements to one or more rooms within each such dwelling unit as reasonable and appropriate as determined by the CITY and MMC. The CITY shall contract for such work and MMC shall be responsible for the costs associated therewith. Before entering into any contract for such work, the CITY shall notify MMC and give MMC the opportunity to comment on the scope of the proposed work and the estimated cost thereof. The properties to be included under this provision are as follows: 19 Ellsworth Street, 23 Ellsworth Street, 2 Crescent Street, 19 Crescent Street, 25 Crescent Street, and 29 Crescent Street. MMC included these properties on the direction of the City of Portland Planning Staff. These properties were included in previous City of Portland zoning ordinances regulating MMC's helipad and are proximate to the East Tower helipad.

Mitigation shall only be made available if the present owners of such buildings request such improvements no earlier than six months and no later than eighteen months after commencement of the operation of the Helicopter Landing Pad. For owners to qualify the DNL generated by the use of the helipad must be above FAA DNL threshold. If average measurement in the sound study indicates a DNL above the threshold, residences will qualify for sound mitigation.

## Conclusion

This revised Sound Management Plan identifies the location of sound measurement devices, the formula for calculating DNL, establishes that comparisons to previous sound studies are complex and unproductive, and identifies a plan for mitigating the sound impact of emergency helicopter traffic to and from MMC's Bramhall campus should there be any such impacts.

This plan fulfills all requested revisions made by the City of Portland and the meets the requirements established in a condition of approval for MMC's East Tower expansion project approved by the City of Portland Planning Board on March 27, 2018.

# Appendix

## *Appendix 1: Consultant Qualifications*

## NORMAN R. DOTTI, P. E., P. P.

**Principal**

Mr. Dotti is a graduate Mechanical Engineer, a Registered Professional Engineer, and a Licensed Professional Planner. As a practicing Acoustical Engineer since 1971, he has over 30 years of direct experience with sound and vibration measurement, analysis, control and engineering project management. He has applied over two decades of electronics, instrumentation and computer programming experience to designing and supplying systems and software for sound and vibration measurement and analysis.

As part of his work he has: conducted hundreds of on-site studies of environmental, architectural and industrial sound and vibration problems; started, developed and managed a group of consulting engineers specializing in noise and vibration control; testified as an expert witness in planning hearings and local, State and Federal courts; worked with experts in other fields on large engineering and architectural projects to integrate sound and vibration controls; designed, programmed and built automated sound and vibration measurement systems for environmental and industrial clients; worked with clients from industry, all levels of government, associations, military, as well as private individuals and community groups.

**Professional Experience**

- 2005 - Present
  Principal, Russell Acoustics, LLC. Consulting engineering services pertaining to sound and vibration measurement, analysis and control.
- 1987 - 2004
  President, Knorr Associates. Acoustical consulting and management of environment, health and safety information management systems development. Responsible for all company technical and business operations. This includes proposal development, field and laboratory studies, analysis and design, report writing, and testimony.
- 1979 - 1987
  Vice President, Ostergaard Associates. Planned, proposed, managed and conducted architectural, environmental and industrial sound and vibration studies for client projects. Developed field instrumentation for long-term environmental monitoring projects. Planned and managed corporate computer system for word processing and data collection and analysis, including spectrum analyzer interfaces and computer graphics. Testified as an expert witness in acoustics for planning boards and in courts to the Federal level.
- 1971 - 1979
  Manager, Noise & Vibration Services, National Loss Control Service Corporation (NATLSCO). Proposed, started and managed sound and vibration (S&V) consulting group within large multi-national consulting firm. Developed computerized sound lab and company multi-user computer system for engineering. Work included performing and managing S&V projects for environmental, architectural and industrial clients, including finite element analysis of power plant and submarine systems. Developed and taught training courses for Bruel & Kjaer Instruments (INC I & II) and the OSHA Training Institute.
- 1968 - 1971
  Pilot, U. S. Air Force. U.S.A.F. pilot training, AC-119K combat crew pilot. Holds a Commercial Pilot license with Multi-engine and Instrument ratings.
- 1965 - 1968
  Research Engineer, Underwater Weapons Division, Davidson Laboratory. Computer analysis and modeling of high performance underwater vehicles; DSRV submarine rescue vehicle, Polaris missile,

MK-48 torpedo, DENISON hydrofoil boat. Performed original research in the mathematics of modeling complex stability and control systems on digital computers.

**Education**

- Bachelor's degree: Stevens Institute of Technology, Bachelor of Engineering degree, 1968. Machine design, stability and control, computer programming.
- Master's degree: New Jersey Institute of Technology, School of Management, Master of Business Administration (MBA) in Management of Technology, 2003

**Specialized Postgraduate Courses**

- Fifth Institute of Noise Control Engineering Industrial Noise Control (B&K)
- Designing Quiet Products (B&K) Microphones & Accelerometers (B&K)
- Acoustic Materials & Structures (B&K) Designing Digital Filters
- Applied Time Series Analysis (GenRad) Acoustic Modeling (MIT)
- Industrial Hygiene Engineering Industrial Hygiene Toxicology
- Reading Speech Spectrograms (MIT)

**Professional Licenses**

- Licensed Professional Engineer, New Jersey and Illinois
- Licensed Professional Planner, New Jersey
- Professional Associations, Societies & Memberships
- Acoustical Society of America
- Audio Engineering Society
- Institute of Noise Control Engineers
- American Industrial Hygiene Association - Noise Committee
- Air Pollution Control Association - TP6 Noise Committee
- Illinois Manufacturers Association Noise Advisory Committee - Chairman
- National Council of Acoustical Consultants representative to American National Standards Institute S3 Committee on Bio-acoustics
- New Jersey Noise Control Regulation Task Force
- Research Fellow of the Research and Development Staff of Metrosonics, Inc.

**Teaching**

Mr. Dotti has developed courses for and taught at the U.S. Department of Labor's OSHA Training Institute, Des Plaines, IL, for over ten years. His Advanced Noise Control course has been presented to hundreds of OSHA industrial hygienists and safety compliance officers, military personnel, Coast Guard and Postal Service employees and labor and industry representatives.

He also developed the course notes for and taught week-long sound and vibration measurement and control seminars for Bruel & Kjaer Instruments. The Industrial Noise Control I and II courses were taught over a period of six years.

The above courses and custom classes have been prepared for and taught to Federal, State and local government agencies, including the U. S. Navy and the States of Virginia, Kentucky and South Carolina. Classes in sound and vibration measurement and control for industry have been presented to companies including IBM, Borg-Warner and several workers' compensation insurance carriers.

Mr. Dotti was an Adjunct Professor for several years at Montclair State College, where he taught courses in numerical analysis and computer programming.

**Representative Projects**
Mr. Dotti has managed many of the following projects and has actively participated in the planning, measurement and engineering of all of them:

**Environmental Sound**
Custom design, construction and installation of computer controlled community noise monitoring systems for industrial plants and other community sources|Test and design of muffler and barrier systems for manufacturing plant fan, process and stand-by equipment noise control|Solid waste transfer station testing and analysis for engineering noise control and permitting|Computer programming for acoustical evaluation of S&V engineering alternatives|Helicopter and fixed wing aircraft sound assessment, measurement and regulation development|Truck and other motor vehicle drive-by tests, road-side barrier design|Long-term measurement of community sound levels and variations, including HUD surveys|Site development community and traffic noise surveys for zoning and planning review|Measurement of interior sound levels from outside sources and acoustical design review of construction details|Property line measurements for regulation compliance

**Industrial Sound**
Employee noise exposure and OSHA surveys|Engineering noise control measurement and design|Hearing conservation and audiometric testing programs|Computerized noise exposure and audiometric test data analysis|Machinery noise source identification and control|Employee education programs and manuals|Sound level contour mapping.

**Architectural Sound**
Recording and broadcast studio building and ventilation design|Office sound isolation materials selection and ventilation system (HVAC) modeling and modifications|Conference and classroom voice articulation|Electronic paging and voice re-enforcement systems|Isolation of exterior noise sources; traffic, aircraft, music, manufacturing|Apartment, town house and other residential sound isolation|Identification of exterior noise sources.

**Vibration**
Finite element analysis of nuclear power plant components for earthquake response|Structure-borne noise generation measurements and analysis of Navy shipboard power supplies and Trident submarine trailing SONAR array|Air conditioning chiller pipe and floor vibration isolation design and test|PATH Journal Square Transportation Center building and cooling tower vibration tests|Semiconductor manufacturing and clean room equipment vibration isolation|Impact isolation of power press and general manufacturing equipment|Measurement and prediction of human response to ground-borne and building vibration |Design and programming of maintenance vibration monitoring systems.

**Forensic Acoustics**
Expert witness testimony and litigation support|Measurements to determine compliance with local, State and Federal regulations|Expert report review|Identification of contributing sound and vibration sources|Regulation review and development|Enhancement and recovery of tape-recorded conversations|Tape authentication|Speech analysis and speaker identification|Measurement and analysis of live and recorded voice intelligibility and comprehension|Physiological and psychological response to sound and vibration|Testing of "cordless" telephone in-ear sound levels|Measurement of sound and vibration levels and frequency for determining human detectability and annoyance|Pre- and post-construction building site ambient levels measurement and design of mitigation measures|Re-zoning application surveys|Heliport and helistop sound level assessment|Gunshot measurement and analysis; hearing damage.

**Personal Background**
Mr. Dotti enjoys teaching and is active in community affairs; he has served as a Captain in his community's volunteer fire department and has been a member for over 25 years.

## Thomas Judge, CCT-P

*Executive Director, LifeFlight of Maine*

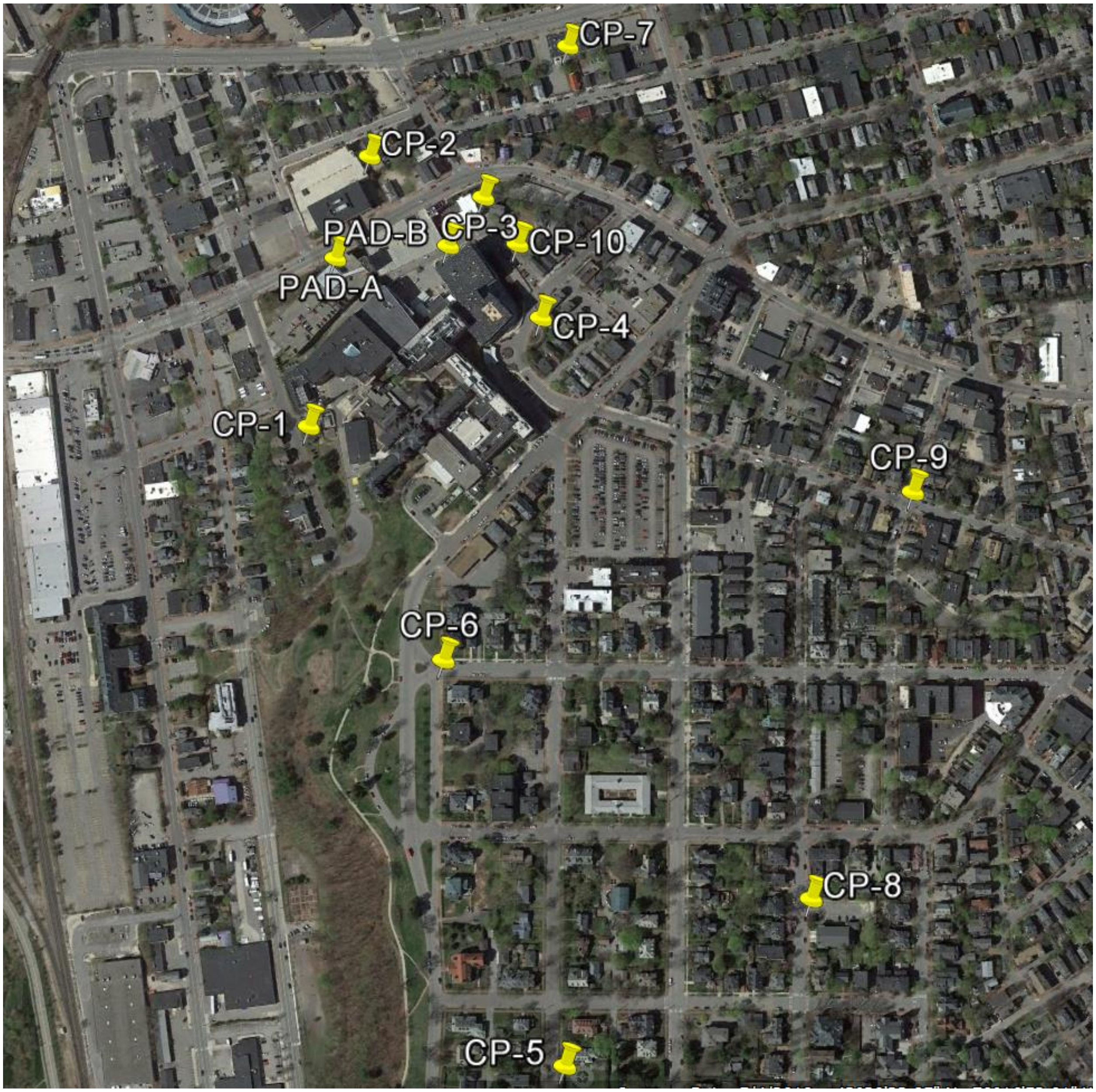
Tom Judge serves as the Executive Director of LifeFlight of Maine, a non-profit hospital-based helicopter critical care system serving the entire state of Maine. He also serves as Executive Director of the LifeFlight Foundation, a non-profit charitable organization that funds aviation infrastructure and outreach education services to hospital and EMS providers. LifeFlight has been nationally recognized for quality, safety and innovative excellence in community service.

Tom brings thirty years of experience in pre-hospital emergency medical services to these organizations, in roles ranging from provider to system planner. He currently serves on the board of the Foundation for Airmedical Research and Education and is a past president of the board of the Association of Air Medical Services. In 2009, he was appointed to the National EMS Advisory Council where he provides advice and recommendations on matters relating to all aspects of the development and implementation of EMS. He also is a consultant for an international accreditation group, serves on the faculty of the annual conference of the National Association of EMS Physicians and on the editorial board of the Emergency Medicine Journal. Locally, he serves as a trustee for Penobscot Bay Healthcare in Rockport and is an active paramedic for the St. George Volunteer Firefighters and Ambulance Association.

In the mid-1990s, Tom spent a year in the United Kingdom as an Atlantic Fellow in Public Policy, during which time he studied at the Medical Care Research Unit, the University of Sheffield and with the Scottish Ambulance Service. He is particularly interested in the effects of healthcare policy and the issues of access and equity in the provision of rural medical care.

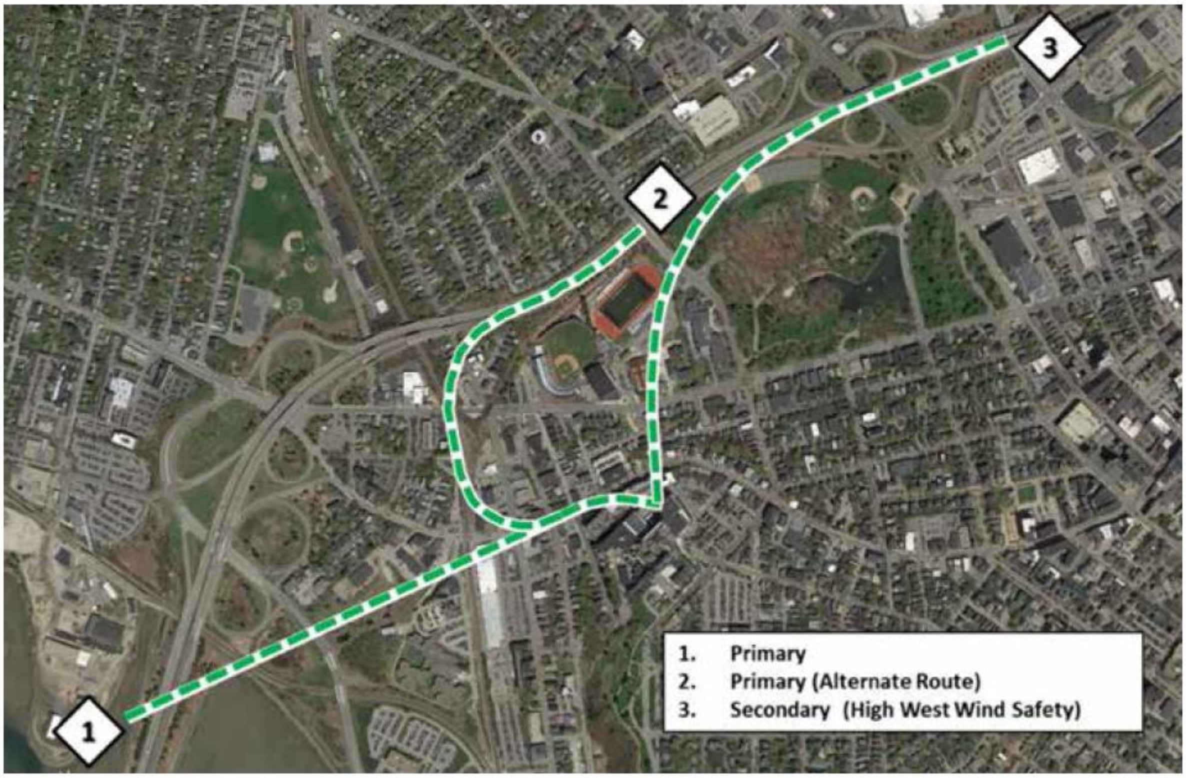
Tom has written dozens of articles for emergency and air medical journals and made several presentations at international EMS conferences around the world including South Africa, London, the Czech Republic, Vancouver, Japan, Paris, Spain, Scotland and across the United States.

*Appendix 2: Sound Measurement Locations*



## *Appendix 3: Flight Paths*

**Fig.4.5** Proposed Flight Routes for the new MMC Helipad




**NOTE: Path #3 is new and will only be used under high wind conditions if required by the Federal Aviation Administration.**

## *Appendix 4: Sound Measurement Summary Tables*

Table 2 Replicate

| Position | Ambient Range | Ambient Average | 5-Second Leq Flight Test Range | Flight Test Average | Sound Level Change of Averages | Arrive & Depart |
|---|---|---|---|---|---|---|
| CP1 | 83-84.1 | 83.5 | 76.1-77.3 | 76.7 | -6.8 | 72.4, 63.7 |
| CP2 | 92-94.1 | 93 | 85.8-89.2 | 87.5 | -5.5 | 88.6,83 |
| CP3 | 84.1-99 | 91.5 | 95.1-97.2 | 96.2 | 4.7 | 78.7, 81 |
| CP4 | 78.1-81.5 | 79.8 | 88.3-89.6 | 89 | 9.2 | 65.2, 70.4 |
| CP5 | 84.6-92 | 88.3 | 65.8-66.8 | 66.2 | -22.1 | 64.2, 53.5 |
| CP6 | 76.3-82.3 | 79.3 | 71.1-73 | 72.4 | -6.9 | 65.5, 67.5 |
| CP7 | 77.8-83.4 | 80.6 | 84.7-87.7 | 86.2 | 5.6 | 71.2, 83.1 |
| CP8 | 85.2-91.9 | 88.5 | 58.7-68.1 | 63.4 | -25.1 | 63.2, 52.6 |
| CP9 | 89.9-94.8 | 92.4 | 68.8-71.1 | 70 | -22.4 | 77.3, 67.3 |

Table 3 Replicate

| Position | Ambient Range | Ambient Average | 1-Minute Leq Flight Test Range | Flight Test Average | Sound Level Change of Averages | Arrive & Depart |
|---|---|---|---|---|---|---|
| CP1 | 75.3-76.1 | 75.7 | 69.4-71.2 | 70.3 | -5.4 | 66.9, 58.9 |
| CP2 | 82.2-84.4 | 83.3 | 82.8-86.4 | 84.6 | 1.3 | 81.8, 77.8 |
| CP3 | 73.7-78.3 | 76 | 88-90.1 | 89 | 13 | 73.4, 74.3 |
| CP4 | 71-74.1 | 72.6 | 79.5-82.7 | 81.1 | 8.5 | 59.8, 61.9 |
| CP5 | 75.6-83.3 | 79.4 | 56.8-58.8 | 57.8 | -21.6 | 58.6, 49.1 |
| CP6 | 70.4-75.2 | 72.8 | 64.5-67.3 | 65.9 | -6.9 | 61.8, 59.6 |
| CP7 | 70.5-75.6 | 73 | 79.8-82.7 | 81.2 | 8.2 | 67.5, 74.3 |
| CP8 | 78-83.3 | 80.6 | 55.4-62 | 58.7 | -21.9 | 55.4, 50.2 |
| CP9 | 81.5-88 | 84.8 | 62.6-64.6 | 63.6 | -21.2 | 67.1, 63.1 |

Table 2 and Table 3 were extracted from a February 2, 2018 memo from Russell Acoustics, LLC to MMC's Manager of Facility Development that was submitted to the City of Portland as part of the East Tower & Visitor Garage site plan review process.