**Boston Logan Airport Noise Study**

# Phase 2

# REASSESSED SCOPE OF SERVICES

**FINAL**

**October 2009**

# PREAMBLE

The following scope of work outlines tasks to be performed during Phase 2 of the Boston Logan Airport Noise Study. Phase 1 was a collaborative process between the Logan Airport Community Advisory Committee (CAC), the Boston Technical Advisory Committee (BOS/TAC), the Federal Aviation Administration (FAA), and Massport, with support from the Project Consultant (PC) and the Independent Consultant (IC). The CAC represents over 30 communities and towns within the Greater Boston area, each of which has appointed a representative to the organization. BOS/TAC contains representatives of FAA, CAC, and Massport. Each of these parties played an important role in identifying potential measures to reduce noise impacts to communities surrounding Boston Logan International Airport (the Airport). Measures identified in Phase 1 that were determined to be feasible based on operational, safety, and technical criteria were retained for further consideration. Those measures that could be implemented without causing adverse environmental impacts were identified and may be implemented during the early stages of Phase 2 (Task 3).

Other measures identified in Phase 1 that were determined to be safe and operationally and technically feasible, but had the potential to cause adverse environmental impacts if implemented, were retained for further analysis in Phase 2. Those measures will be subjected to more detailed technical analyses to determine the significance of any environmental impacts, which will then be the subject of an environmental document to be prepared by FAA.

Because the purpose of the Boston Logan Airport Noise Study is to identify and implement measures to reduce noise impacts to communities surrounding Boston Logan International Airport (BOS), the active participation of representatives of communities most affected by noise from aircraft operating at the Airport is crucial to the success of the project. Thus, the FAA proposes to directly involve BOS/TAC and CAC, as well as the public at large, in completing three critical tasks in Phase 2:

- Task 2 – Public Coordination/Involvement
- Task 5 – Develop Existing Conditions, and
- Task 6 – Alternatives Analysis-Identification and Evaluation.

Additional resources, such as the FAA Evaluation Team that evaluated Phase 1 measures for safety and operational and technical feasibility, will be brought into the Phase 2 study process as needed.

The public involvement process is outlined further in Task 2 – Public Coordination/ Involvement. The purpose of this process is to ensure that BOS/TAC, CAC, and the general public have the opportunity to provide input on the conduct of this noise study in the spirit of collaboration that existed in Phase 1. It will also serve to assist the CAC in reaching consensus at key decision points during Phase 2.

At the conclusion of Phase 2, the CAC and Massport will recommend a series of measures for implementation; these measures will be the subject of an environmental document to be prepared

in Phase 3 that will document the potential environmental impact of the proposed measures. Based on the significance of any potential environmental impact, the FAA will either prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS). Because the significance of the potential environmental impacts of the proposed implementation measures is currently unknown, the FAA will initiate the environmental process in Phase 3. Whether an EA or EIS is ultimately prepared, FAA will commit to implementation of any approved measures in either a Finding of No Significant Impact (FONSI) or a Record of Decision (ROD). At the February 2008 BOS/TAC meeting, CAC stated that they were not prepared to address runway use until there was a firm understanding of the desirable flight routes to and from each runway end so that a more informed opinion might be reached on the ability of each runway use action to maximize the reduction of noise exposure over incompatible areas. The Massport Preferential Runway Advisory System (PRAS) will be discussed in Phase 2 (see Task 7.1). PRAS is defined as the program that was implemented since 1982. As scoped for Phase 2, Massport and CAC must reach a conclusion related to the continuance of PRAS. If there is concurrence between both parties that PRAS is to be discontinued, the proposed runway use measures would be evaluated, an evaluation which would be conducted in Phase 3. If there is concurrence that PRAS should continue, no further runway use measures will be evaluated, because the concept of preferential use of runways for noise abatement starts with PRAS.

This reassessed scope of work contains adjustments required due to the extended duration of Phase 2. Originally, the scope of work accounted for efforts to be completed by June 2009. Based on existing progress (as of October 2009), the project is expected to be completed by December 2011. Due to the extended timeline, additional funding for duration-based tasks was required. This reassessed scope of work also provides updates on whether tasks have been completed. It also provides minor corrections and additions to the scope of work language for clarification purposes.

Under these scope reassessment efforts, existing planned efforts were reviewed and changed in order to free up funding within the existing budget and apply to those tasks that require additional funding. Several major tasks under Project Consultant responsibility were transferred to the FAA in order to free up needed funds within the existing budget. With the addition of a Massport funded FAA staffing position, tasks such as document record management and meeting administration were transferred over to FAA. FAA also committed public relations staff to assist in media outreach and public coordination. FAA was also successful in obtaining committed FAA staff to conduct RNAV procedural design and consultation.

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**AUGUST 16, 2006**

## INTRODUCTION

The Boston Logan Airport Noise Study is in fulfillment of the requirements of the FAA's Record of Decision dated August 2, 2002. The study is being completed in three phases.

During Phase 1, 55 airspace and operational measures to potentially improve the noise environs around Boston Logan International Airport were identified. Each measure was subjected to a preliminary screening process that examined safety and operational feasibility. If a measure was found to be technically feasible and met FAA safety criteria it was subjected to a secondary screening analysis. If a measure was technically infeasible or did not meet FAA safety criteria, it was discarded from further consideration. Through this process, 18 of the 55 Phase 1 measures were ultimately discarded.

The remaining 37 measures considered in Phase 1 were examined in a secondary screening analysis to determine whether implementation would potentially cause an adverse environmental impact (as defined in FAA Orders 1050.1E[1] and 5050.4B[2]) that require disclosure and consideration in an Environmental Assessment (EA) or Environmental Impact Statement (EIS). Measures that would not cause an impact requiring disclosure and consideration in an EA or EIS, and were listed in and met the conditions of FAA Order 1050.1E to be considered as the type of action that would normally be categorically excluded, were identified as Early Implementation Measures. Of the Phase 1 measures considered, 23 were identified as Early Implementation Measures.

The remaining 14 measures deferred from Phase 1 (combined together into 12 measures) will be further evaluated in Phase 2 to determine potential impacts to communities and noise sensitive areas. The intent of these measures is to reduce noise impacts to communities surrounding Boston Logan International Airport. These 12 combined measures are:

- Measure 4 – Runway 14 Departures: develop departure procedures to increase altitudes of aircraft over land. The intent of this measure is to avoid overflights of Hull and increase altitude of aircraft at the point where their flight path crosses from the ocean to land. FAA-designed routing from Runway 14 was not available during Phase 1. Therefore, analysis for this measure is to be addressed in Phase 2.
- Measure 16 – Runway 32 Arrivals: develop approach procedure that maximizes flight over water. The intent of this measure is to minimize noise impacts to South Shore communities. FAA-designed routing to Runway 32 is not complete and is currently under review by FAA National Flight Procedures Office. Therefore, analysis for this measure is to be addressed in Phase 2.

[1] Federal Aviation Administration, Order 1050.1E Chg 1, *Environmental Impacts: Policies and Procedures*, March 30, 2006.
[2] Federal Aviation Administration, Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, April 28, 2006.

- Measure 17 – Runways 27 and 33L Departures: develop departure procedures for fanning. The intent of this measure is to provide respite to close-in communities in departure areas of these runways.
- Measure 18 – All Departure Runways: apply cockpit alternatives for thrust and climb management to benefit certain nearby communities through implementation of close-in noise abatement departure procedures. The intent of this measure is to minimize noise impacts to close-in communities.
- Measure 19 – Runway 27 Departures: establish balanced use of Runways 27 and 33L for departures. The intent of this measure is to minimize noise to close-in communities.
- Measure 20 – Runway 4L Departures and 22R Arrivals: remove noise emission restriction to achieve more utilization of this runway. The intent of this measure is to develop a more equitable distribution of noise impacts.
- Measure 21 – All Departure Runways: develop fanning procedures based on route of flight. The intent of this measure is to disperse noise impacts in departure areas of runways.
- Measure 22 – Runways 4R/L and 22R: develop runway use procedure to more reasonably distribute operations between these runways in meteorological conditions with small tailwind components. The intent of this measure is to provide more equitable distribution of noise impacts from Runways 4R/L and 22R.
- Measure 23 – Runway 27 Arrivals and Runway 15 Departures: arrive on Runway 27 and depart on Runway 15 during late night hours. The intent of this measure is to minimize noise impacts on South Shore/Hull.
- Measure 24 – Runway 15R Departures: implement a preferential runway use procedure during operational (FAA) nighttime hours (midnight to 6 a.m.) that places all departures on Runway 15R, unless tailwinds exceed 11 knots or departures exceed 60 per hour. The intent of this measure is to reduce aircraft noise exposure during nighttime hours for communities in the departure area of Runway 27.
- Measure 26 - Runways 27 Departures: modify the Runway 27 WYLYY departure procedure so that aircraft are fanned after the 2nd gate. The intent of this measure is to provide respite to close-in communities in departure areas of runways.
- Measure 27 – Runways 4R/4L LDA Approaches: develop offset approaches from the east and west. The intent of this measure is to minimize noise to communities under the existing approach to 4R/4L.
- Measure 28 – Runway 27 Departures: modify Runway 27 departure procedure to an initial right turn in order to direct aircraft over the Charles River basin and away from heavily populated areas. The intent of this measure is to reduce the aircraft noise exposure for the communities in the departure area of Runway 27.

Any measure identified during Phase 1 and found by CAC and the FAA to potentially provide noise relief, but also might be found to generate significant noise effects (with the potential to be mitigated) or substantial public controversy, was carried over for inclusion in the evaluation process of Phase 2. [3]

[3] In accordance with 40 CFR 1508.4, and FAA Orders 1050.1E and 5050.4B.

For budgetary purposes, it is assumed that three (3) of the Early Implementation Measures from Phase 1 will be carried over for inclusion in the analysis process of Phase 2. Phase 1 Measures 4, 16 and 18 passed from Phase 2 Level 1 to Phase 2 Level 2 screening analysis. Phase 1 Measures 17, 21, 26, 27 and 28 were eliminated in Phase 2 Level 1.

Note that Phase 1 Carried-Over measures related to PRAS have been delayed from the current alternative evaluation process as discussed during the February 28, 2008 BOS/TAC meeting. The CAC did not desire to address runway use until there was a firm understanding of the desirable flight routes to and from each runway end so that a more informed opinion might be formed of the ability of each runway use action to maximize the reduction of noise exposure over incompatible areas. Therefore, Phase 1 Measures 19, 20, 22, 23 and 24 will not be evaluated in Phase 2, and their evaluation in Phase 3 will depend upon Massport and CAC decision related to PRAS or other types of strategies for preferential runway use.

At the time of updating this scope of work, 53 measures were identified and assessed in Level 1. The following measures were passed to Level 2 for further consideration:

- Measure G-D (32): Runway 4R Arrivals on the centerfield taxiway. The intent is to reduce aircraft ground noise levels for communities west of Taxiway November by increasing distance between the source (aircraft) and the receiver (residents west of the Airport located within close proximity of line-of-site of Taxiway November).
- Measure G-F (34): Limit use of reverse thrust during landing on all runways. The intent is to reduce landing noise levels on nearby communities. This measure would require longer landing roll distances.
- Measure G-G (35): Erect noise barriers on the community side of the shoreline. The intent is to reduce aircraft ground noise levels for residences that have direct line of site of Runways 15R/22L/22R/27. The number of residences targeted for reduction depends on height of the proposed noise barriers.
- Measure G-I (37): Build a dedicated hush house building for run-ups. The intent is to Reduce aircraft maintenance run-ups by as much as 20 dBA.
- Measure G-J (38): Seek a location on the airport for a hold apron/penalty box to park aircraft as they await takeoff queuing onto Taxiway N. The intent is to reduce the duration of aircraft ground noise levels associated with taxiway movements and queuing .
- Measure G-M (41): Erect noise barrier for 15R departures – northwest end of 15R/33L along East Boston shoreline. The intent is to reduce aircraft ground movement, departure roll and arrival reverse thrust noise levels for residents located northwest of the Airport within close proximity to the direct line of site of Runways 15R/22L/22R.
- Measure G-N (71): Encourage air carriers and based or frequent general aviation users at BOS, subject to pilot discretion and the absence of conflicting traffic in Visual Meteorological Conditions (VMC) with clear and dry pavements, to 1) voluntarily use single-engine taxi operations for ground operations, and 2) voluntarily give preference to the use of an engine on the aircraft side away from the nearest communities. The intent is to reduce ground taxi noise when possible.
- Measure F-A (42): Establish continuous descent approach to Runways 4R/L, 27, 33L, 32, 22R/L and 15R. The intent is to allow for a gradual descent at low power settings all the

way to the runway end, which generally results in lower noise in areas beyond the final approach.

- Measure F-G (47): Establish an over water visual or RNAV arrival to Runways 33L/32 over harbor mouth during night hours to increase distance north from Point Allerton. The intent is to Increase the distance between an aircraft (noise source) and receiver (resident located on Point Allerton), thereby reducing noise levels during more sensitive hours.
- Measure F-H (48): Leave Runway 32 arrivals where they are indicated by the Runway 14/32 EIS (approximately 4,000 feet west of the Runway 33L approach course) when used in conjunction with Runway 33L arrivals. The intent is to maintain an offset approach to Runway 32 west of Hull at all times, instead of a straight in approach to Runway 32, which may reduce the noise over Hull when Runway 32 is in use.
- Measure F-I (49): Maintain 3 mile in-trail separation intervals between all aircraft on arrival to Runways 22R/L – never let the 2.5 mile exemption to the separation rule be applied. The intent is to reduce intensity of aircraft arrival noise events, even if it does not reduce the overall noise.
- Measure F-K (51): Extend Runway 27 departure gates farther south to I-95/R128/Dedham area before turning to enroute courses. The intent is to reduce frequency of overflight noise events.
- Measure F-M (Phase 1 Carry Over Measure 4): Develop departure procedures to increase altitudes of aircraft over land by establishing course guidance to route traffic north of Hull, when used in conjunction with Runway 27 arrivals. The intent is to Increase distance between an aircraft (noise source) and residents (receiver) on the ground by staying north of Hull and increase altitude when crossing back over the shoreline. By increasing distance, noise levels detected on the ground could reduce.
- Measure F-N (53): Establish a departure waypoint from Runway 15R for use at night to move departures farther north of Hull than established by Phase 1 Alternative 3. The intent is to Increase the distance between an aircraft (noise source) and receiver (resident located on Point Allerton), thereby reducing noise levels during more sensitive hours.
- Measure F-R (57): Shift Runway 4R Phase 1 Alternative 1 RNAV initial fix to east to move the course away from Revere Beach, while avoiding noise increases to Nahant. The intent is to increase the distance between an aircraft (noise source) and receiver (resident located along Revere), thereby reducing noise levels. Measure F-R is intended to assure that any modification of the course of the Phase 1 RNAV departure course from Runway 4R does not result in increased noise impacts in the Nahant area.
- Measure F-S (Phase 1 Carry Over Measure 18): Departure Runways 4R, 9, 27, and 33L: apply cockpit alternatives for thrust and climb management to benefit certain nearby communities through implementation of close-in or distant noise abatement departure procedures. The intent is to evaluate each measure for noise reduction effects off the end of each runway. Effects from either a close-in or distant noise abatement departure procedure may vary among Runways 4R, 27, and 33L, while Runway 9 is expected to achieve greater benefit from a close-in departure procedure.
- Measure F-T (58): Establish altitude floor to increase altitudes over downtown area for local VFR traffic under BOS Tower control that are not on approach or initial climb. The intent is to increase the distance between an aircraft (noise source) and receiver (resident located in the downtown area), thereby potentially reducing noise levels.

- Measure F-U (59): Maintain helicopter routings within downtown area airspace for all users, including hospitals, businesses and media. The intent is to locate all helicopter operations over less noise-sensitive areas such as highways.
- Measure F-V (60): Extend initial departure course for turboprop aircraft to 2,000 MSL before initiating turns over populated areas. The intent is to reduce the frequency of low altitude propeller departures and associated noise levels (below 2,000 feet MSL) over populated areas.
- Measure F-DD (68): Move all the departures over Marshfield, including for Runways 4, 9, 14, 15, 22L and 22R out over the water. This includes both conventional and RNAV procedures. The intent is to reduce noise levels by having the traffic stay over the water as it heads south towards Cape Cod and Providence, rather than coming over Marshfield at North Marshfield and then heading south over Marshfield.
- Measure F-GG (72): Establish a new approach crossing point at a location that is approximately two miles to the east and several miles south of the current DRUNK intersection for arrivals to Runways 22R/L, 27, 33L and 32 from the PVD fix (related only to Phase 1 Alternatives 6, 7 and 11), and establish a minimum crossing altitude of not less than 8,000 feet MSL. The intent is to raise the altitude of arrivals to Runway 22L and Runway 27 over land while the aircraft are descending to the proposed fix, and relocate the arrivals to remove BOS Runway 27 and 22L jet arrival noise over Marshfield.
- Measure F-HH (73): Jet aircraft departing Runway 33L shall be assigned a course that will route the aircraft over the Wellington Station until reaching a point seven (7) miles beyond the fly over end of the runway or to an altitude of 5,000 MSL before turning to in-route or intermediate courses. The intent is to reduce frequency of overflight noise events over noise-sensitive areas by increasing overflights over less sensitive areas (e.g., industrial, commercial).
- Phase 1 Carry Over Measures 17, 21, 26, 27, and 28 were eliminated from further consideration.

A collective assessment of all Phase 2 measures recommended for implementation will be required to determine if the intent and goal of the program, to reduce noise impacts on communities surrounding Boston Logan International Airport, would be realized. Different combinations of Phase 2 measures may need to be analyzed to determine the set of measures that best minimizes noise impacts. This will take place in the Level 3 analysis.

This document presents the proposed scope of services, also referred to as the work plan, for Phase 2 of the Boston Logan Airport Noise Study. The objectives of Phase 2 are to:

1. Continue collaboration between CAC, Massport, and FAA.
2. Enhance the public coordination and involvement program through the project web site.
3. Update the GIS database and develop existing conditions of inflight aircraft and ground noise exposure.
4. Develop a future Planning Activity Level (PAL) Baseline with Phase 1 Noise Study Alternatives baseline for Boston Logan International Airport that alternative measures

will be compared against to determine if the measures would improve the noise environment for the communities surrounding the Airport. (Note: for the alternative analysis, the PAL will be based on the 2009 FAA Terminal Area Forecast (TAF) operations levels for 2015).

5. Develop Phase 2 evaluation screening criteria and process to identify reasonable and feasible measures that will improve the noise environment for the communities surrounding Boston Logan International Airport.
6. Determine appropriate level of National Environmental Policy Act (NEPA) documentation required to consider and approve recommended actions for implementation.

A follow-on phase, Phase 3, will include an examination of Massport's PRAS if decided to proceed or Measures 19, 20, 22, 23 and 24 if PRAS is eliminated to determine potential runway preferential use that could minimize aircraft noise on near-by communities, and the development by FAA of either an EA or EIS documenting and considering the potential environmental impacts of the measures recommended by CAC and Massport for implementation. The PRAS evaluation and environmental documentation will occur in Phase 3 since the measures and projects to be evaluated in PRAS and the FAA's environmental document are still undefined. Assuming that Massport and CAC agree that PRAS or Phase 1 runway use measures is still applicable at the end of Phase 2 (see Task 7.1), the details related to the evaluation process will be discussed during the Phase 3 scope of work development task. An analysis of PRAS or Phase 1 runway use measures will be conducted after other measures are better defined and a preferred alternative is identified. Phase 2 of the Boston Logan Airport Noise Study will define the measures and projects that will be used to determine the Sponsor's Proposed Action to be environmentally evaluated by FAA for implementation approval.

# 1 PROJECT MANAGEMENT

This element addresses the overall project administration, management, and coordination of the work effort. There are four tasks in this element as defined below. The FAA will have overall responsibility for management of the project. The FAA, Massport, and BOS/TAC/CAC will continue to collaborate on project direction and alternatives development. The CAC will have overall responsibility for management of the IC.

## 1.1 Project Administration and Coordination

The scope of work of Task 1.1 is hereby reassessed.

This task covers the day-to-day project administration and coordination required by the PC and IC in coordination with FAA, Massport, BOS/TAC, and CAC. For purposes of scope and budget development, it is assumed that 48 months will be needed for project administration and coordination to complete all tasks included in Phase 2. This 48-month period includes the 24-month extension provided for under this scope reassessment.

**PC Activities:**

- The PC will maintain a summary project schedule on a monthly basis. The monthly summary schedules will be published on the BLANS Forum website.
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- The PC will prepare and submit monthly invoices and progress reports. This task is assumed to require two (2) hours per week for subconsultant coordination, reconciliation of invoices and budgets, and completion and preparation of invoices and status reports.

**IC Activities:**

- Participate in teleconferences with the PC as needed to coordinate technical evaluations (one hour bi-weekly is assumed).
- Prepare monthly invoices and progress reports for delivery to the CAC management and Massport. This task is assumed to require two (2) hours monthly.
- Provide project files and records for Independent Consultant efforts for inclusion in the Administrative Record.

## 1.2 FAA Coordination

The PC will hold regular project management meetings with FAA, Massport, and BOS/TAC/CAC during Phase 2 to review material, discuss work progress, and respond to comments. It is anticipated that these project management meetings will be held bi-weekly. This task will also include periodic coordination with IC.

**PC Activities:**

- Coordination with the IC – the PC will coordinate with the IC via conference calls as needed. This coordination is assumed to require two (2) hours per month to conduct the meetings. These meetings will involve project managers from PC and IC. Effort

associated with additional meeting attendees is accounted for in the technical tasks described below. IC.

- Continue PMT calls and limit forum to project questions only. Bi-Weekly conference calls – the PC will prepare a project activity report, which will serve as the agenda for the bi-weekly calls. This activity report will outline the current activities of the study and will be available on the project website. Following each conference call, each of which is anticipated to last approximately an hour, meeting notes will be prepared and distributed by the PC within 3 days of each bi-weekly conference call. This coordination is assumed to require no more than two PC staff members to participate in weekly calls, and one administrative member to prepare meeting notes. Effort required for this coordination is assumed to be 3 hours per meeting.
- Utilize Net meetings as directed by FAA with up to three (3) face-to-face meetings as needed.

**IC Activities:**

- The IC will participate in the bi-weekly conference calls held (up to one hour each) and coordinate CAC interests in the preparation of the measures to be considered in Phase 2. For budgetary purposes, three (3) separate trips to FAA offices are assumed.

### 1.3 Assemble and Maintain Document Record and Index

The scope of work of Task 1.3 is hereby reassessed.

A document record will be developed that will form the basis for the FAA's Administrative Record for the subsequent environmental documentation (Phase 3). A copy of each record/document/information relating to the project that is used by the FAA in its decision making process will be kept. A database index of this material will also be developed.

Task 1.3 is hereby closed. Efforts incurred through March 31, 2009 will remain under the present task and will be invoiced accordingly. Starting on April 1, 2009, PC will no longer be responsible for the assembling and maintaining of the document record and index. The FAA will assume responsibility of the assembling and maintaining of the document record and index from April 1, 2009 onward. Remaining funds will be relocated to fund re-assessed tasks. PC will comply with FAA document record requirements as tasks are conducted.

### 1.4 Work Scope Re-Assessment

The scope of work of Task 1.4 is hereby reassessed.

At two (2) points during Phase 2, the PC may need to re-assess the work scope and budget to determine if any changes are required to enhance the overall effectiveness of the study effort. Work scope re-assessment will occur at the following points:

1. Prior to Level 2 Analysis of Phase 2 Measures (Task 6.3 - Level 2 Screening Analysis)

2. Prior to Level 3 Analysis of Phase 2 Measures (Task 6.4 - Level 3 Screening Analysis)

**PC Activities:**

- The PC will prepare and provide input/suggestions on possible work scope and budget revisions in coordination with FAA, Massport, and BOS/TAC/CAC.
- The PC will revise its work plan (scope, budget, and schedule) in coordination with the IC. Duration to develop and review each re-assessment is assumed be no more than one month.

**IC Activities:**

- The IC will coordinate with the PC in the revision of the project work scope to accommodate unforeseen project requirements.
- The IC will subsequently revise its own work scope and budgetary allocations in accordance with the modifications made to the PC work scope and the needs of the CAC.

**FAA/Massport:**

- Prior to changes to the consultant contracts, the FAA in coordination with Massport must approve the changes.

# 2 PUBLIC COORDINATION/INVOLVEMENT

This task will focus on the dissemination and gathering of information from the general public, the CAC, and other organizations regarding the Boston Logan Airport Noise Study. This important aspect of the project will be conducted throughout the study process with increased activity associated with key milestones. The FAA will be responsible for outreach to communities represented by the CAC and for other communities within the project study area.

## 2.1 Develop Decision Process/Communications Protocol

A decision process/communications protocol will be developed at the start of Phase 2 in conjunction with the CAC. It will outline the overall outreach strategy for Phase 2 and will address specific concerns raised by CAC and BOS/TAC members, including the decision making process, and when material will require decision making by the CAC and/or BOS/TAC, depending on specific tasks. The goal of the project is for the FAA, Massport and CAC to work jointly to identify and assess the enhancement of existing and/or develop new noise abatement measures applicable to aircraft overflights which do not diminish safety and efficiency, and/or cause adverse impacts to other communities. A scope re-assessment for this task may be necessary after the protocol is developed.

This process will be designed to foster informed consent within the CAC and the wider community to reduce noise impacts of Boston Logan Airport. Essential elements of this process that will be clearly defined in this task include:

- A clearly defined set of objectives.
- Identify milestones that require decisions by the full CAC.
- A schedule of particular tasks, desired outcomes and the specific meetings and other efforts needed to accomplish those outcomes.
- Determine the kinds of material necessary to make informed decisions including the technical, political, and community benefits and tradeoffs associated with the options presented, and how far in advance of a meeting these must be made available.
- A process and meeting design that allows the CAC to work through the measures and their pros and cons and make decisions about which course of action to pursue.
- An integration of the CAC decision making in conjunction with the BOS/TAC.
- Develop a process and materials with which to engage community stakeholders and members of the public.

These elements together will allow the CAC, the FAA, and Massport to engage in a purposeful, well-informed, and highly structured process that will allow for and incorporate a wide range of perspectives, and ultimately will have the potential to identify enhancements to existing and/or development of new noise abatement measures applicable to aircraft overflights which do not diminish safety and efficiency, and/or cause adverse impacts to other communities

**PC Activities:**

- Prepare draft BOS/TAC decision process/communications protocol for consideration by FAA, Massport, and BOS/TAC/CAC. TASK COMPLETED
- Review draft CAC decision process/communications protocol prepared by IC for consideration by the FAA, Massport, and BOS/TAC/CAC.
- Finalize decision process/communications protocol. TASK COMPLETED

**IC Activities:**

- Prepare a draft CAC decision process/communications protocol for consideration by the full BOS/TAC/CAC. TASK DELAYED IN CAC
- Consult with CAC membership regarding optional approaches to key outreach issues and concerns. TASK COMPLETED
- Peer review PC efforts in preparation of overall BOS/TAC decision process/communications protocol and communicate results to CAC. TASK COMPLETED

## 2.2 CAC Coordination

The scope of work of Task 2.2 is hereby reassessed.

This task covers the consultants' coordination and assistance to the CAC in addition to the bi-weekly meetings discussed in Task 1.2.

The number of CAC meetings requiring PC attendance (also termed "face to face" meetings) is reduced to two (2) meetings over the entire course of Phase 2 work, compared with five (5) meetings originally scoped.

**PC Activities:**

- Up to two (2) face to face periodic meetings with the CAC to discuss project issues or attend CAC meetings. For budgetary purposes, one (1) face to face CAC meeting remains to be scheduled towards the end of Phase 2 work. The first of two meetings was replaced by three mini-summit teleconference meetings on February 25, 2009, March 16, 2009 and April 14, 2009. Coordination and attendance for the second meeting is assumed to require 24 hours for preparation and attendance for each of two PC representatives.
- The PC will provide the project lead and a noise expert (as required) at all meetings. Note that the FAA will provide an air traffic and procedure design expert, as required, to attend the meetings.

**IC Activities:**

- Allow for meetings with the CAC prior to every BOS/TAC/CAC meeting. For those meetings held in Boston, meeting opportunities will be provided for the evening prior to the BOS/TAC/CAC meetings, and for those meetings held by teleconference, teleconference opportunities will be provided. Each pre-meeting opportunity will be intended to assist the CAC membership in understanding of the materials under consideration. This coordination assumes 16 hours of meeting and preparation by not more than three IC team members for each CAC meeting. For budgetary purposes assume 4 teleconferences and 4 on-site meetings during the remainder of this scope.
- Gather in meetings or teleconferences as needed with the general CAC membership to discuss project issues and status. This coordination assumes the participation of one to three members of the IC team at each meeting. The IC or CAC leadership will be responsible for the location of meeting spaces during the course of the project. (Assume two meetings and three teleconferences for budgetary purposes through the remainder of the period covered by this scope).
- Meet or teleconference up to 14 times (5 remaining opportunities at the time of this update) during the remaining course of the project, as directed by CAC leadership, with small focus groups of the CAC membership and other public representatives to focus on specific areas of interest where greater understanding of the information is desired. For example, such focus groups of the CAC and other public representatives may include those members with intense interest in the noise modeling process, residents under the 27 departure path, residents under the 33L departure path, residents in communities near the airport most interested in ground noise dispersion and mitigation, etc. The CAC coordination will include discussion and review of the current PRAS (Preferential Runway Advisory System). This review will seek to develop a strategy for addressing the PRAS including but not limited to support for developing a new PRAS and broad understanding of goals and metrics (e.g. relevancy of annual runway use advisory goals, short term persistence use of runways). The IC will develop a short, summary memorandum reviewing the discussion and suggested CAC approach. For budgeting purposes, it is intended that any travel for these focus group meetings will occur during any travel that occurs for periodic CAC meetings (assume three meetings and two teleconferences).
- Conduct periodic teleconference consultations with CAC leadership to discuss project related issues (assume one hour monthly by IC project manager).
- Notices/agendas should be sent electronically via e-mail distribution lists.

## 2.3 BOS/TAC/CAC Meetings

The scope of work of Task 2.3 is hereby reassessed.

This task covers all primary meetings of the BOS/TAC/CAC. Sub-committee meetings (should they be held) will be covered under specific technical tasks described later in the work scope. It is anticipated that the BOS/TAC/CAC will hold up to ten (10) face-to-face meetings over the anticipated 48-month timeframe for the entire course of Phase 2. For budgetary purposes, the face-to-face meetings will not last more than four (4) hours and will be held at a location to be determined. (As of the date of this scope of work reassessment, six out of ten face-to-face meetings have been held).

It is assumed that day face-to-face meetings will be held at the Massport or Volpe conference facilities. Meetings will be held as needed and will be scheduled for no more than six hours. All evening meetings will be facilitated as directed by FAA.

In addition to up to ten face-to-face meetings, the BOS/TAC/CAC will use telemeetings (i.e. conferences calls with audio and video telecommunications). It is anticipated that up to six (6) telemeetings will take place in between face-to-face meetings, as needed. The telemeetings will not last more than two hours. The purpose of holding telemeetings is to ensure that the project is moving forward which would be difficult if only 4-hour face-to-face meetings were held.

**PC Activities:**

- The PC will prepare a draft agenda for review by the BOS/TAC/CAC for each meeting or teleconference and incorporate comments as appropriate. Presentation or discussion material will be prepared as part of separate technical tasks for specific issues that will be discussed at each meeting.
- Following each meeting the PC will review draft meeting notes prepared by the FAA, notes that capture the primary issues discussed and proposed follow-up actions. These notes are not intended to be minutes of every issue discussed or specific comments made by members of the BOS/TAC/CAC. The meeting notes will be distributed to the BOS/TAC/CAC and IC for review and comment by the FAA.
- The PC will provide the project lead and a noise expert at all meetings, as required. Note that the FAA will provide an air traffic and procedure design expert, as required, to attend the meetings.

**IC Activities:**

- The IC will participate in each BOS/TAC/CAC meeting or teleconference to assist the CAC in understanding the issues discussed and to provide peer review of technical presentations made by the PC during the meetings.
- IC will review PC meeting notes.

## 2.4 Elected Representative Meetings

The scope of work of Task 2.4 is hereby reassessed.

Elected Representative meetings will be held at two points during the Phase 2 process. The first meeting will be held to present the findings of Phase 1, describe the intent and goals of Phase 2, and present the measures to be examined in Phase 2. Input on Phase 2 measures and areas of concern will be solicited during this meeting. The purpose of this meeting is to provide elected officials an update on the project and give them an opportunity to comment on the measures proposed to be analyzed and to identify any additional measures to be examined in Phase 2. A second intent is to provide the representatives with enough information so that they can adequately address questions from their constituents. (Note: the first meeting out of 2 was held on May 30, 2008).

A second meeting is provided for similar purposes to deliver information about Phase 2 activities to the elected representatives. The FAA will provide the logistical support for setting up the meeting, including invitation letters, space, equipment, handouts and post-meeting material

(meeting notes, etc.). FAA will provide staffing (sign-in table). FAA will take the lead in receiving comments and drafting responses. By transferring these responsibilities to the FAA, additional budget is available to fund existing tasks that require additional funds due to the extended duration of this project.

The second meeting would be held at the conclusion of the Phase 2 technical analyses to present findings and gain feedback on the measures to be recommended for implementation and eventual assessment in the FAA's environmental document.

Each elected representative meeting will be held in one (1) location, as suggested by the CAC and approved by the FAA.

**PC Activities:**

- Working from material prepared in the technical process, prepare a draft PowerPoint presentation and handouts.
- Provide up to two professional staff for the meetings. Assume attendance by the project manager and appropriate technical lead.
- Comments received during the meetings will be reviewed and cataloged. The PC will assist FAA in reviewing comments.

**IC Activities:**

- Review and comment on the behalf of CAC on materials prepared for BOS/TAC/CAC review for each meeting.
- Provide appropriate staff to participate in the meeting on behalf of the CAC. Assume attendance by the Independent Consultant Project Manager.
- Prepare and coordinate IC and CAC comments regarding presentations of material made at each meeting.

## 2.5 Web-Based Periodic Community Updates

The scope of work of Task 2.5 is hereby reassessed.

This task will be used to provide the public with periodic updates regarding the study. Information will be similar to materials provided to the BOS/TAC and CAC during the Study but will be tailored for the public website. There will be information updates throughout Phase 2. The web site will be reviewed monthly to determine if additional material should be posted. Results of Phase 1, appropriate public information, and other material deemed appropriate will be posted to the site. All material posted on project web sites will be compliant with Section 508 of the Rehabilitation Act of 1973, as amended.

**PC Activities:**

- Develop website materials, additional pages, necessary graphics and reports.
- Provide site production and progress reviews.
- Enhance web site functionality (one full design update funded).
- Provide monthly website updates.
- Coordinate with IC.

**IC Activities:**

- Review and comment on website materials.
- Coordinate CAC comments.

## 2.6 Media Outreach

The scope of work of Task 2.6 is hereby reassessed.

In addition to the outreach described above, the FAA will prepare and disseminate material to the media and through other outreach mechanisms to maximize the overall public outreach for this program. Press releases will be prepared and sent to the various major and local media (print, radio, and television) within the study area at the beginning of this study, and at up to three key milestones during Phase 2. These press releases will be concise and written in plain English, so that people can understand them. Similar material will be sent to local, state and federal elected officials in the study area. This task will be further defined as part of Task 2.1, Develop Communications/Outreach Protocol. FAA will conduct most of the activities related to this task, which will free up funds for tasks that involve a longer duration.

**PC Activities:**

- As requested, develop materials related to the technical studies and coordinate with Massport/FAA for distribution.
- Review FAA letters and media releases as requested.

**IC Activities:**

- Coordinate review with CAC membership familiar with specific issues covered in the press releases for public sensitivities.
- Review and comment on FAA public release material prior to release, as well as efforts on media distribution and follow up.

# 3 PHASE 1 IMPLEMENTATION

After conclusion of the Phase 1 analysis, the recommended early implementation measures (those that are categorically excluded from additional environmental evaluation) will be implemented. While the Phase 1 measures analysis predicted the impacts of the proposed measures, actual results will not be known until the measures proceed through the FAA process and are implemented. Under an adaptive management model, two additional steps will be conducted to ensure that the intended result(s) actually occur, as described below. For purposes of this scope, it is assumed that PC services for this task would be available for up to a 36-month period following the issuance of the Phase 1 CATEX/ROD. It is assumed that conventional procedures that overlay the RNAV procedures will be implemented in advance of the FAA's approval of the RNAV procedures.

## 3.1 Implementation Monitoring Assistance

The scope of work of Task 3.1 is hereby reassessed to include support related to post-implementation monitoring assistance to extend beyond the end of the currently scoped task. See details under "PC Activities" below.

Prior to implementation of the early implementation measures, the PC and IC will aid, when requested, the FAA in procedure development.

**PC Activities:**

- Attend meetings as necessary during the implementation process; assume attendance at two meetings. (refer to Scope Change SC-3) - TASK COMPLETED
- Assist in reviewing proposed adjustments, if any are proposed by FAA during procedure development.
- Provide background information to FAA as needed regarding RNAV designs developed in Phase 1. - TASK COMPLETED
- Preparation of Charted Visual Flight Procedure Request Package. (refer to Scope Change SC-3) - TASK COMPLETED
- Coordinate efforts and produce one (1) additional graphics package of procedures for an additional amendment to procedures.

**IC Activities:**

- Attend one meetings as appropriate during the implementation process. TASK COMPLETED
- Coordinate with the PC to assist the FAA in reviewing proposed adjustments.
- Communicate proposed adjustments to the CAC and coordinate public comment regarding adjustments to procedures for which environmental approval has been provided.

## 3.2 Post-Implementation Assessment

The IC, with some PC review, will assist CAC in determining the monitoring metrics and reports required to determine if the early implementation measures are being implemented as planned, and assess actual data to determine if the intended results of the measures are being achieved.

Massport has an aircraft operations and noise monitoring system in place that was upgraded and enhanced at the end of 2006. This system may be used to monitor implementation of the approved actions.

After both the conventional and RNAV elements of the Phase 1 measures are implemented and at least two months of use have passed, supplemental measurements for three separate 24-hour periods will be conducted by the IC at three sites within the south shore communities (Cohasset, Hull and Scituate) that were measured early during Phase 2. It is anticipated that measurements will be conducted during the late Spring 2011 time frame to provide comparability to previous noise measurements and that logs of activity will be recorded by on-site observers for a period of 8 hours at each location. Efforts will be made to capture traffic days when departures on Runways 33L or 27 are not being used. Additional costs for monitoring and correlation assessments will be drawn from under utilized budget for Task 3.1.

After the early implementation measures have been implemented, the IC will review the results of the monitoring and operational compliance reports generated by Massport (requires agreement from Massport) and by supplemental monitoring conducted by IC, if any, to determine whether the intended results of the approved actions are being achieved. If the intended results are not being achieved, the IC, with PC review of only operational data, will analyze the procedures and develop recommendations to BOS/TAC/CAC for possible adjustments to the procedures that would achieve the intended results. FAA will review IC proposed adjustments related to actual procedures after implementation based on long-term operational and flight track data only that depicts how flights are operating compared to the proposed federal action (e.g. procedure changes) as described in the October 2007 Phase 1 Record of Decision (ROD).

**PC Activities:**

- Review IC findings and recommendation related only to their flight operational data analysis and provide feedback as it relates to consistency with the October 2007 Phase 1 ROD federal action. .

**IC Activities:**

- Conduct attended single-event noise measurements for three 24-hour periods at previously measured sites on the south shore.
- Compare single event noise levels measured with those projected by the Integrated Noise Model and by Phase 1 planning.
- Assist the CAC in determining the metrics and reports needed to monitor the implementation of approved actions and coordinate with Massport
- Coordinate with Massport to calculate and review the results of the flight track monitoring data provided from Massport.
- Identify procedures that may require further enhancements and provide recommendations to BOS/TAC/CAC.

# 4 STUDY AREA DEFINITION

The study area for the project defined in Phase 1 will be used in Phase 2. For purposes of identifying the communities in the study, the study area will be defined as the area within a 20-mile lateral radius of the BOS TRACON radar. Guidance contained in FAA Order 1050.1E, states that noise impacts should be determined from the ground to 10,000 feet AGL for aircraft departures and from the ground to 7,000 feet AGL for aircraft arrivals. However, in order to be consistent with Phase 1 evaluations, the study area will incorporate BOS arrivals and departures up to 14,000 feet AGL. For noise modeling purposes to ensure the communities are captured, the modeling area will be defined as the area within a 25-nautical mile radius of the Airport that will incorporate BOS arrivals and departures up to 15,000 feet MSL.

# 5 DEVELOP EXISTING CONDITIONS

Existing conditions aircraft noise exposure and land use conditions at and around Boston Logan International Airport will be updated, documented, and modeled to provide a basis against which the noise abatement measures can be compared by CAC. The information gathered during Phase 1 of the study will need to be updated or verified to reflect an existing conditions year of 2005.

## 5.1 GIS Database

Existing data and map sources will be used to refine and supplement the GIS database developed during Phase 1 of the study. All GIS data will be obtained from the Massachusetts Geographic Information System (MassGIS) as of January 2007. This scope of work does not include any field surveys.

### 5.1.1 Update Land Use Base Map

The land use base map developed and utilized in Phase 1 will be updated from MassGIS data. The land use map will be used to identify noise sensitive areas surrounding the airport.

**PC Activities:**

- Obtain land use data for the study area from MassGIS. - TASK COMPLETED
- Identify noise sensitive areas surrounding the airport.

**IC Activities:**

- Review periodic modifications by PC to land use data for the study area from MassGIS.

### 5.1.2 Update Socioeconomic Data

Socioeconomic data for the study area will be reviewed to determine if more recent (as of January 2007) data is available from MassGIS. If updated socioeconomic data is available, it will be incorporated into the GIS database for the project. The socioeconomic data will be used to determine potential impacts to residents, minority populations, and low-income populations from the noise abatement measures.

**PC Activities:**

- Update project GIS database for the study area if more recent socioeconomic data from MassGIS is available. - TASK COMPLETED

**IC Activities:**

- Review updates to project GIS database for the study area prepared by PC.

### 5.1.3 Update Natural & Cultural Resources Data

Natural and cultural resources data for the study area will be reviewed to determine if more recent data (as of January 2007) is available from MassGIS. If updated data is available, it will be incorporated into the GIS database for the project. The natural and cultural resources data

will be used to determine potential impacts to Department of Transportation (DOT) Act Section 4(f)/303(c) and historic properties from the noise abatement measures. In addition, coordination with federal, state, and local resource agencies will be conducted to determine if other eligible DOT Section 4(f)/303(c) properties exist within the study area and determine existing and future uses of the DOT Section 4(f)/303(c) and historic properties.

**PC Activities:**

- Update project GIS database for the study area if more recent natural and cultural resources data from MassGIS is available. - TASK COMPLETED
- Assist FAA in coordination with federal, state, and local resource agencies to determine existing and planned uses of DOT Section 4(f)/303(c) and historic properties.

**IC Activities:**

- Review updates of project GIS database for the study area prepared by PC.

## 5.2 Fast-time Air Traffic Simulation

Fast-time air traffic simulation will provide input data for noise modeling of ground movement. The Total Airspace and Airport Modeler (TAAM) will be used to simulate air traffic at Boston Logan International Airport. TAAM has been effectively used in support of recent Final Environmental Impact Statements at Chicago O'Hare International Airport and Philadelphia International Airport and for the Draft Environmental Impact Statement on the New York, New Jersey, and Philadelphia Metropolitan Airspace Redesign Project.

The TAAM and ground movement simulations of Boston Logan International Airport, prepared for the Logan International Airport, Additional Taxiway Evaluation Report, and the data contained within those simulations will be utilized to the extent possible.

### 5.2.1 Model Verification

The purpose of model verification is to ensure that the simulation reasonably reflects the actual operation of the airfield/airspace system as characterized by key operating statistics. The verification involves an iterative process of (1) comparing model outputs to actual measured data, (2) visually verifying that the model is routing traffic appropriately, (3) making refinements to the model inputs, and (4) rerunning the model until the outputs approximate the measured data and operational characteristics. Inputs to the model would be coordinated with the noise modeling team and FAA Air Traffic Control (ATC) personnel. Results of the model calibration would be reviewed and approved by FAA. The TAAM model of Boston Logan International Airport, developed for the additional taxiway study will be obtained and used, to the extent practicable, in this study. The PC will review the model and airspace structure contained within the model to validate that arrival and departure routes, SIDS, and STARS are included in the model.

Two conditions would be modeled and correlated. One would be the configuration most frequently used in Visual Meteorological Conditions (VMC). A date when this configuration was operating in 2005 will be identified; operational and schedule data from that date will be

collected and then input into the model. Results will be compared with the actual operating statistics for that date and the model will be adjusted accordingly.

The other condition would be a configuration in Instrument Meteorological Conditions (IMC). A date when this configuration was operating in 2005 will be identified; operational and schedule data from that date will be collected and then input into the model. Results will be compared with the actual operating statistics for that date and the model will be adjusted accordingly.

**PC Activities:**

- Develop two-modeled configurations, one for VMC and one for IMC, for specific dates; test, compare, and calibrate model. - TASK COMPLETED
- Validate that developed routes, SIDS, and STARS are included in the model. - TASK COMPLETED
- Conduct independent calibration of TAAM model (refer to Scope Change SC-2) - TASK COMPLETED
- Coordinate calibration results with IC. - TASK COMPLETED

**IC Activities:**

- Review TAAM model input and results of the calibration. TASK COMPLETED
- Coordinate with CAC. TASK COMPLETED

### 5.2.2 Development of Existing Conditions Schedule

An existing conditions (2005) schedule will need to be developed for use in the modeling efforts. The PC will obtain the most recent operational data for the existing conditions year (2005). Using these and passenger airline schedules found within the Official Airline Guide (OAG), the PC will develop an existing conditions schedule representing an average day during the peak month (PMAD) of 2005. The schedule will include information on air service provider, flights (i.e. arrival, departure, or touch-and-go), fleet mix, operator type (i.e. air cargo carrier, passenger air carrier, general aviation, or military), origin-destination pair, and time of operation in adequate detail for use within the simulation.

Arriving and departing aircraft will be matched and assigned to specific terminals, but not specific gates (consistent with the FAA centerfield taxiway analysis).

**PC Activities:**

- Develop existing conditions schedule and match aircraft to specific terminals (groups of gates). - TASK COMPLETED
- Coordinate schedule with IC. - TASK COMPLETED

**IC Activities:**

- Review existing conditions flight schedule. TASK COMPLETED
- Coordinate with CAC. TASK COMPLETED

### 5.2.3 Existing Conditions Modeling

Six major representative configurations will be simulated using TAAM. The six configurations simulated will involve the existing airfield layout as of 2005, and are identified in the Phase 1 air traffic baseline paper. These simulations will produce the following in support of the taxiway movement noise analysis:

- Operational data produced from the schedules of aviation activity processed by the simulation. This data shall include but not be limited to, out-off/on-in (aircraft pushback from gate area to departure from runway/aircraft touchdown on runway to arrival at gate) times at Boston Logan International Airport, departure or arrival airspace routes, aircraft type and arrival or departure runway assignment.
- Global Flight Data Record (GFDR) files that will provide data including but not limited to:
    - Airspeed
    - Heading
    - Altitude
    - Track across ground
- Data on taxiway utilization including, but not limited to, aircraft type, taxiway link (location) and total travel time on the taxiway link for use in ground noise modeling.

**PC Activities:**

- Model existing conditions for six operating configurations and develop an annualized condition for 2005. - TASK COMPLETED
- Coordinate simulation results with IC. - TASK COMPLETED

**IC Activities:**

- Coordinate with PC on the development of simulation models. - TASK COMPLETED
- Review existing conditions simulation input and results. - TASK COMPLETED
- Coordinate with CAC.

## 5.3 Existing Conditions Noise

Existing conditions noise modeling will be required to establish average annual day existing conditions at Boston Logan International Airport. The existing conditions year of 2005 will be developed and modeled, which will serve as the baseline for developing the future Baseline with Phase 1 Noise Study Alternatives noise conditions at the Airport (use of flight tracks and utilization where applicable).

The intent of this task is to develop an aircraft inflight noise environment that describes the 2005 noise environment within the constraints of the latest-available industry research, data, and accepted noise and aircraft performance modeling tools available. The existing conditions will be developed with the goal of providing an analysis tool that captures the effects of real-world flight conditions (e.g., departure hold-downs and extended downwind approaches, among others) for an average annual condition at the Airport. The FAA's Integrated Noise Model (INM) 7.0a will be used to model all aircraft noise.

Development of the existing conditions noise model will require customizing aircraft profile INM input parameters to model the statistically significant vertical components of the aircraft flows in and out of the Airport. The INM inputs will be developed to best model the average annual day three-dimensional flight trajectories and the performance characteristics of the aircraft experienced at the Airport.

### 5.3.1 Prepare Noise Modeling and Measurement Protocols

The PC will prepare a protocol for developing the existing conditions and future (Task 6) noise model for Boston Logan International Airport and for conducting the noise analysis. The protocol will be developed and submitted to FAA for review and any required approvals of software, input adjustments, or models, prior to conducting the noise modeling effort. During the development process, input and feedback from FAA Airports, FAA ATO, FAA Office of Environment & Energy (AEE), Massport and CAC will be sought. The protocol will address:

- Collection and consolidation of radar data into representative backbone and dispersed flight tracks.
- Collection and consolidation of radar data into representative climb and descent profiles along primary departure and approach corridors.
- Dispersion of operations among backbone and dispersed flight tracks.
- Noise modeling of flight and ground-based activity.
- Supplemental/alternative noise metrics.
- Future Baseline with Phase 1 Noise Study Alternatives and measure noise modeling input development.

The IC will develop a protocol for noise measurements, including metrics, site selection, durations of measurement and intended operational conditions to be measured. In addition, IC will conduct comparative measurements with a selection of Massport's permanent noise monitors in order to establish an acceptable error factor that will be factored in when comparing modeled levels.

The protocols will identify any proposed measures that may need approval from FAA AEE. Protocols for both efforts will discuss verification, validation, and sensitivity assessments for application to modeling efforts. Quality assurance/quality control techniques, including statistical tests of the significance of input/results will be incorporated.

A draft working paper will be prepared for submission to the FAA's AEE to seek any approvals required if the use of previously-unproven models or proposed modifications to the INM noise modeling databases is proposed.

Opportunities for public involvement in the development of the protocols will be provided through two meetings (one meeting and one net meeting) with a focus group of the CAC and other interested parties. Upon completion of the draft protocol working paper, the results will be presented to the CAC for review and comment.

**PC Activities:**

- Develop noise modeling protocol with input from BOS/TAC, FAA Airports, FAA ATO, FAA AEE, Massport, CAC, and IC. - TASK COMPLETED
- Identify noise modeling procedures that may require FAA AEE approval. - TASK COMPLETED
- Prepare documentation for submission to FAA AEE for approval of use of any non-standard INM profile datasets as well as screening tools. - TASK COMPLETED
- Review noise measurement protocols developed by IC. - TASK COMPLETED
- Coordinate protocols with BOS/TAC/CAC, FAA, and IC. - TASK COMPLETED
- Finalize noise modeling and measurement protocol document based on input from FAA, Massport, CAC, and IC. - TASK COMPLETED

**IC Activities:**

- Confer with the PC in the selection of appropriate approaches to modification of INM input files from standard input. - TASK COMPLETED
- Peer review any proposed usage of non-INM modeling and recommend appropriate modifications to protocol to assist the FAA AEE approval decision, if required. - TASK COMPLETED
- Peer review the PC's documentation for submission to the FAA AEE, if required for any and all approvals required prior to noise modeling- TASK COMPLETED.
- Prepare noise measurement protocols for side-by-side measurements at up to 12 of Massport's permanent noise monitoring stations for periods of several hours. - TASK COMPLETED
- Prepare noise measurement protocol for independent measurements with portable equipment at up to 6 sites located at distances beyond the coverage area of the Massport permanent noise monitoring system. - TASK COMPLETED
- Develop protocol to obtain and correlate radar data from FAA or Massport systems to measured noise events collected at permanent and independent portable measurement sites. - TASK COMPLETED
- Prepare a protocol document describing the noise measurement program selection of sites, measurement periods, desired operations for measurement, and intended utility for the PC in the validation of INM-modeled noise levels. - TASK COMPLETED

### 5.3.2 Noise Modeling Input and Methodology

#### 5.3.2.1 Radar Data Collection/Verification

The PC will obtain a 12-month (CY 2005) radar data sample from Massport's airport noise monitoring system, which collects and archives the FAA BOS TRACON radar data. Within a 25-mile radius of the BOS TRACON radar, all radar data for aircraft operating in and out of the study area will be collected. The PC will analyze the data using Wyle's radar analysis software package, Noise Data and Display System (NDADS)[4]. NDADS is an interactive tool for creating flight tracks and flight profiles for further INM analysis. It reads a sample of air traffic control radar data and displays it in a manner that allows the operator to analyze the data statistically and

[4] Per discussions between FAA ATO and FAA AEE, the NDADS tool can be used with no restrictions and without AEE approval.

mathematically create representative tracks and profiles. NDADS will also allow the PC to conduct statistical analyses of airport operations by aircraft type, operation type, runway assignment, and time of day. The IC will be provided an overview and working demonstration of the software during analysis of the radar data, either at the PC's offices in Arlington, Virginia, or via a web interface. Further details are given below which relate to the work effort for each main INM input element.

**PC Activities:**

- Obtain 12 months of radar data from Massport's airport noise monitoring system and incorporate into preprocessing software. - TASK COMPLETED
- Purge incomplete days from radar data. - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED

**IC Activities:**

- Coordinate with PC to review evaluation software and radar data for later analysis. - TASK COMPLETED
- Conduct peer review on PC's analysis of radar data. - TASK COMPLETED

5.3.2.2 Aircraft Operations, Fleet Mix, and Runway Use

The PC will rely on the results of the radar data analysis to derive statistical operational distributions and daily operations by aircraft type, operation type, runway assignments, and time of day. All flight operations data collected from the noise monitoring system will be used in the existing conditions noise modeling. Because this data was utilized by Massport as part of their 2005 EDR noise analysis, PC assumes that the flight datasets are complete, and will not require further runway assignments or null value replacement. If data records have no corresponding operations data, the PC will purge them from the database. Additional information will also be added for each recorded flight, if the database does not have all of the required information. This information includes:

- Aircraft category
- User category
- Aircraft origin and destination
- Runway configuration in use
- Arrival fix
- Departure fix

This information will be necessary in order for the PC to process and identify the appropriate radar tracks that will serve as the basis for INM flight track calculations.

**PC Activities:**

- Obtain 12 months of flight header data that includes arrivals, departures, and origin/destination data and merge with radar data (e.g., ETMS or SDAT STARS data). - TASK COMPLETED
- Merge additional information required for analysis. - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED

**IC Activities:**

- Review PC evaluations- TASK COMPLETED.

5.3.2.3 Analysis of Radar Flight Trajectories

The intent of this task is to sub-divide the composite set of radar trajectories into small operational bundles. A bundle refers to a grouping of radar flight trajectories that have the following common characteristics (listed in order of importance):

1. Arrival or departure
2. Runway use
3. Aircraft type
4. Flow direction
5. Similar aircraft climb and acceleration characteristics and descent profiles.

The PC will develop INM ground tracks to best capture the aircraft flows and dispersion characteristics for both arrival and departure streams. The PC will produce flight tracks for the six BOS runway configurations for 2005 existing conditions and the annual average day configuration. The six common operating conditions will be developed by first sub-dividing the radar trajectories within the 365 days of radar data into the six common operating configurations. This will be accomplished by incorporating the configuration used for each hour as logged by the BOS Tower and collected by Massport. A configuration code will be assigned to each unique flight. Once sub-divided, each configuration subset will be further sub-divided into operational bundles, where the appropriate INM ground tracks and profiles will be developed for each operating configuration. Existing conditions noise will be calculated for each of the six operating configurations, as well as for the annual average day configuration, as described in the following sections.

The INM ground tracks and the associated operations assigned to the tracks will be determined statistically using the 12 months of radar data for 2005. The overall goal is to use NDADS to best simulate a representative horizontal dispersion of aircraft along each of the arrival and departure flows for BOS. This will involve bundling the operations according to various aircraft categories, which may include: Heavy Jet-Air Carrier, Large Jet-Air Carrier, Regional Jet-Air Carrier/Air Taxi, Business Jet-General Aviation, Propeller-Air Taxi, and Propeller-General Aviation. Each bundle will be created using a "gate" in NDADS; a gate is a representation of a window in space through which the aircraft flight tracks pass.

Within each aircraft category, radar tracks will be bundled according to runway. For each runway, the bundle will be further subdivided by visual inspection. Different components of each flow will be grouped, including variations near the runways (such as varying turn radii that result from air traffic decision-making in the sequencing of arriving and departing aircraft) and variations farther from the airfield (such as departures splitting off to different navigation fixes). This exercise will create more bundles of tracks, with each individual bundle representing a smaller number of radar trajectories.

For every bundle of radar tracks, representative average (backbone) flight tracks will be developed. In addition, the altitude profiles will be plotted for each aircraft category for each radar track bundle. Profiles for a given aircraft category may vary between different runways, and may also vary on the same runway, depending on the ground track. Bundles will be further sub-divided to account for vertical dispersion characteristics identified by viewing the radar data. This will be accomplished via the statistical vertical gate analysis stated above. Ground tracks for each bundle will be modeled using the ground track dispersion feature of INM. Profile development is discussed in Task 5.3.2.5.

**PC Activities:**

- Group radar tracks by aircraft category, runway, operation mode, traffic flows, and profiles, subdividing them into appropriate bundles. - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED

**IC Activities:**

- Peer review PC's work in developing radar tracks assumptions and results/by aircraft category and runway, subdividing them into bundles, and developing representative average flight tracks for each bundle. - TASK COMPLETED
- Coordinate results with PC and CAC. - TASK COMPLETED

5.3.2.4 INM Flight Track Calculation

The PC will further utilize the NDADS software to create ground tracks from each bundle of radar tracks. Each saved bundle will be handled separately. The bundle will be loaded into NDADS, and a series of closely-spaced gates will be drawn across the bundle of tracks, beginning at the runways and ending at the end of the radar tracks. NDADS will be used to compute the mean and standard deviation of ground tracks developed for each bundle at each gate. The user will then interactively draw a series of straight and curved vector segments through the one-standard-deviation indicator at each gate. In this manner a statistically meaningful "nominal" ground track is created. NDADS will save the nominal ground track and all of the statistical data computed at each gate.

Each nominal ground track will be converted to a point track and loaded into INM as the backbone flight track. NDADS statistical data will be used to specify the sub-track spacing and distribution in INM. The INM dispersion modeling will include all operations within the bundle and across the full width of the gate.

**PC Activities:**

- For each bundle, create a nominal ground track and convert them to point tracks for INM. - TASK COMPLETED
- For each bundle, calculate the horizontal dispersion and model it within INM. - TASK COMPLETED
- Perform statistical analyses for quality assurance (QA)/quality control (QC). - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED

**IC Activities:**

- Review PC's backbone and dispersed flight track definitions for INM with NDADS by application of a comparable methodology for flight track definition used to prepare data for use in the FAA NIRS model. A random sampling of PC-developed tracks will be evaluated to determine the statistical validity of the proposed backbone and dispersed flight tracks. - TASK COMPLETED
- Coordinate results with PC and CAC – TASK COMPLETED

5.3.2.5 INM Flight Profile Development

A flight profile defines the distance, altitude, speed, and thrust settings at many locations along a modeled flight path. The INM contains "standard" departure and approach profiles for every aircraft type in the INM database. The "standard" profiles have been developed to ensure valid three-dimensional flight trajectories that correlate well with actual speeds and thrust settings for each aircraft. In addition, the user may define "custom" flight profiles; however, the user must first determine the correct inputs for the INM, based on actual aircraft operations, and receive FAA AEE approval to use the customized data before applying them to INM modeling.

The first step in the process is to conduct an analysis of the radar flight trajectories (refer to Section 5.3.2.3) to determine – based on the effects of how aircraft are actually flown and how the air traffic flows in and out of the Airport are controlled. Using the bundled tracks, PC will calculate an average altitude profile. The average flight profiles will be based on the average values of all trajectories within each bundle, specific to an aircraft category, that occur within each bundle. The PC has developed several utilities to help automate portions of this process.

Where possible, the PC will develop evaluation criteria, with input and review by the IC, to determine the appropriateness of using standard profiles in the existing conditions model in lieu of calculating a customized profile for identified bundles. Criteria may include unrestricted climb procedures. Wherever appropriate the standard INM profiles will be utilized. However, the PC anticipates that some operations cannot be suitably modeled using standard INM profiles and will require development of custom flight profiles.

If customized flight profiles are needed, the PC proposes to use the FAA's Noise Integrated Routing System (NIRS 7.0a) Flight Segment Generator (FSG) model using existing INM version 7.0a procedure step profile data. The FSG is an FAA-approved process that allows for the development of approved customized flight profiles for each INM aircraft type. The average profile calculated via the bundled radar data will be inputted into FSG. FSG will utilize the available INM procedure steps for each unique aircraft and construct a customized profile along the average profile. The end result is a customized profile for a specific aircraft type that operates along the average profile path. For INM aircraft that do not have procedure step data, the PC, with IC input, will determine the appropriate INM aircraft substitution that will provide similar acoustical results, and have been used in previous FAA EIS studies. Some substitutions may need to be pre-approved by FAA AEE. The calculated profiles will then be converted to INM input format in order to conduct noise calculations. (note: FAA AEE approved the use of NIRS FSG to customize profiles)

**PC Activities:**

- Obtain FAA AEE approval for use of Dicerno™ to reallocate operations and INM to calculate noise screening results for Level 2 noise screening and aircraft substitutions. - TASK COMPLETED
- Calculate average flight profiles for each flight trajectory bundle by aircraft category. - TASK COMPLETED
- Calculate INM procedure step profiles via NIRS FSG. - TASK COMPLETED
- Convert FSG results into INM input - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED

**IC Activities:**

- Cooperate with the PC in the development of an FAA/AEE approved methodology to generate user-defined profiles, if necessary, to accommodate BOS-specific variations from INM default climb and descent profiles. - TASK COMPLETED
- Peer review PC-developed INM flight profiles for each aircraft type on each INM flight track. - TASK COMPLETED
- Coordinate review findings with PC, CAC, and BOS/TAC. - TASK COMPLETED

5.3.2.6 INM Input File Development

Data will be formatted for input into version 7.0a of FAA's Integrated Noise Model (INM). A database will be compiled which includes the number of day and night operations for every combination of aircraft type, operation type, flight profile, stage length, runway, and track name, for each of the six air traffic configurations and the annual average operational condition. The database will be compiled based on the results of the radar analysis detailed above in Task 5.3.2.1.

Wyle's Dicerno™ software will be used to conduct supplemental metric analyses.[5] Input for Dicerno™ will rely on the INM existing conditions. The IC will be provided with INM database files. The CAC will be provided an overview and working demonstration of the software during analysis of the radar data, either at the PC's offices in Arlington, Virginia, or via a web interface. IC will be provided with input and output of interest that is identified after the demonstration for each scenario that is analyzed.

**PC Activities:**

- Create INM input files. - TASK COMPLETED
- Provide a full copy of all INM directories and cases and Dicerno™ output to the IC for review. - TASK COMPLETED
- Setup Dicerno study and input. - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED

[5] The use of Dicerno™ for developing input files for INM and to produce data associated with the Number of Events Above (NA) does not require FAA AEE approval per discussions between FAA ATO and FAA.

**IC Activities:**

- Peer review all aspects of the PC's INM input and output files. - TASK COMPLETED
- Coordinate review results with PC, CAC, and BOS/TAC. - TASK COMPLETED

5.3.2.7 Noise Measurements

A supplemental noise measurement program to provide a comparison between modeled INM levels and those measured in the field will be conducted. The intention of this task is to determine if the INM modeled noise levels provide a reasonable representation of the sample measurements at specific locations, with the understanding that the INM input and output represent an average annual day condition in 2005 and are not directly linked to the specific operations that occurred during the measurement period. The measurement data will assist in verifying that the input generated in previous tasks provides a reasonable representation of typical operational patterns within the study area.

This task includes both remote and side-by-side (with permanent monitors) monitoring. The remote measurements are intended to provide supplemental data to validate INM input developed in the INM modeling process for areas beyond three miles from the Airport. Where noise measurements significantly deviate from modeled noise levels, anomalies to the data will first be sought in the measurement data, and if not discovered, the operational and location input to the INM (developed in Tasks 5.3.2.3 through 5.3.2.5) will be checked to assure that modeling assumptions and distributions are reasonable and statistically correct before proceeding to alternative modeling. The technical criteria and limitations associated with this analysis will be determined via the noise protocol developed in Task 5.3.1. The PC and IC, based upon the noise protocol, will jointly determine the appropriate adjustments, if necessary, based upon comparative results. Adjustments will be made by the PC and will be limited to the inputs developed in Tasks 5.3.2.3 through 5.3.2.5. This may involve radar track bundling verification for a specific set of flight tracks and/or representative profiles and/or number of sub-tracks associated with each representative INM track. Any adjustments made will require INM recalculation. This effort is assumed as part of Tasks 5.3.2.3 through 5.3.2.5 related to input development iterations and adjustments.

Up to six supplemental field sites will be selected to ascertain aircraft noise levels at locations under current flight paths, but beyond the capture area of the current noise monitoring equipment. Noise measurement methodology and locations will be determined during the development of the noise protocol. At each site, measurements will be collected for five consecutive 24-hour days. Each supplemental measurement site will be attended for five 8-hour daytime periods during which aircraft overflight events will be logged by an observer. Noise level data will be collected in A-weighted 1-second intervals.

Also, in order to assess differences between permanent monitor and INM values, side-by-side measurements will be conducted at no more than 12 existing permanent monitoring sites for periods of four hours each. Sites selected for this task will be distributed throughout the area and selected to represent both within and outside three (3) miles from the Airport. Locations will be determined during development of the noise protocol. This analysis will provide a comparison with the range of aircraft single event noise levels registered by the Airport's noise monitoring

system. The information gathered from this assessment will provide a better understanding of modeled and measured differences. The means in which the comparison will be conducted will be consistent with the protocol developed in Task 5.3.1. If measured level variance does not account for the differences between measured and modeled values, INM inputs that are candidates for adjustment as identified in the noise protocol will be reviewed. The adjustment limitations associated with the remote sites are the same for the side-by-side measurement comparisons.

Massport will provide noise measurement data collected at permanent monitoring sites for the same periods as supplemental and side-by-side measurements are conducted. In addition, all settings associated with the selected permanent monitors will be provided. Electronic time stamped radar data with flight numbers will be provided by Massport from its noise and operations monitoring system for the supplemental and side-by-side measurement period.

Results will be documented for delivery to the CAC and PC.

**PC Activities:**

- Review proposed locations and protocol for supplemental and side-by-side noise measurement sites (see Task 5.3.1). - TASK COMPLETED
- Review preliminary noise measurement results. - TASK COMPLETED
- Coordinate findings regarding noise measurement results with IC and CAC. - TASK COMPLETED
- Review final noise measurement program documentation and results. - TASK COMPLETED
- Determine, in conjunction with the IC and in conformance with the Noise Modeling and Measurement Protocol developed in Task 5.3.1, if any adjustments to the existing conditions noise model input (flight track locations, operation distributions, profile assignments) are warranted. Adjustment efforts will be conducted under the appropriate task(s). - TASK COMPLETED

**IC Activities:**

- Conduct supplemental noise measurement program in accordance with the protocol developed under Task 5.3.1. - TASK COMPLETED
- Conduct comparative analysis between radar data and measured noise levels to determine correlated aircraft noise source information. - TASK COMPLETED
- Determine confirmed potential anomalies associated with permanent sites. - TASK COMPLETED
- Develop draft measurement report and provide to CAC and PC for review. - TASK COMPLETED
- Document preliminary results and suggestions for delivery to PC for use in INM input file development, as appropriate. - TASK COMPLETED
- Upon completion of Task 5.3.2 and 5.3.3, compare measured noise levels with modeled noise level results. - TASK COMPLETED
- Coordinate review of final results with PC and CAC. - TASK COMPLETED

### 5.3.3 INM DNL 75, 70, 65, 60 and 55 dB Contours

Noise contours will be generated using Version 7.0a of INM at DNL values of 75, 70, 65, 60 dB and 55 dB, and overlaid on local vicinity maps. DNL values below 55 dB will use grid point analysis. The contour grid will be 50 nautical miles wide and 50 nautical miles high, centered on the airfield. This will ensure a large enough area to cover the entire radar coverage area and all surrounding communities. The grid spacing will be 500 feet.

**PC Activities:**

- Generate DNL 75, 70, 65, 60 and 55 dB noise contours. - TASK COMPLETED
- Provide all INM output files to the IC for review. - TASK COMPLETED
- Coordinate results with IC and BOS/TAC/CAC.

**IC Activities:**

- Review computed DNL 75, 70, 65, 60 and 55 dB noise contours for consistency with input assumptions and files. - TASK COMPLETED
- Coordinate findings with PC, CAC, and BOS/TAC. – TASK COMPLETED

### 5.3.4 Alternative Noise Metrics

The PC will run the INM and generate appropriate noise metrics, analyses, graphics, and maps, with input and oversight from the IC and BOS/TAC/CAC. The alternative noise metrics identified thus far in meetings held during Phase 1 include (the referenced metrics are defined below): (1) Number of Events Above (NA) and Time Above (TA) analyses above a series of thresholds (to be determined) and presented in tabular format; (2) DNL color gradient maps as well as selected grid points within the study area; (3) NA and TA maps for selected grid points and thresholds; (4) flight corridor maps overlaying radar data on INM flight tracks for various aircraft groupings (e.g., heavy jets and RJs); (5) DL and NL analysis; (6) Lmax values at selected grid points; (7) SEL (and corresponding Sound Exposure, E) values at selected grid points; and (8) aircraft altitude at selected grid points. The use of supplemental noise metrics will be detailed in the noise protocol and will be used to more clearly identify the potential benefits and adverse impacts of each measure evaluated in Phase 2.

Maximum A-Weighted Sound Level, Lmax

A common metric that is used to help in describing a single aircraft noise event is the Maximum Sound Level, or Lmax, which is measured in decibels (dB). For the purposes of describing community or environmental noise, A-weighting is assumed unless otherwise indicated. The Lmax metric is described technically as the highest A-weighted integrated sound level that is measured during a single event in which the sound level values vary with time (e.g., an aircraft over-flight). During an aircraft over-flight, the noise level starts at the ambient or background noise level, rises to the maximum level as the aircraft flies closest to the observer, and returns to the background level as the aircraft recedes into the distance. Lmax indicates the maximum sound level occurring for a fraction of a second. In simplest terms, Lmax is the highest sound level measured during a single noise event and describes the maximum level of a noise event, but does not take into account its duration. In other words, an event with a relatively low Lmax but a longer duration can be just as intrusive as a short duration event with a higher Lmax.

Sound Exposure Level, SEL

SEL is a composite metric that represents both the duration and magnitude (or amplitude) of a time-varying noise event. Two good examples are an aircraft over-flight and a passing truck. The sound levels of individual time-varying events have several main characteristics – the time when the sound level exceeds the lower threshold level, rising to a maximum noise level (Lmax) during the aircraft flyover, then the time during which the sound level decreases to the lower threshold level.

SEL is a logarithmic measure of the total acoustic energy that occurs during the noise event. Mathematically, it is defined as the total acoustic energy of an event from background to background (typically computed from 10 to 20 dB from the event peak), but "normalized" to a one-second time period. The single value represents the level of a constant sound that, in one second, would generate the same acoustic energy as the actual time-varying noise event. In effect, the SEL metric "squeezes" the energy of the entire noise event into one second.

Sound Exposure, E

E (in linear units of $Pa^2$-s) is simply a measure of the total acoustic energy of the entire noise event. Use of this measure will require FAA AEE approval.

Equivalent Sound Level, Leq

The equivalent sound level (Leq) is the most straightforward and flexible time-averaged metric used to describe aircraft noise. It is useful because it enables analysts and planners to evaluate the cumulative effects of a number of noise events on people. The time-averaged sound level is dominated by the louder levels that occur during the averaging period. As a simple example, consider a sound level which is 100 dB and lasts for 30 seconds, followed by a sound level of 50 dB which also lasts for 30 seconds. The time-average sound level over the total 60-second period is 97 dB, not 75 dB.

In essence, Leq represents the average sound level of all events occurring over a specified period of time. The time period is denoted in hours in parentheses. For example Leq(1), Leq(8), and Leq(24) represent the average noise energy over a 1-hour, 8-hour, and 24-hour time period, respectively. For analysis of daytime noise impacts, Leq(16) or Daytime Average Sound Level (DL or LD) is often used, while for analysis of nighttime noise exposure, Leq(8) or Nighttime Average Sound Level (NL or LN), may be used. For analysis of noise impacts at schools, Leq(7) might be used, corresponding to the typical 7-hour school day.

Time Above a Specified Level (TA)

Time-Above a specified level, usually described by the symbol TAL(X), is a measure of the total time or percentage of time that the A-weighted aircraft noise level exceeds a defined sound level threshold (L) over the desired time period (X). TA values can be calculated for a full 24-hour annual average day, the 15-hour daytime and 9-hour nighttime periods, a school day, or any other time period of interest, provided there is enough operational data to define that time period of interest. The time period (X) is usually defined in terms of minutes. As an example, TA65(60) calculated over a 24-hour day describes an area (or single point of interest) where an Lmax of 65 dB is exceeded for 60 minutes over a 24-hour annual average day. TA information will be developed and reported for a range of noise levels.

Number-of-Events Above a Specified Level (NA)
Number-of-Events Above, usually symbolized by NAL(X), is a noise metric that calculates the total number of aircraft events (X) that exceeds a certain sound level threshold (L) during a specified period of time. The sound level threshold can be defined using either the SEL or Lmax metric, and the period of time can be an average 24-hour day, daytime, nighttime, school day, etc., depending on the nature and application of the NA analysis. NA information will be developed and reported for a range of noise levels.

Slant Range Distance/Altitude
Slant Range distance/altitude may also be calculated for expected areas of interest that are consistent with what was evaluated in Phase 1. For budgetary purposes, it is assumed that Slant Range/altitude values will be calculated at no more than 5 grid points (assumed the same number of points assessed in Phase 1).

The PC will use Wyle's Dicerno™ software to compute the Number-of-Events Above (NA)[6] and INM for other supplemental metrics for the defined cases. If supplemental metrics are proposed for the purpose of screening measures, FAA AEE approval will be obtained prior to use.

**PC Activities:**

- Generate noise metrics, analyses, graphics, and maps in coordination with the IC and BOS/TAC/CAC. - TASK COMPLETED
- Provide all INM output files for supplemental metric evaluation to IC for review. - TASK COMPLETED
- Coordinate results with IC and BOS/TAC/CAC.

**IC Activities:**

- Review PC-developed supplemental noise metrics, analyses, graphics, and maps for consistency with INM input assumptions and files. - TASK COMPLETED
- Coordinate findings with PC, CAC, and BOS/TAC.

### 5.3.5 Identify Population and Noise Sensitive Area Impacts

The PC will identify the population and noise-sensitive area impacts, as defined by FAA Order 1050.1E Paragraph 11 (8), within the DNL 75, 70, 65, and 60 dB noise contours. This task will quantify noise exposure in terms of population, households, and land use, as well as identifying minority and low-income populations, Section 4(f) properties, and historic sites. Tables will be developed to summarize the noise exposure estimates for the existing conditions noise model.

For examination of potential noise impacts due to changes in flight tracks, air traffic allocation, and other measures, grid point maps will be developed showing existing conditions noise exposure within the 25-mile radius area surrounding the radar located on the BOS airfield. The grid point maps will, at a minimum, identify political jurisdictional boundaries, existing water features, and shoreline.

[6] FAA AEE has approved the use of Dicerno for NA calculations.

**PC Activities:**

- Identify and document population, households, and noise sensitive land uses affected by aircraft noise within the defined study area.
- Coordinate results with IC and BOS/TAC/CAC.

**IC Activities:**

- Peer review the PC's evaluations of population, households, and noise sensitive land uses affected by aircraft noise within the defined study area.
- Coordinate results with PC, CAC, and BOS/TAC.

### 5.3.6 Ground/Taxiway Noise

A model of the existing ground noise environment at the Airport will be developed for informational purposes. Taxiway routes used in the noise modeling will be provided via the existing conditions TAAM analysis, because there are no known sources of data that collect and archive historic taxiway movement data for the Airport similar to radar data used for the inflight analysis. The only taxiway routes to be modeled will be those that are widely used for each of the six major air traffic configurations. TAAM output results will also be used to provide aircraft queuing (aircraft departures waiting to depart or arrivals waiting to cross active runways) time estimates.

The information provided by the TAAM simulation will be converted into a format accepted by INM. Aircraft noise source data developed for their study will be applied for this existing conditions ground noise model. The output provided will be determined via the noise protocol (Task 5.3.1) It is expected that the protocol will require the combination of the ground noise and inflight noise grids to produce a cumulative existing conditions contour or metric value.

**PC Activities:**

- Setup INM input (tracks and profile) parameters. - TASK COMPLETED
- Develop existing conditions ground/taxiway noise model using sources identified above. - TASK COMPLETED
- Coordinate results with IC. - TASK COMPLETED
- Calculate agree upon output. - TASK COMPLETED

**IC Activities:**

- Peer review existing conditions ground/taxiway noise modeling prepared by PC. TASK COMPLETED
- Coordinate review findings with PC, CAC, and BOS/TAC. – TASK COMPLETED

### 5.3.7 2007 Update

The scope of work of Task 5.3.7 is hereby reassessed.

In conjunction with the scope of work items included in the Level 3 analysis Task 6.4.3 "Noise Modeling" related to existing conditions, the PC will update the 2005 existing conditions aircraft noise analysis to 2007. (Note: this task will begin subsequent to the completion of the 2005

analysis.) PC will use the 2005 INM input developed under Task 5.3 "Existing Conditions Noise" as well as the full year of 2007 operations flight data to update operation levels and fleet mix.

As part of this 2007 Update, in accordance with the methodology proposed by the Independent Consultant (IC), PC will develop INM tracks and customized profiles for Runway 14 departures and Runway 32 arrivals based on 2007 radar data samples provided by Massport. This will be done in accordance with the Noise Modeling Protocol dated December 10, 2007. PC will also update the runway operating configuration use to account for the change in said use since Runway 14/32 was opened. PC will also adjust the definition of runway configurations for those that include the use of Runway 14/32. As noted in task 6.4.3, an additional runway operating configuration will be modeled compared to the 2005 configurations modeled.

**PC Activities:**

- Update runway operating configuration use - TASK COMPLETED
- Update definition of Configuration 1, 2 and 5 with Runways 14/32 - TASK COMPLETED
- Update operations levels and associated fleet mix using 2007 EDR data - TASK COMPLETED
- Update taxiway movement levels based on 2007 operations identified above - TASK COMPLETED
- Finalize INM input files and coordinate with IC during review
- Generate grids for 2007 taxiing operations
- Assess runway configuration use scaling using DicernoTM based on 2006/2007 use
- Run INM and generate grid results. DNL contours and grid point results similar to the 2005 analysis will be calculated.
- Calculate population counts by DNL band (55, 60, 65, 70 and 75 DNL)

**IC Activities:**

- Peer review of 2007 input data prepared by PC.
- Peer review of 2007 updated existing conditions results prepared by PC.

# 6 ALTERNATIVES ANALYSIS - IDENTIFICATION & EVALUATION

The alternatives analysis process will include the identification and evaluation of potential measures that may reduce noise impacts on noise sensitive areas and the communities surrounding Boston Logan International Airport. Measures to be evaluated include ground noise measures, the 12 measures recommended for further evaluation in Phase 1, Phase 1 measures moved to Phase 2, and others that may be added during the public outreach process.

Once the measures to be examined have been identified, they will be evaluated through a three-level screening process. The Level 1 screening analysis would eliminate any measures that diminish safety or present substantial operational hurdles. Measures that successfully meet the Level 1 screening criteria will be evaluated in a Level 2 screening analysis, which will evaluate each measure's ability to provide noticeable reductions in aircraft noise levels on noise sensitive areas and communities within the study area. Measures that successfully meet the Level 3 screening criteria will be evaluated against a Future Baseline with Phase 1 Noise Study Alternatives noise model at a future planning activity level to determine the relative benefit or impact of each measure.

The intent of Task 6 is to provide pertinent information to BOS/TAC and CAC members who will ultimately accept and recommend to Massport a set of measures that will move forward in the FAA's environmental document (to be completed in Phase 3).

The Future Baseline with Phase 1 Noise Study Alternatives will be developed as part of this task, and will include the following assumptions:

- Increased number of operations as determined by the forecasting to be completed in Task 6.4.1.
- Changes to the aircraft fleet mix as determined by the flight schedule to be completed in Task 6.4.1.
- Incorporation of Phase 1 measures (Early Implementation Measures) that are or will be implemented in the future year planning activity level.
- Addition of Runway 14-32 in accordance with the Record of Decision.[7]
- Unrestricted operation of Taxiway November and the Centerfield Taxiway.
- Southwest taxiway improvements.
- An additional runway operating configuration which involves the use of Runway 14/32.

## 6.1 Identify Measures

The purpose of this task is to identify the measures to be evaluated and define them sufficiently such that they can be submitted through a Level 1 screening analysis described in Task 6.2.

### 6.1.1 Measures Recommended for Evaluation from Phase 1

Information about the 12 measures identified in Phase 1 to be further evaluated in Phase 2 (identified and described in the introduction section of this document) will be reviewed in

[7] *Record of Decision, Airside Improvements Planning Project, Logan International Airport, Boston, Massachusetts,* FAA, August 2, 2002.

preparation for analysis. Information not available from FAA for proposed procedures in Phase 1, but needed for Phase 2 analysis will be obtained and reviewed.

**PC Activities:**

- Collect, review, and document any additional operational information from FAA on measures from Phase 1 for evaluation during Phase 2. For budgetary purposes, it is assumed that 15 measures will be carried over from Phase 1 (12 identified as Phase 2 measures, plus 3 Phase 1 early implementation measures that need further environmental evaluation). - TASK COMPLETED
- Work with FAA to Draft a Goals and Objectives topical paper intended for BOS/TAC and CAC review and comment. - TASK COMPLETED
- Coordinate information with IC. - TASK COMPLETED

**IC Activities:**

- Assist the CAC in the development of a statement of Goals and Objectives for CAC's use in evaluating measures for noise abatement. - TASK COMPLETED
- Coordinate with PC in the preparation of concept illustrations for each measure. - TASK COMPLETED
- Review documentation on measures. - TASK COMPLETED
- Coordinate with CAC. - TASK COMPLETED

### 6.1.2 Ground Noise Measures

Ground noise sources, such as aircraft taxiway movements and run-ups will be analyzed to identify potential measures that could minimize ground noise impacts on surrounding communities. Results from previously completed studies will be incorporated into the review. The FAA will consult with CAC in identifying key concerns related to ground noise at the Airport and to identify potential measures that were not previously examined by FAA. However, alternatives previously examined by the FAA in the Additional Taxiway Evaluation Report, will not be re-examined in this study.

The PC will meet with BOS/TAC/CAC to discuss and identify additional ground noise measures that were not examined in the current FAA study[8] and have the potential to reduce ground noise impacts. Criteria will be established to be used in developing measures, which may be similar to the criteria used in the FAA study. The data derived from the baseline (future year Baseline with Phase 1 Noise Study Alternatives) simulation analysis (Task 6.4.2) on taxiway utilization and runway use may be used as one basis for identifying potential additional measures.

**PC Activities:**

- Coordinate with IC on potential ground noise abatement measures. For budgetary purposes, it is assumed that up to 5 ground noise measures will be identified. - TASK COMPLETED
- Present the findings at a meeting with BOS/TAC and CAC for their consideration. - TASK COMPLETED

[8] Harris Miller Miller and Hanson, Logan International Airport Additional Taxiway Evaluation Report, May 2006.

**IC Activities:**

- Coordinate with CAC on potential ground noise abatement needs. TASK COMPLETED
- Coordinate with the PC to identify and evaluate potential ground noise abatement measures TASK COMPLETED.
- Peer review all noise distribution results developed through use of FAA and non-FAA models.
- Participate in BOS/TAC/CAC meetings and presentations. - TASK COMPLETED

### 6.1.3 Other Measures

Additional measures may be identified during the public involvement process. If this occurs, the PC will develop sufficient information for each of them for evaluation and comparison with the other measures being considered. For budgetary purposes, evaluation of up to 10 additional measures is provided for in this study.

**PC Activities:**

- Present potential measures at a meeting with BOS/TAC and the CAC for consideration. - TASK COMPLETED

**IC Activities:**

- Coordination with CAC on additional measures. - TASK COMPLETED
- Provide peer review of PC technical assessments. - TASK COMPLETED

## 6.2 Level 1 Screening Analysis

The evaluation of measures will focus on their ability to reduce noise impacts on noise sensitive areas and communities surrounding Boston Logan International Airport without negatively impacting the FAA's organizational goals and stated mission[9], and can be successfully accomplished within a reasonable period of time, taking into account environmental, social, economic, and technological factors. Similar to the Phase 1 work, a three-level screening process will be conducted. The first level screening would eliminate measures that diminish safety or present substantial operational hurdles (e.g., technical feasibility, exceeds air traffic facility capabilities, requires airspace redesign[10]). The PC will hold two web-based meetings with BOS/TAC/CAC during the Level 1 screening analysis process to first discuss how the measures will be analyzed, and second, present preliminary findings of the analysis. The PC will coordinate with the IC and present the findings of the Level 1 screening analysis at a meeting with BOS/TAC/CAC.

[9] FAA has defined organizational goals, which include increased safety and providing greater capacity in the airspace system to meet projected demand in an environmentally sound manner. FAA's stated mission is to provide the safest, most efficient aerospace system in the world (http://www.faa.gov/about/mission/).

[10] The TRACON boundary includes the airspace within approximately 30 nautical miles of Boston Logan International Airport. Changes outside the TRACON airspace boundary are considered to be an airspace redesign element. While this Study will not consider airspace changes outside the TRACON airspace boundary, it may consider changes of air traffic control sector boundaries that lie within the TRACON airspace if such a change does not require a change to BOS Air Traffic Control Center sectors or boundaries.

**PC Activities:**

- In coordination with FAA, identify and define safety and operational criteria to be utilized. - TASK COMPLETED
- Conduct and document a qualitative evaluation analysis based on safety and operational criteria. For budgetary purposes, it is assumed that up to 25 measures will be evaluated. - TASK COMPLETED
- Identify and document measures eliminated from further consideration. - TASK COMPLETED
- Identify and document measures retained for further consideration. - TASK COMPLETED
- Coordinate analysis with IC. - TASK COMPLETED
- Present findings at a meeting with BOS/TAC/CAC and the IC for their consideration. The PC will recommend (based on the Level 1 screening analysis) and CAC will approve measures that should be retained for further consideration. - TASK COMPLETED

**IC Activities:**

- Coordinate with PC to define evaluation criteria. . - TASK COMPLETED
- Peer review PC evaluations and documentation of results. . - TASK COMPLETED
- Coordinate with CAC to provide feedback from web-based meetings to PC. . - TASK COMPLETED
- Participate in BOS/TAC/CAC meetings and presentations. . - TASK COMPLETED

## 6.3 Level 2 Screening Analysis

The purpose of the Level 2 screening analysis is to better define the Level 1 measures, determine which measures will meet operational criteria, and identify the measures that should be modeled for their noise reduction potential. Measures retained for consideration from the Level 1 screening analysis will be evaluated to assess the potential of each measure to meet the objectives of the study, namely the ability to provide reductions in aircraft noise levels on noise sensitive areas and communities within the study area of evaluation in accordance with CAC and FAA criteria. Each measure carried over from the Level 1 screening analysis will be refined to determine potential procedures, flight tracks, and viability. Criteria would be developed, defined, and agreed upon in conjunction with BOS/TAC/CAC to determine the benefit or impact of each measure on noise exposure upon noise-sensitive land uses.

### 6.3.1 Refine Measures

Each of the measures retained as reasonable and feasible through the Level 1 screening analysis will be analyzed and refined to identify more specific operational procedure definitions required for implementation. Each measure definition will be in compliance with FAA air traffic control requirements and checked against the CAC procedure criteria.[11] This information will be necessary in order to adequately assess the viability of each measure.

[11] **1.** There shall be only a single initial departure (IC assumes jet) corridor for each runway. **2.** Departing aircraft shall be routed over low population areas in the following priority: Bodies of water, marshes, wetlands and open space, industrial areas, parks and cemeteries, business areas and transportation corridors. **3**. Departure corridors shall be kept as narrow as possible to reduce the number of residences affected. **4**. Aircraft shall be kept within the

**PC Activities:**

- Refine measures for Level 2 screening analysis. For budgetary purposes, it is assumed that up to 18 measures will be evaluated in the Level 2 screening analysis. Upon completion of Level 1, 22 measures will pass to Level 2. Based on PC's estimation, approximately two of the 22 measures will not require detailed PC efforts (noise barrier measures). PC considers that a Level 2 scope of work reassessment is not required due to the additional two to four measures.
- Coordinate refinements with BOS/TAC/CAC and IC.

**IC Activities:**

- Coordinate with the PC in refining operational definitions of proposed procedures.
- Coordinate with CAC and BOS/TAC regarding procedure intent and detail.

### 6.3.2 Screening Analysis

The Level 2 screening process will focus on these criteria:

- **Operational Issues** – Utilizing the refined definitions of the measures, FAA personnel will perform a detailed analysis of the measures and identify any that may significantly compromise their organizational goals and stated mission. This analysis will be coordinated with the IC and documented.

- **Noise Reduction Potential** – Flight procedure measures will be qualitatively and/or quantitatively reviewed for the potential of providing noise reduction in accordance with CAC's noise criteria.[12] PC will utilize a screening methodology to assess the potential for reduction in the order of the CAC criteria. In some cases, those measures that show a potential reduction in population exposed to Ldn levels would not be assessed for supplemental metrics, because it meets higher level criteria and would be passed to Level 3 for a more detailed analysis. Using the refined air traffic

departure corridor until climbing out of 4 to 5000 feet. **5.** Aircraft shall be kept within the departure corridor until reaching specific coordinates at least 7 miles from the departure fly over end of the runway. **6**. Arrivals shall not descend below 3000 feet MSL until within 11 miles of the runway and established on final approach.

[12] **1.** Reduce the number of persons who are exposed to aircraft noise in excess of 60 decibels of DNL (60 Ldn); **2.** Enact air traffic measures that will reduce or minimize increasing the noise level on people currently exposed to aircraft noise above 55 decibels of DNL (55 Ldn). An increase of more than 1 ½ DNL on people within the 55 DNL will be considered to be of substantial concern to the CAC; **3.** Enact air traffic procedures that will minimize the introduction of aircraft noise above 55 decibels of DNL (55 Ldn) onto people not currently exposed to noise of that level, unless necessary to reduce noise on people exposed to 60 Ldn or more. Further, a change of 3 DNL or more within 50 Ldn will be considered to be of substantial concern to the CAC; a change of 5 DNL or more within 45 Ldn will be considered to be of substantial concern to the CAC; **4.** Reduce, to the greatest extent practicable, the existing total number of persons exposed to cumulative daily aircraft noise in excess of 55 decibels of DNL (55 Ldn); **5.** Reduce, at each grid assessment point, to the greatest extent practicable, the number of single-event flight operations with maximum noise levels in excess of 60 decibels (60 dBA Lmax), using the NEA60 metric; **6.** Reduce, to the greatest extent practicable, the existing total number of persons exposed to cumulative daily aircraft noise in excess of nighttime exposure of more than 55 decibels of Leq(n); and **7.** Reduce, at each grid assessment point, to the greatest extent practicable, from the existing total daily duration, the amount of time (TA60 as modeled in minutes per average annual day) of aircraft in flight, and separately on taxiways, at the gate, at maintenance facilities, or elsewhere during a ground operation at BOS, above 60 decibels.

measure definitions, the PC will modify the targeted baseline routes using the 2007 INM input to look like the expected corridors and utilize Dicerno[TM13] to reallocate operations and INM to estimate the potential reductions and increases.

Those measures that are determined to cause adverse impacts and involve no benefits or do not provide a reduction in population in accordance with CAC criteria will be identified as being eliminated from further consideration. This analysis will be coordinated with the IC and documented for review by the BOS/TAC/CAC. These analyses are informational.

The PC may hold two web-based meetings with BOS/TAC/CAC during the Level 2 screening analysis process to discuss how the measures will be analyzed and present preliminary findings of the analysis. The PC will coordinate with the IC and present the final analytical findings of the Level 2 screening analysis at a meeting with BOS/TAC/CAC.

**PC Activities:**

- In coordination with FAA identify and define criteria to be utilized.
- Conduct and document a qualitative analysis based on CAC criteria agreed upon by FAA. For budgetary purposes, it is assumed that up to 22 measures will be evaluated during the Level 2 screening analysis.
- Identify and document measures eliminated from further consideration.
- Identify and document measures retained for further consideration.
- Coordinate with the IC.
- Present preliminary findings at a meeting with BOS/TAC/CAC and the IC. The PC will solicit feedback from BOS/TAC/CAC and the IC on the preliminary findings.
- Present final findings at a meeting with BOS/TAC/CAC and the IC. The PC will recommend (based on the Level 2 screening analysis) and CAC will approve measures that should be retained for further consideration.
- At the direction of FAA provide documentation that includes details that describe methodology, results, and conclusions associated with each measure.

**IC Activities:**

- Coordinate with PC to identify and define criteria.
- Coordinate with PC to review analytical results and documentation.
- Coordinate with CAC regarding advisability of keeping/discarding measures.
- Participate in BOS/TAC/CAC meetings and presentations.

## 6.4 Level 3 Screening Analysis

Measures retained for consideration from the Level 2 screening analysis will be evaluated in a Level 3 screening analysis that will quantitatively examine the ability of the measures to meet the objectives of the study, namely reduce noise impacts on noise sensitive facilities and residential areas within communities surrounding the Airport without adversely impacting other communities and are considered safe and efficient. Analyses will be conducted on each measure retained from the Level 2 screening analysis, followed by a cumulative analysis or analyses of

[13] The proposed use of Dicerno and INM for this task has been approved by FAA AEE.

the measures that CAC identifies for potential implementation. For budgetary purposes, it is assumed that up to 12 measures will be evaluated during the Level 3 screening analysis.

The quantitative analysis will require a multi-step process, as described below.

### 6.4.1 Forecasting and Flight Schedule

The scope of work of Task 6.4.1 is hereby reassessed.

Due to the extended timeline of this project, application of the 2010 design day flight schedule applied for the FAA Centerfield Taxiway Evaluation is no longer applicable due to the major changes that occurred over the past three years. PC will develop a Peak Month Average Week Day (PMAWD) Design Day Flight Schedule (DDFS) for the projected future Planning Activity Level (PAL) (Year 2015), based on the 2009 FAA's Terminal Area Forecast (TAF) projected number of operations and air carrier/air taxi enplanements at Boston Logan International Airport. This version of the TAF reflects the substantial decrease in operations due to current economic conditions.

**PC Activities:**

- Research and assemble existing and future (as available) data sets related to all scheduled and unscheduled operations at Boston Logan International Airport.
- Prepare a 2008 baseline air carrier schedule based on data obtained from the Official Airline Guide (OAG) and U.S. Department of Transportation (USDOT) T100.
- Identify target data by airline and origination/destination markets in terms of seats, passengers, growth rates, origins and destinations, load factors for each air carrier, and consequently fleet mix requirements, to reach the total number of operations identified in the FAA TAF report.
- Through an iterative process, grow the 2008 baseline schedule to PAL (Year 2015) to reach targeted numbers of operations and passengers, assuming growth rates derived from the FAA TAF report, as well as currently available data on aircraft fleet and orders.
- For unscheduled operations (general aviation and military operations) and based on historical radar data obtained from Massport's flight radar data, assemble the 2008 baseline flight schedule for general aviation and military unscheduled operations, and grow operations based on assumed growth rates from the FAA TAF.
- For cargo operations, and based on reported cargo tonnage for 2008 as well as 2008 cargo operations from tower data, grown operations based on an accepted growth factor to project cargo tonnage in PAL (Year 2015) using local trend data and/or FAA Aerospace Forecast projections.
- Coordinate schedule assumptions and preliminary statistics and results with Massport, FAA and IC.
- Prepare brief technical memorandum to include assumptions, data sources, brief description of the process as well as resulting statistics for each category of operations and each year (2008 and PAL (Year 2015)).

**IC Activities:**

- Peer review of 2008 baseline and 2015 Baseline with Phase 1 Noise Study Alternatives flight schedule.
- Coordinate with CAC to describe/explain findings.

### 6.4.2 Operational Modeling

The scope of work of Task 6.4.2 is hereby reassessed.

Fast-time air traffic simulation (TAAM) analysis would be conducted for a future year Planning Activity Level (PAL) Baseline with Phase 1 Noise Study Alternatives and Baseline with No Noise Study alternative airfield.[14] Input development will include both taxiway movement and inflight procedures. In addition to existing data, PC will develop the six major configurations, which will include Runway 14-32 as appropriate.

[14] Baseline with Phase 1 Noise Study Alternatives is the same as No Action, which includes Phase 1 implemented alternatives; Runway 14/32 procedures; Centerfield Taxiway operations; and BOS Airside Improvement taxiway realignments. Baseline with No Noise Study Alternatives is the same as No Project, which includes Runway 14/32 procedures; Centerfield Taxiway operations; and BOS Airside Improvement taxiway realignments.

TAAM modeling will then be conducted on measures with operational impacts retained for consideration from the Level 2 screening analysis. The TAAM simulation will provide input data for noise modeling of ground movements and determination of aircraft departure and arrival profiles. Demand and delay results would be compared to the PAL Baseline with Phase 1 Noise Study Alternatives and Baseline with No Noise Study results produced from this task to assess the impact of the measure on the future airfield capacity. Simulation data containing but not limited to out-off/on-in (aircraft pushback from gate to departure from runway/aircraft touchdown on runway to arrival at gate) times at Boston Logan International Airport, departure or arrival routes, aircraft type, and arrival or departure runway would be produced for input to the noise modeling. Global Flight Data Record (GFDR) files generated by TAAM and containing aircraft profile data including heading, altitude, and track across the ground for each aircraft operation modeled will be used as inputs into INM. This data will be used for ground noise modeling to assess the effects of different taxiway utilizations, including but not limited to aircraft type, taxiway link (location), and total travel time on the taxiway link. Results and output of the TAAM modeling will be used as the basis for the INM modeling, but will be supplemented and verified through the use of other source information including FAA air traffic control personnel input.

Results will be compared to the baseline future PAL Baseline with Phase 1 Noise Study Alternatives and Baseline with No Noise Study Alternative to determine potential benefits or impacts of each measure. The output metrics from this modeling will be used as inputs into the noise modeling. This analysis will be coordinated with the IC. For budgetary purposes it is assumed that the measures being analyzed will only require seven (7) TAAM runs (one configuration for each of the 7 measures assumed for this task).

**PC Activities:**

- Seven TAAM air traffic simulation runs (one configuration for each of the 7 measures assumed for this task) will be conducted.
- Conduct an analysis to quantify annualized operational metrics associated with each measure.
- Assess and document the impact of each measure on airfield capacity and delay.
- Coordinate results with IC.

**IC Activities:**

- Coordinate with PC on the development of simulation assumptions.
- Peer review simulation input, results, and documentation.

### 6.4.3 Noise Modeling

The scope of work of Task 6.4.3 and subtasks are hereby reassessed.

Noise modeling for the future PAL Baseline with Phase 1 Noise Study Alternative (assumes the implementation of "early implementation" Phase 1 measures accepted for implementation and approved BOS Airside airfield improvements) and PAL Baseline with No Noise Study Alternative (assumes approved BOS Airside airfield improvements are implemented and no Phase 1 measures) will be performed. Noise modeling will also be conducted for each measure that successfully meets Level 2 screening criteria, under Baseline with Phase 1 Noise Study

Alternatives conditions. The future PAL Baseline with Phase 1 Noise Study Alternatives, Baseline with No Noise Study and alternative scenarios would be compared to determine if a measure would alleviate noise impacts or introduce noise impacts in other areas. Noise impact evaluations would consider INM, grid-point analysis, and alternative noise metrics identified in the noise protocol for use in the existing conditions noise modeling. This analysis will be coordinated with the IC.

6.4.3.1 Noise Model Input Development

The modeling effort that will be required to determine the potential impact of the future PAL Baseline with Phase 1 Noise Study Alternative, Baseline with No Noise Study Alternative and the selected measures will be dependent on the complexity of the measures. For example, the modeling must predict the acoustic impact of moving flight tracks from one geographic location to another, moving operations from one runway to another, or changing flight approach and/or departure profiles, and, in some cases, a combination of the above. In order to discern the acoustic impact of these measures on the surrounding communities, the level of analysis must be commensurate with the level of detail in the measures. The noise impact in a given community is dependent on the quantity and location of the aircraft operations as well as the aircraft altitude, speed, and thrust setting. Greater detail associated with the proposed work efforts will be provided after a scope re-assessment is conducted, as described in Task 1.3. The work efforts described below are general in nature and provide the expected methodologies and framework to be utilized.

*6.4.3.1.1 PAL Baseline with Phase 1 Noise Study Alternatives/Baseline with No Noise Study Alternative*

The first step will be to develop the inflight INM inputs for the PAL No Noise Study Alternative. The PC will re-assess the inflight existing conditions noise model (developed in detail under Task 5) and determine the changes needed to update the INM case to model the airport operations projected for the PAL. Based on actual use since Runway 14/32 was operational, an additional runway operating configuration will need to be modeled. Therefore, six runway operating configurations and one (1) AAD configuration (all other configurations not used frequently) will be modeled.

Outputs from the TAAM simulations will be used as supplemental information to assist in inputs into the INM future scenarios. Because TAAM uses a peak month average day (PMAD) schedule and FAA requires that an annual average day (AAD) schedule be used for INM, the PMAD schedule from TAAM will need to be modified to reflect an AAD schedule. Operational data and aircraft fleet mix will be derived from the PAL No Project Alternative simulation model results. The TAAM outputs will be normalized from peak month average day to annual average day for use in INM. Most of these changes will be carried out by editing the INM input database files except for the profile data needed for the measures implemented after Phase 1.

The PAL No Noise Study Alternative will represent the baseline used as a basis for comparison, updated to reflect future PAL operating levels and fleet mix, including the addition of Runway 14-32, actual use patterns of the Centerfield Taxiway, and use of other airfield improvements. Once the Baseline with No Noise Study scenario is developed, the Baseline with Phase 1 Noise

Study Alternatives scenario will be developed by adjusting the Baseline with No Noise Study routes to reflect the Phase 1 implemented measures.. The following components of the existing conditions noise model developed under Task 5 will be included:

- Physical location of flight tracks.
- Approach and departure profiles.
- Percentage distribution of categories of aircraft (i.e., air carrier, regional jet, and propeller) among the defined runways, tracks, and profiles (assumes flight destination/origin will remain the same as existing conditions).
- Percentage of nighttime operations unless TAAM evaluations of Task 6.4.2 indicate a shift to nighttime shoulder hours.
- Runway layout and usage, with the addition of new Runway 14-32.
- Taxiway use with the addition of access to new Runway 14-32 (approved Airside EIS improvements).

The PAL Baseline with No Noise Study and Baseline with Phase 1 Noise Study Alternative inflight inputs and outputs will be compared to the existing conditions noise model to identify any potential data anomalies and identify that differences are accurately depicted. The Baseline with No Noise Study and Baseline with Phase 1 Noise Study Alternative inputs will be coordinated with the IC. Next, the PAL Baseline with No Noise Study and Baseline with Phase 1 Noise Study Alternative inflight noise model will be used to compare the impacts of the measures.

Baseline with No Noise Study/Baseline with Phase 1 Noise Study Alternatives taxiway movement noise will be developed via a process similar to the existing conditions analysis. Aircraft ground movement data will be provided by the TAAM analysis above. The data will be converted to a format accepted by INM, and the metrics identified by the noise protocol will be calculated. For run-ups, the INM will be used. The results from this analysis will serve as the basis for ground noise measures comparison.

**PC Activities:**

- Develop INM inputs for the PAL Baseline with No Noise Study and Baseline with Phase 1 Noise Study Alternative.
- Compare PAL INM inputs and outputs with existing conditions noise model; make corrections to PAL INM inputs, if needed.
- Develop and calculate PAL Baseline with No Noise Study/Baseline with Phase 1 Noise Study Alternatives ground noise.
- Coordinate results with IC.

**IC Activities:**

- Peer review PC's INM input and output assumptions and input files for the PAL Baseline with No Noise Study/Baseline with Phase 1 Noise Study Alternative.
- Coordinate results with CAC.

*6.4.3.1.2 Measures*

As described in Task 6.4.2, TAAM air traffic simulation analysis will be completed for each measure that has an operational impact. The output data from the TAAM will be used as a source to generate the necessary INM inputs along with PAL Baseline with Phase 1 Noise Study Alternatives INM input variables. The TAAM outputs will be normalized from peak month average day to annual average day for use in INM, as discussed in Task 6.4.3.1.1.

There are several types of noise abatement procedures outlined in the recommended measures from Phase 1, with varying levels of noise-modeling complexity. Changing the distribution of operations among runways and existing tracks will involve a certain level of complexity. However, these measures would work within the confines of the future Baseline with Phase 1 Noise Study Alternatives airport configuration. Therefore the only changes needed to the Baseline with Phase 1 Noise Study Alternative would be recalculating the numbers of operations and then editing the INM database files. The types of procedures include:

- Creating new flight tracks and profiles and shifting operations from existing tracks to the new tracks.
- Moving and editing an existing flight track.
- Creating additional departure flight tracks to model "fanning" of operations over an area, and distributing operations among these fanned tracks.
- Changing the amount of operations on a given runway.
- Shifting operations to different runways.
- Relocating nighttime operations to different runways.

Measures that include changes to runway use, such as moving and creating flight tracks and profiles, will introduce more complexity to the analysis. The physical tracks (GFDR output from TAAM will provide the flight track backbone) would need to be created in the INM. Next, the appropriate operations would be placed on these tracks. In addition, the expected climb and descent performance flight profiles for these tracks will be output from TAAM and reviewed with FAA air traffic control personnel, before being modeled in INM. These profiles may be different than the profiles modeled in the Baseline with Phase 1 Noise Study Alternatives and existing conditions INM cases, and would therefore need to be analyzed and developed using the FSG methodology identified in Task 6.4.3.1.3. Any differences from the Baseline with Phase 1 Noise Study Alternatives and existing conditions profiles would be clearly described and explained. For budgetary purposes, it is assumed that up to 12 measures will be modeled.

Additional measures identified during the Phase 2 process, including ground noise measures will also be modeled. Any variables that are shared between the Baseline with Phase 1 Noise Study Alternative and other measures will be incorporated in the alternative INM data set. New assumptions will be supported by the TAAM simulation output (for operational measures) and FAA air traffic control input. Key data variables and assumptions will be coordinated with the IC. This method will be applied for each measure that has been retained from the Level 2 screening process.

Ground noise sources, such as aircraft taxiway movements and run-ups will be analyzed to identify potential measures that could minimize long-term ground noise impacts on surrounding communities. This task will incorporate and will utilize the same methodology and modeling

conducted for existing conditions to analyze any additional ground noise measures identified. Any required engine run-up noise calculations will be modeled using INM.

For any additional ground noise measures, not previously examined by FAA, a comparison between the associated measure and corresponding Baseline with Phase 1 Noise Study Alternatives scenario will be conducted. For any new measures identified, appropriate taxiway routes used in the noise modeling will be provided via the future PAL Baseline with Phase 1 Noise Study Alternatives baseline and associated measure TAAM analysis (see Task 6.4.2).. The only taxiway routes to be modeled will be those that will be widely used for each of the six major Baseline with Phase 1 Noise Study Alternatives air traffic configurations in PAL and an additional configuration that encompasses all other minor configurations not substantially used that are grouped together to constitute one INM configuration input, for a total of seven configurations. Note that this additional configuration will not be simulated in TAAM.

TAAM output results will also be used to develop the necessary input for SoundPlan to calculate the appropriate metrics.

**PC Activities:**

- Normalize TAAM outputs from peak month average day to annual average day.
- Utilize TAAM outputs and ATC input to provide acceptable INM inputs for each inflight operational measure, to include data such as flight profiles (unless addressed in Task 6.4.3.1.3) and flight tracks, as required.
- Utilize TAAM outputs to provide acceptable INM inputs for each ground movement measure.
- Compare PAL INM inputs for each measure modeled with Baseline with Phase 1 Noise Study Alternative inputs; make corrections to PAL INM inputs, if needed.
- Coordinate results with IC.

**IC Activities:**

- Peer review PC modifications of TAAM output data to INM/SoundPlan input standards.
- Coordinate results with CAC.

*6.4.3.1.3 Flight Profiles for Measures*

Some measures may require editing of the Baseline with Phase 1 Noise Study Alternative approach and departure profiles. Profiles used in either the existing conditions or Baseline with Phase 1 Noise Study Alternative will include some standard INM profiles and some custom-defined profiles (as described in Section 5.3.2.5). Both standard and custom profiles may have to be edited in any or all of the measures in order to adequately determine the average annual acoustic impacts for each measure. For example, a departure profile modeled in the Baseline with Phase 1 Noise Study Alternative may have a hold down segment included due to traffic located above the specific flight track. An alternative case may have a replacement flight track that does not pass under the same traffic, and therefore the hold down segment may potentially be shortened, changed to a different altitude, or eliminated. These changes may depend on aircraft category, and the runway and track utilized.

As described in Section 6.4.2, the TAAM operational modeling will supply aircraft track and profile data. A combination of ATC input and the radar data used to construct the existing conditions (inherited in the Baseline with Phase 1 Noise Study Alternative) flight tracks and profiles will be used as a basis to determine the appropriate distribution of profiles associated with a specific measure.

INM procedure steps will be used to model the flight profile. Flight profile development will follow the same procedures and methodology as described in Task 5.3.2.5, including receiving FAA AEE approval to use any customized data before applying it in INM. If necessary, the PC will coordinate with the IC to determine the use of aircraft substitutions not identified in Task 5.3.2.5.

**PC Activities:**

- Obtain FAA AEE approval of profiles or profiling process, if necessary. - COMPLETED
- Develop or modify approach and departure flight profiles for measures, if/as needed.
- Convert FSG results into INM input format.
- Coordinate results with IC.

**IC Activities:**

- Peer review the PC's work in the modification of approach and departure flight profiles for measures, if needed.
- Coordinate results with the CAC.

6.4.3.2 INM Analysis

The PC will run the INM and generate the appropriate noise metrics, analyses, graphics, and maps, with input and oversight from the IC and BOS/TAC/CAC (an initial set of analysis tools was presented during Phase 1, which to the extent practicable, will be held consistent for Phase 2 analyses). Toolsets and metrics applied for each measure will be detailed in the noise protocol. Examples include: (1) Number of Events Above (NA) and Time Above (TA) analyses above a series of thresholds (to be determined) and presented in tabular format; (2) DNL color gradient maps; (3) NA and TA maps for selected grid points and thresholds; (4) flight corridor maps overlaying radar data on INM flight tracks for various aircraft groupings (e.g., heavy jets and RJs); (5) Daytime Level (DL) and Nighttime Level (NL) analysis; (6) Lmax values at selected grid points; (7) Case SEL (and corresponding Sound Exposure, E) values at selected grid points; and (8) distributed range of aircraft altitudes at selected grid points (location of interest - point of closest approach analysis). Appropriate metrics for each measure will be determined. Grid points and analysis tools will be selected to allow BOS/TAC/CAC members a better understanding of the benefits and adverse impacts of the measure. As necessary, supplemental metrics that require post-processing of INM data or the generation of additional data will be completed.[15] Preliminary results will be discussed with the IC. Population and housing counts will be completed within the DNL contours as well as any other demographic analysis required for environmental justice review. In addition, indications of potential environmental justice

[15] Tools to be used in this step will be detailed in the noise protocol developed in Task 5; any approvals required by FAA AEE will be obtained prior to use.

impacts or constructive use of DOT Section 4(f)/303(c) properties or historic properties will be identified.

The analysis will be conducted on a dual-track basis. The environmental effects of each measure will first be presented on an individual basis, allowing the BOS/TAC/CAC to better understand the implications of going forward with an individual procedure. BOS/TAC/CAC will assess the information and determine for each measure whether to discard or retain for further analysis. Measure-specific considerations will be identified during the scope re-assessment, which occurs prior to Level 3 screening. In addition, to properly assess the combined effect of the individual measures, a combined analysis of all measures in a single noise analysis will be conducted (refer to Task 6.4.4 below).

**PC Activities:**

- Coordinate with IC on the development of assumptions and results.
- Conduct noise modeling for each measure using the latest available version of the INM.
- Assess and document potential impact of each measure in terms of noise exposure to population and sensitive land uses.
- Identify potential environmental justice issues.
- Identify potential impacts to DOT Section 4(f)/303(c) properties or historic properties.
- Coordinate results with BOS/TAC/CAC.

**IC Activities:**

- Coordinate with PC on the development of assumptions and results.
- Peer review all noise model input and output files prepared by the PC for every case evaluated.
- Coordinate with CAC to describe input and output results.
- Participate in BOS/TAC/CAC meetings and presentations.

### 6.4.4 Phase 1 with Phase 2 Preferred Alternative Development

The scope of work of Task 6.4.4 is hereby reassessed.

Criteria will be developed, defined, and acceptable to BOS/TAC/CAC to determine the benefit or impact of the measures when considered individually, as a whole, or in subsets/groupings. Noise modeling will be conducted for the Phase 1 with Phase 2 Preferred Alternative and compared to the future Baseline with Phase 1 Noise Study Alternative noise results to determine the effect of combining the measures retained through all of the previous screening analyses together, or the effect of combining some of the measures into subsets or groups.

A comparison to the future Baseline with No Noise Study and Phase 1 with Preferred Phase 2 Alternative noise will also be conducted. This is done to account for the entire noise study project-related cumulative impacts. The Baseline with No Noise Study and Phase 1 with Phase 2 Preferred Alternative comparative analysis is required to determine if cumulative implementation of all of the recommended measures together would effectively alleviate noise impacts or

introduce new significant noise impacts in other areas. For purposes of scope development, it is assumed that one combined alternative scenario will be modeled.

A comparative analysis of the alternatives indicating both positive and negative impacts on airport operations, noise conditions, population, sensitive land uses, environmental justice issues, DOT Section 4(f)/303(c) properties, and historic properties will be developed, both for the individual measures and for the combined alternative scenarios. This information will be presented in both tabular and graphic format for review by BOS/TAC/CAC and the IC.

The PC will hold two web-based meetings with BOS/TAC/CAC during the Level 3 screening analysis process to discuss how the alternatives will be analyzed and present preliminary findings of the analysis. The PC will present the final findings of the Level 3 screening analysis to BOS/TAC/CAC. CAC and Massport will assess the information and recommend a package of measures as the Proposed Action for implementation.

**PC Activities:**

- Identify and define criteria to be utilized in coordination with FAA and BOS/TAC/CAC.
- Coordinate with IC on the analysis of alternatives.
- Conduct and document an alternatives evaluation analysis based on criteria agreed upon by FAA and BOS/TAC/CAC.
- Conduct noise modeling of combined measures.
- Conduct an environmental justice analysis of combined measures.
- Conduct a DOT Section 4(f)/303(c) impact analysis of combined measures.
- Conduct a historic properties impact analysis of combined measures.
- Identify and document alternatives eliminated from further consideration.
- Identify and document alternatives retained for further consideration.
- Hold 2 web-based meetings with BOS/TAC/CAC to discuss process and present preliminary findings.
- Present final findings to CAC for recommendation to Massport.

**IC Activities:**

- Coordinate with PC on the selection of measures for inclusion within combined scenarios.
- Peer review the PC's analysis and documentation of combined alternative scenarios.
- Coordinate with CAC.
- Participate in BOS/TAC/CAC meetings and presentations.

# 7. SCOPE OF SERVICES – PHASE 3

## 7.1 PRAS Objectives

The primary purpose of this task is to provide support as needed to assist discussions between Massport and CAC related to the viability of the Preferential Runway Advisory System (PRAS) at the airport. This task does not include technical analysis related to the current PRAS or any proposed runway use measures. The main goal is for Massport and CAC to reach a consensus on the future of PRAS: maintain or discontinue PRAS at the airport. Discussion and analysis related to the Proposed Phase 1 runway measures will depend upon the decision made by CAC and Massport related to PRAS. Detailed analysis related to PRAS or runway use measures would occur in Phase 3. The PC working with the IC will facilitate and support when necessary a strategy discussion involving the FAA, Massport, and the CAC on PRAS. If necessary, this will include a development of a scope of technical work on developing a new PRAS for further study in Phase 3. If the FAA, Massport, and CAC decide not to proceed with PRAS, then the PC will produce a short summary memorandum reviewing the discussion and decision points.

**PC Activities:**

- Attend one separate meeting with the FAA, Massport, and CAC to facilitate discussion on PRAS.
- Prepare draft memorandum summarizing the PRAS discussion and decisions on whether PRAS should be continued, and if so, FAA, Massport, and CAC's objectives for a revised PRAS.
- Participate in one teleconference with FAA, Massport, BOS/TAC/CAC, and IC to review comments on the draft memorandum and finalize any discussions/decisions on PRAS.
- Finalize memorandum after receipt of comments from FAA, Massport, CAC, and IC.

**IC Activities:**

- Participate in meeting with the FAA, Massport, CAC, and PC on PRAS discussion.
- Review draft memorandum summarizing the PRAS discussion and decisions.
- Participate in teleconference to review draft memorandum and finalize any discussions/decisions on PRAS.
- Review final memorandum on PRAS.

## 7.2 Develop Phase 3 Scope of Services

Based on Phase 2 study findings and the outcome of the PRAS discussion in Task 7.1, prepare a draft scope of services for Phase 3. Phase 3 may include an examination of Massport's PRAS or the proposed Phase 1 runway use measures that could minimize aircraft noise on near-by communities. Phase 3 would also include the development by FAA of either an EA or EIS documenting and considering the potential environmental impacts of the measures recommended by CAC and Massport for implementation.

The Phase 2 study findings will define the measures and projects to be evaluated in the FAA's environmental document.

**PC Activities:**

- Meet with the FAA and BOS/TAC/CAC to establish framework for scoping Phase 3.
- Participate in scoping meeting with the FAA and BOS/TAC/CAC.
- Prepare draft scope, budget and schedule for Phase 3 in collaboration with the FAA and IC.
- Meet with the FAA and BOS/TAC/CAC to review the proposed Phase 3 work plan.
- Revise work plan, as necessary.

**IC Activities:**

- Participate in scoping meeting with the FAA, BOS/TAC/CAC, and PC.
- Prepare draft scope, and budget for Phase 3 IC activities in collaboration with the FAA, PC, and CAC.
- Meet with the FAA and BOS/TAC/CAC to review the proposed Phase 3 work plan.
- Revise work plan, as necessary.

## List of Abbreviations

| | |
|---|---|
| AAD | Annual Average Day |
| AEE | FAA Office of Environment & Energy |
| AGL | Above-Ground Level |
| ALPA | Air Line Pilots Association |
| ATC | Air Traffic Control |
| ATCT | Airport Traffic Control Tower |
| ATO | FAA Air Traffic |
| BOS | Boston Logan International Airport |
| BOS/TAC | Boston Technical Advisory Committee |
| CAC | Logan Airport Community Advisory Committee |
| C.F.R. | Code of Federal Regulations |
| CY | Calendar Year |
| dB | Decibel |
| DEIS | Draft Environmental Impact Statement |
| DL | Daytime Average Sound Level |
| DNL | Day-Night Level |
| DOT | Department of Transportation |
| E | Sound Exposure |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| FAA | Federal Aviation Administration |
| FEIS | Final Environmental Impact Statement |
| FMS | Flight Management System |
| FONSI | Finding of No Significant Impact |
| FSG | Flight Segment Generator |
| GFDR | Global Flight Data Record |
| GIS | Geographic Information Systems |
| IC | Independent Consultant |
| IMC | Instrument Meteorological Conditions |
| INM | Integrated Noise Model |
| LDA | Localizer Directional Aid |
| Leq | Equivalent Sound Level |
| LTO | Landing and Takeoff |
| Lmax | Maximum Sound Level |

| | |
|---|---|
| MassGIS | Massachusetts Geographic Information Systems |
| NA | Number of Events Above |
| NDADS | Noise Data and Display System |
| NEPA | National Environmental Policy Act |
| NIRS | Noise Integrated Routing System |
| NL | Nighttime Average Sound Level |
| OAG | Official Airline Guide |
| PC | Project Consultant |
| PMAD | Peak Month Average Day |
| PRAS | Preferential Runway Advisory System |
| QA | Quality Assurance |
| QC | Quality Control |
| RJ | Regional Jet |
| RNAV | Area Navigation |
| ROD | Record of Decision |
| SEL | Sound Exposure Level |
| TA | Time Above |
| TAAM | Total Airspace and Airport Modeler |
| TAF | Terminal Area Forecast |
| TRACON | Terminal Radar Approach Control Facility |
| U.S.C. | United States Code |
| VMC | Visual Meteorological Conditions |