3.0

Noise Abatement Measures
3. Noise Abatement Measures

3.1 Introduction

Federal Aviation Regulation (FAR) Part 150 specifies many types of alternatives which must be considered in the planning process. Noise Abatement Alternatives are those that address aircraft noise at its source and may be implemented by the users or controllers of aircraft in flight or on the ground. Types of noise abatement alternatives include:

- Flight Path Locations;
- Flight Frequency;
- Flight Management;
- Flight Restrictions;
- Ground Activity Restrictions; and
- Facility Design and Construction

3.2 Noise Abatement Alternatives

A full range of noise abatement alternatives was examined based on the requirements of the Federal Aviation Regulation (FAR) Part 150, as well as input from the Study Advisory Committee and the general public. These alternatives are summarized in Table 3-1 and fully documented in Appendix E.

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Table 3-1: Noise Abatement Alternatives

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Alternatives were evaluated based on: safety; noise benefit; cost of implementation; and, feasibility of implementation. The results of the alternatives analysis yielded eight alternatives which were recommended for inclusion in the Program Update as Measures. This section presents details on those eight recommended noise abatement measures.
Recommended Noise Abatement Measure NA-1 (Alternative NA-U)
Runways 09L/09R/17/35/08 Noise Abatement Departure Flight Tracks

Description

Previously approved Measure NA-1, a continuation of existing conditions at the time of the 2003 FAR Part 150, stated:

Aircraft weighing 12,500 pounds or more departing Runways 09L/09R/17/35/08 fly runway heading until reaching 2,000’ Above Ground Level.

For aircraft departures to the east, north, or south departing from all runways except Runway 27L and 27R, aircraft weighing more than 12,500 pounds are directed to fly runway heading until reaching an altitude of 2,000 feet above the ground. This procedure applies to all aircraft except those weighing less than 12,500 pounds (generally, small single-engine propeller aircraft) and certain excepted aircraft, including passenger turboprop aircraft such as the Dash-8, Embraer 120, and Beech Super King Air which begin their turns as instructed by ATCT. Once the aircraft reach their prescribed altitude, aircraft are directed to begin their turns towards a navigation fix or destination. Aircraft may not always follow these procedures, owing to weather patterns, safety, or ATCT instructions.

FIGURE 3-1: FAA Airspace Redesign Divergent Departure Headings (east, north, and south)
Source: http://www.faa.gov/airports_airtraffic/air_traffic/nas_redesign/regional_guidance/eastern_reg/nynjphl_redesign/

1 Exempt aircraft include common turboprop and small jet passenger aircraft, including the Dash-7 (DH-7), Dash-8 (DH-8), Shorts 360 (SH36), Avion de Transport ATR 72 (AT42), AT72, BE02, Beech King Air 100 (BE10), Beech Super King Air (BE20), Beech Super King Air 300 (BE30), Saab 340 (SF34), Fairchild Swearingen Merlin 3 (SW3), Beechcraft 1900 (BA31), British Aerospace Jetstream 41 (BA41), Embraer 120 (E120), and Dornier 228 (DO82).
This procedure represents the historical departure procedures in place at PHL. However, with the recommendations recently implemented (and those yet to be implemented) as a result of the NY/NJ/PHL Metropolitan Area Airspace Redesign Project (ARD), the times in which aircraft follow these procedures are limited from some runways. Namely, aircraft departures from Runways 09L and 09R are now prescribed to follow a set of dispersed headings, as represented in Figure 3-1 above. These dispersed headings are in use from 6:00 a.m. until 10:00 p.m. Outside of that window, the traditional procedures are followed for departures from Runways 09L and 09R. Aircraft weighing greater than 12,500 pounds departing Runways 17, 35, and 08 generally continue to follow the noise abatement procedure.

The measure is currently a part of the PHL Rules and Regulations, the PHL ATCT Standard Operating Procedures document, the previous FAR Part 150 study, and is available on aviation resources that provide details on PHL, such as the comprehensive Boeing Airport Noise Regulations website (http://www.boeing.com/commercial/noise/phil.html).

Clarification of the terminology used to describe the altitude of aircraft is being proposed, as well as prescribing that the procedures be utilized when the dispersed headings are not in use. An aircraft’s altimeter measures the barometric pressure outside the aircraft, which decreases with altitude. The altimeter is referenced to mean sea level (MSL). The elevation of PHL is approximately 36 feet. The recommended modified Noise Abatement Measure NA-1 states:

Unless directed otherwise by PHL ATCT, aircraft weighing greater than 12,500 pounds departing from Runways 09L/09R/17/35/08 should fly runway heading until reaching 2,000' Mean Sea Level.

**Relationship to PHL Noise Environment**

Existing procedure, currently in use from 10:00 p.m. until 6:00 a.m. This measure was approved by the FAA in the 2003 Record of Approval (ROA).

**Noise Benefits**

Though there would be no direct reduction to the number of persons within the DNL 65 dB noise exposure contour, the use of this measure reduces the areas of overflight of noise-sensitive development and ensures that aircraft reach higher altitudes prior to turning towards a navigation fix or destination.

**Other Benefits**

Employing standard aircraft noise abatement departure procedures assists in the reduction of controller workload.

**Drawbacks**

With the implementation of multiple dispersed departure headings from Runways 09L and 09R, this noise abatement procedure is not utilized between 6:00 a.m. and 10:00 p.m. from these runways.

**Implementation Details**

**Responsible Implementing Party:** Ultimately, the PHL ATCT and pilot are responsible for the safe operation of aircraft. PHL ATCT would continue to instruct aircraft to follow the noise abatement procedures when not in conflict with weather, safety, or other ATCT procedures. The PHL Airport Noise Abatement Program Manager would continue to promote the use of the procedure through the Fly Quiet Program (Measure PM-8) and Community Awareness Program (Measure PM-5).

**Schedule of Implementation:** As this measure is part of the existing procedures in place at PHL, implementation is ongoing.

**Costs associated with Implementation/Funding:** There are no direct additional costs associated
with the continued implementation of this procedure, however, it is expected that staff time associated with monitoring noise results and encouraging its use would occur.

**Relationship to Other Recommended Measures**

Measures NA-2 and NA-3 outline the noise abatement departure flight paths for Runway 27L and 27R aircraft departures. Alternative NA-C evaluated various departure procedures for aircraft departures from Runway 35, Alternative NA-L evaluated existing and proposed RNAV departure procedures which could further narrow the dispersion of flight paths over noise-sensitive development. This updated measure would be a part of the Fly Quiet Program (Measure PM-8) and the Community Awareness Program (Measure PM-5).

**Preliminary Recommendations**

*NA-1: Unless directed otherwise by PHL ATCT, aircraft weighing greater than 12,500 pounds departing from Runways 09L/09R/17/35/08 should fly runway heading until reaching 2,000’ Mean Sea Level.*
Recommended Noise Abatement Measure NA-2 (Alternative NA-V)
Runways 27L Noise Abatement Departure Flight Track

Description

Previously approved Measure NA-2, a continuation of existing conditions at the time of the 2003 FAR Part 150, stated:

Aircraft weighing 12,500 pounds or more departing Runway 27L turn left to a 255 degree heading until reaching 3,000’ Above Ground Level.

This measure directs aircraft departing Runway 27L (to the west) weighing over 12,500 pounds and certain excepted aircraft, including passenger turboprop aircraft such as the Dash-8, Embraer 120, and Beech Super King Air\(^2\), to turn towards a designated heading over the Delaware River until reaching a prescribed altitude (3,000 feet AGL). This heading of 255-degrees places most jet aircraft over the Delaware River prior to beginning turns towards a navigation fix or destination. This procedure represents the historical departure procedures in place at PHL. However, with the recommendations recently implemented (and those yet to be implemented) as a result of Noise Mitigation Report for the NY/NJ/Philadelphia Airspace Redesign Project issued by the FAA on April 6, 2007, the times in which aircraft follow these procedures are limited.

\(^2\) Exempt aircraft include common turboprop and small jet passenger aircraft, including the Dash-7 (DH-7), Dash-8 (DH-8), Shorts 360 (SH36), Avion de Transport ATR 72 (AT412), A772, BE02, Beech King Air 100 (BE10), Beech Super King Air (BE20), Beech Super King Air 300 (BE30), Saab 340 (SF34), Fairchild Swearingen Merlin 3 (SW3), Beechcraft 1900 (BA31), British Aerospace Jetstream 41 (BA41), Embraer 120 (E120), and Dornier 228 (DO28).
With the implementation of the dispersed headings from Runway 27L, aircraft departures are now prescribed to follow a set of dispersed headings of either 268-degrees, 245-degrees, or 230-degrees (not yet implemented), as represented in Figure 3-2. These dispersed headings are in use from 6:00 a.m. until 10:00 p.m, as traffic levels during that time allow for it. Outside of that window, the traditional procedures are followed for departures from Runway 27L.

Clarification of the terminology used to describe the altitude of aircraft is being proposed, as well as prescribing that the procedures be utilized when the dispersed headings are not in use. An aircraft's altimeter measures the barometric pressure outside the aircraft, which decreases with altitude. The altimeter is referenced to mean sea level (MSL), which is commonly used by pilots. This change in terminology does not impact the procedure (i.e. aircraft are anticipated to follow the same general flight paths). The modified Noise Abatement Measure NA-2 states:

Unless directed otherwise by PHL ATCT, aircraft weighing greater than 12,500 pounds departing from Runway 27L turn left to a 255 degree heading until reaching 3,000’ Mean Sea Level.

**Relationship to PHL Noise Environment**

Existing procedure, currently in use between 10:00 p.m. and 6:00 a.m. This measure was approved by the FAA in the 2003 Record of Approval (ROA).

**Noise Benefits**

The use of this measure reduces the areas of overflight of noise-sensitive development and ensures that aircraft reach higher altitudes prior to turning towards a navigation fix or destination. Its continued implementation reduces the direct overflight of noise-sensitive residents in Tinicum Township and areas further south and west of the Delaware River. However, the continued implementation of this measure during portions of the day would not reduce the number of persons within the DNL 65 dB noise exposure contour.

**Other Benefits**

Employing standard aircraft noise abatement departure procedures assists in the reduction of controller workload.

**Drawbacks**

With the implementation of multiple dispersed departure headings from Runway 27L, this noise abatement procedure is not utilized between 6:00 a.m. and 10:00 p.m.

**Implementation Details**

**Responsible Implementing Party:** Ultimately, the PHL ATCT and pilot are responsible for the safe operation of aircraft. PHL ATCT would continue to instruct aircraft to follow the noise abatement procedures when not in conflict with weather, safety, or other ATCT procedures. The updated language of the measure would be reflected in the PHL Rules and Regulations publication, the current FAR Part 150 Noise Compatibility Program, the PHL ATCT SOP, and on the PHL website, Boeing Airport Noise Regulations page, and other resources as available.

**Schedule of Implementation:** As this measure is part of the existing procedures in place at PHL, implementation is ongoing.

**Costs associated with Implementation/Funding:** There are no direct additional costs associated with the continued implementation of this procedure, however, it is expected that staff time associated with monitoring noise results and encouraging its use would occur. PHL has historically monitored use of the Noise Abatement Procedure and currently monitors its use during the hours that the 255° is used. There is
no legal requirement for monitoring, as use of noise abatement procedures are voluntary. However, voluntary adherence with the procedure is excellent. PHL has also historically monitored other aircraft activity, such as the altitude of arriving flights to encourage pilots to avoid flying lower than needed. This data, while provided to ATCT management, airport management and airline chief pilots, is informational and used to encourage aircraft operators to voluntarily operate their aircraft in a quiet manner.

Relationship to Other Recommended Measures

Measures NA-1 and NA-3 outline the noise abatement departure flight paths for other runways at PHL. Alternative NA-C evaluated various departure procedures for aircraft departures from Runway 35, Alternative NA-K evaluated Runway 27L departure procedures. Alternative NA-L evaluated existing and proposed RNAV departure procedures that could further reduce the dispersion of flight paths over noise-sensitive development.

Preliminary Recommendations

NA-2: Unless directed otherwise by PHL ATCT, aircraft weighing greater than 12,500 pounds departing from Runway 27L turn left to a 255-degree heading until reaching 3,000' Mean Sea Level.
Recommended Noise Abatement Measure NA-3 (Alternative NA-W)
Runways 27R Noise Abatement Departure Flight Track

Description

Previously approved Measure NA-3, a continuation of existing conditions at the time of the 2003 FAR Part 150, stated:

Aircraft weighing 12,500 pounds or more departing Runway 27R turn left to a 240 degree heading until reaching 3 DME, then turn right to a 255 degree heading until reaching 3,000' Above Ground Level.

Similar to Measures NA-1 and NA-2, this measure directs aircraft departing Runway 27R to the west weighing over 12,500 pounds and certain excepted aircraft, including passenger turboprop aircraft such as the Dash-8, Embraer 120, and Beech Super King Air, to turn towards a designated heading over the Delaware River until reaching a prescribed altitude (3,000 feet AGL). However, because of separation requirements between aircraft departures from Runway 27L and 27R, aircraft must first fly a divergent heading of 240-degrees prior to adjusting course over the Delaware River. This heading of 255-degrees places most jet aircraft over the Delaware River prior to beginning turns towards a navigation fix or destination. This procedure represents the historical departure procedures in place at PHL. However, with the recommendations recently implemented (and those yet to be implemented) as a result of the NY/NJ/PHL Metropolitan Area Airspace Redesign Project (ARD), the times in which aircraft follow these procedures are limited.

With the implementation of the dispersed headings from Runway 27R, aircraft departures are now prescribed to follow a set of dispersed headings of either 268-degrees, 245-degrees, or 230-degrees (not yet implemented), as represented in Figure 3-2. These dispersed headings are in use from 6:00 a.m. until 10:00 p.m. Outside of that window, the traditional procedures are followed for departures from Runway 27R.

Clarification of the terminology used to describe the altitude of aircraft is being proposed, as well as prescribing that the procedures be utilized when the dispersed headings are not in use. An aircraft’s altimeter measures the barometric pressure outside the aircraft, which decreases with altitude. The altimeter is referenced to mean sea level (MSL), which is commonly used by pilots. This change in terminology does not impact the procedure (i.e. aircraft are anticipated to follow the same general flight paths). The modified Noise Abatement Measure NA-3 states:

Unless directed otherwise by PHL ATCT, aircraft weighing greater than 12,500 pounds departing from Runway 27R turn left to a 240 degree heading until reaching 3 DME, thence turn right to a 255-degree heading until reaching 3,000' Mean Sea Level.

Relationship to PHL Noise Environment

Existing procedure, currently in use from 10:00 p.m. until 6:00 a.m. This measure was approved by the FAA in the 2003 Record of Approval (ROA).

Noise Abatement Measures

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3 DME refers to three nautical miles from the distance measuring equipment transponder, as indicated in the aircraft cockpit. At PHL the DME for Runway 09L also serves Runway 27R, while the DME for Runway 09R also serves 27L.

4 Exempt aircraft include common turboprop and small jet passenger aircraft, including the Dash-7 (DH-7), Dash-8 (DH-8), Shorts 360 (SH36), Avion de Transport ATR 72 (AT42); AT72, BE02, Beech King Air 100 (BE10), Beech Super King Air (BE20), Beech Super King Air 300 (BE30), Saab 340 (SF34), Fairchild Swearingen Merlin 3 (SB3), Beechcraft 1900 (BA31), British Aerospace Jetstream 41 (BA41), Embraer 120 (E120), and Dornier 228 (DO82).
No noise benefits

The use of this measure reduces the areas of overflight of noise-sensitive development and ensures that aircraft reach higher altitudes prior to turning towards a navigation fix or destination. Its continued implementation reduces the direct overflight of noise-sensitive residents in Tinicum Township and areas further south along the Delaware River. However, the continued implementation of this measure during portions of the day would not reduce the number of persons within the DNL 65 dB noise exposure contour.

Other Benefits

Employing standard aircraft noise abatement departure procedures assists in the reduction of controller workload.

Drawbacks

With the implementation of multiple dispersed departure headings from Runway 27R, this noise abatement procedure is not utilized between 6:00 a.m. and 10:00 p.m.

Implementation Details

Responsible Implementing Party: Ultimately, the PHL ATCT and pilot are responsible for the safe operation of aircraft. PHL ATCT would continue to instruct aircraft to follow the noise abatement procedures when not in conflict with weather, safety, or other ATCT procedures. The PHL Airport Noise Abatement Program Manager would continue to promote the use of the procedure through the Fly Quiet Program and Pilot and Community Awareness program.

Schedule of Implementation: As this measure is part of the existing procedures in place at PHL, implementation is ongoing.

Costs associated with Implementation/Funding: There are no direct additional costs associated with the continued implementation of this procedure, however, it is expected that staff time associated with monitoring noise results and encouraging its use would occur.

Relationship to Other Recommended Measures

Measures NA-1 and NA-2 outline the noise abatement departure flight paths for other runways at PHL. Alternative NA-L evaluated existing and proposed RNAV departure procedures which could further narrow the dispersion of flight paths over noise-sensitive development.

Preliminary Recommendations

**NA-3: Unless directed otherwise by PHL ATCT, aircraft weighing greater than 12,500 pounds departing from Runway 27R turn left to a 240-degree heading until reaching 3 DME, then turn right to a 255-degree heading until reaching 3,000’ Mean Sea Level.**
Recommended Noise Abatement Measure NA-4 (Alternative NA-F)

Nighttime Runway Use Program

**Description**

Approximately 12% of all PHL operations are expected to occur during the nighttime hours (10:00 p.m. to 7:00 a.m.) in 2013. Nighttime activity at PHL primarily consists of the conclusion of a passenger aircraft departure “push”, occasional aircraft arrivals, and cargo operations. The Airport maintains a nighttime runway use program designed to minimize aircraft overflights over noise sensitive areas during these hours. This runway use program is voluntary and informal in nature, and begins at 11:00 p.m. through 6:00 a.m.

When the airport is operating in west flow (a majority of the time), aircraft departures are directed to use Runway 27L then Runway 17. Aircraft arrivals are directed to use Runways 27L, 27R and 35. When weather conditions dictate that the airport operates in east flow, departing aircraft use Runways 09L, 09R, 08, and Runway 17, while arrivals use Runway 09R and Runway 35.

**East Operation:**
- Depart Runways 9L/9R/8
- Land Runway 9R
- Depart Runway 17
- Land Runway 35

**West Operation:**
- Depart Runway 27L
- Land Runways 27L/27R/26
- Depart Runway 17
- Land Runway 35

This runway use program maximizes the use of Runway 09R/27L, which is furthest from the residential areas and closest to the compatible land uses around the Delaware River. The graph below depicts a sample of average daily operations in March 2010. In this example, approximately 12% of operations occur during nighttime hours and approximately 3% occur during 10:00 p.m. to 11:00 p.m.

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Sample of Average Daily Hourly Distribution

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5 Daily operations, runway utilization, and hourly distribution vary.
For noise exposure modeling purposes, nighttime operations are those that occur between 10:00 p.m. and 7:00 a.m., however, the nighttime runway use program at PHL begins at 11:00 p.m. and ends at 6:00 a.m. Since the last Part 150 program at PHL, elements of the NY/NJ/PHL Metropolitan Area Airspace Redesign Project have been implemented, including the use of dispersed flight tracks for aircraft departures from Runways 27L/09R and 27R/09L. These flight tracks can be used, according to the ATCT, until 10:00 p.m. The feasibility of beginning the nighttime runway use program at 10:00 p.m. was considered and is herein recommended for implementation.

**Relationship to PHL Noise Environment**

Implementation of this measure would allow earlier implementation of the nighttime runway use program, which has the potential to reduce the number of overflights from Runway 17/35. Aircraft departures during west flow from Runways 27L and 27R can still take advantage of the traditional flight track that utilizes the river corridor.

**Noise Benefits**

The current runway use program maximizes the use of the compatible land use corridors around PHL, by using Runway 09R/27L for a majority of aircraft arrivals and departures. With the continued implementation of this measure, there would be no direct reduction to the number of persons within the DNL 65 dB noise exposure contour.

**Other Benefits**

Allowing the nighttime runway use program to formally begin at the conclusion of use of the ARD headings could provide a decrease in workload for the ATCT.

**Drawbacks**

No notable drawbacks exist with the continuation of the existing voluntary nighttime runway use program. Due to the nature of operations at PHL (a large passenger hub), occasional ‘shoulder hours’ (the beginning and ends of a departure or arrival push) can be busy and cause delay.

**Implementation Details**

**Responsible Implementing Party:** Ultimately, the PHL ATCT and pilot are responsible for the safe operation of aircraft. PHL ATCT would continue to instruct aircraft to follow the noise abatement procedures when not in conflict with weather, safety, or other ATCT procedures. The PHL ATCT maintains a Standard Operating Procedures guide, which currently specifies the nighttime runway use program beginning at 11:00 p.m. This measure would call for the PHL Airport Noise Abatement Program Manager to work with the PHL ATCT to develop revised language to include in the SOP, indicating that when feasible, the nighttime runway use program begin at 10:00 p.m. No additional actions would be required.

**Schedule of Implementation:** PHL ATCT adoption of increasing the use of the nighttime runway use program could begin at any time, although it is anticipated that the SOP would be updated first. The PHL Airport Noise Abatement Program Manager could begin drafting revised language and coordinating with the PHL ATCT at any time.

**Costs associated with Implementation/Funding:** It is possible that few aircraft may be subject to increases in fuel use associated with the nighttime runway use program, if the operation occurs between 10:00 p.m. and 11:00 p.m. These costs are difficult to quantify. No other costs are associated with the implementation of this measure.
Relationship to Other Recommended Measures

Alternative NA-M evaluated maximizing the use of Runway 27L, including during nighttime hours.

Preliminary Recommendations

NA-4: Modify the existing voluntary nighttime runway use program to begin at 10:00 p.m. and conclude at 6:00 a.m.
Recommended Noise Abatement Measure NA-5 (Alternative NA-X)
Engine Run-up Restrictions

Description

Measure NA-5 is a part of the existing condition, and stated:

Continue existing run-up procedures providing for location and orientation preferences with requirements for pre-approval and limitation to 20 minutes or less.

The PHL ATCT maintains a log of run up requests, indicating the location, requestor, aircraft type, time, duration, and reason for the run up. Run ups occur for reasons such as engine checks following maintenance, ongoing engine tests for aircraft undergoing service at PHL, or investigative issues. Engine run-ups are currently restricted to two locations on the airport – at the intersection of Taxiway K with Taxiway H (preferred location) with the aircraft facing east, and at the intersection of Taxiway P with Taxiway W, with the aircraft facing west. Figure 3-3 depicts the two locations on the airfield. Engine run-ups require prior approval by Airport Operations and are limited to twenty (20) minutes duration. Between 11:00 p.m. and 6:00 a.m., run-ups are restricted unless failure to conduct the run-up will delay the departure of a scheduled flight. In addition, these run-ups are to be conducted at the preferred east location.

Overall, analysis of engine run up logs indicated consistency with the parameters of the original noise abatement measure. Due to the locations of the engine run ups on the airfield, noise is not expected to cause notable intrusion beyond the limits of the airport property line. No changes or modifications to the noise abatement measure are recommended.

Relationship to PHL Noise Environment

This measure was approved by the FAA in the 2003 Record of Approval (ROA).

Noise Benefits

The continued implementation of this measure would provide no direct reduction to the number of persons within the DNL 65 dB noise exposure contour; however, limiting the duration and location of engine run ups provides as much mitigation as possible without constructing an engine run up enclosure or constructing a noise barrier along the perimeter of the airport.

Other Benefits

Limiting the location of engine maintenance run ups to specific locations on the airfield can reduce potential ATCT and pilot confusion and thereby potentially increase safety.

Drawbacks

Because engine run ups are performed occasionally at times when air traffic is low, some noise may be audible beyond the airport boundary.

Implementation Details

**Responsible Implementing Party:** No changes or modifications to the existing noise abatement measure are recommended at this time. The PHL ATCT should continue to log engine run ups, and the
PHL Airport Noise Abatement Program Manager should continue to periodically evaluate the run up activity and noise complaints. No additional actions are required for the continued implementation of this measure.

**Schedule of Implementation:** As this measure is part of the existing procedures in place at PHL, implementation is ongoing.

**Costs associated with Implementation/Funding:** There are no direct additional costs associated with the continued implementation of this procedure.

**Relationship to Other Recommended Measures**

Alternative NA-N evaluated the construction of a noise barrier to reduce the transmission of ground noise, including engine run ups.

**Preliminary Recommendations**

*NA-5: Continue existing run-up procedures providing for location and orientation preferences with requirements for pre-approval and limitation to 20 minutes or less.*
Noise Abatement Measures
Recommended Noise Abatement Measure NA-6 (Alternative NA-L)
Area Navigation (RNAV) and Required Navigation Performance (RNP)

Description

Traditionally, aircraft navigation is performed using visual references on the ground, or by a series of ground-based navigation equipment. First developed in the 1960’s, Area Navigation (RNAV) is a method of navigation that allows an aircraft to choose any course within a network of navigation beacons, as opposed to flying direct paths between navigation aids. The ability of an aircraft to fly point-to-point allows for shorter routes, an increase in safety, reduced controller workload, and the use of less fuel, as well as the potential to reduce noise impacts.

Required Navigation Performance (RNP) is method for measuring locational accuracy in airspace, or RNAV with performance monitoring and altering capability. RNP monitors the reliability of navigation systems and informs aircraft crew if certain requirements are not met. The capability of the system to monitor and alert enhances the crew’s situational awareness and could reduce obstacle clearance and route spacing. RNP operations require special training for the crew, and RNP equipped aircraft can operate in inclement weather at terrain-challenged airports and within close proximity of a parallel runway. This level of accuracy allows for reduced spacing, which thereby increases capacity, without derogating safety.

Area Navigation relies on the use of a sophisticated Flight Management System (FMS) in an aircraft. FMS is an integrated system that provides a centralized control system consisting of location information, navigation, fuel flow data and atmospheric data for flight planning and management. The FMS is essentially a computer containing sensor input data and a navigation database that includes navigation aids, waypoints, and airports. An aircraft must be equipped with an appropriate FMS that is capable of flying the desired approach. An onboard FMS would allow aircraft to fly curved flight tracks avoiding non-compatible land uses around an airport.

A number of airports in the United States utilize RNAV procedures, with participating airports increasing quickly. In October 2006, two RNAV Standard Terminal Arrival procedures were implemented at Phoenix Sky Harbor International Airport (PHX) and significant benefits included a 38% savings in time reduction of aircraft at level flight during step down altitudes in terminal airspace, an estimated $2.4 million savings by aircraft operators, and an estimated 2500 metric ton reduction in carbon dioxide. At Reagan National Airport in Arlington, VA, an RNP approach to Runway 19 was developed for use in inclement weather. This approach avoids restricted airspace by overlying an existing VFR approach that follows the Potomac River. Southwest Airlines is currently equipping their entire fleet of Boeing 737 aircraft to be able to fly RNP’s.

The Airspace Redesign Project evaluated changes to existing and proposed flight path locations that could benefit the noise environment. This included the enhancement of existing departure procedures from the two primary runways (Runways 09L/27R and 09R/27L) by utilizing RNAV procedures to define a specific location at which aircraft could commence turns, rather than a prescribed altitude, which varies by a number of variables including the type of aircraft, wind and weather conditions, and other factors. While the study identified potential noise benefits associated with these procedures, it also identified barriers to their implementation, including the acknowledgement that not all aircraft were equipped to take advantage of RNAV procedures and that each would require additional FAA coordination, environmental approval, and ATCT training.

A number of RNAV procedures are in place or in development at PHL. Standard Terminal Arrivals (STARs) transition aircraft into the terminal airspace. Published STARs with RNAV capabilities include the BOJID ONE, GUNNI, JIMGE, and SPUDS approach procedures. A STAR does not bring the aircraft all the way to the runway, but rather, to final waypoint at which point the PHL ATCT directs the aircraft with radar vectors, ensuring safe sequencing of arriving aircraft.
Instrument Approach Procedures (IAP) provide the transition from the STAR to the runway. At PHL, RNAV GPS procedures are in place for arrivals to all runways, and RNAV RNP (providing a higher level of accuracy) procedures are available on Runways 09L and 09R (including an arrival procedure that approximates the river corridor). Both STARS and IAPs supplement the existing navigation procedures in place at and around PHL, and can only be utilized by properly equipped aircraft and trained pilots.

RNAV departure procedures are also in place at PHL. The MIFLN ONE and STADM ONE DPs are used for departures from Runways 08, 09L, and 09R, and the GRDEN ONE and TBRIG ONE DPs are used for departures from Runways 27L and 27R. Aircraft are cleared immediately to 10,000 feet when using the RNAV DPs, thus maximizing the climb of the aircraft and reducing noise impacts.

The Airport and the PHL Noise Abatement Program Manager’s roles are limited as far as implementing RNAV procedures. The 2003 Part 150 study and the ARD both identified many potential RNAV overlays, and the FAA is implementing these over time. As such, this measure recommends that PHL continue to support the creation and use of RNAV procedures, and monitor use and noise levels.

### Relationship to PHL Noise Environment

2003 Part 150 Measure NA-6 recommended that PHL support creation of RNAV overlay procedures for selected existing and future flight procedures. This measure was approved by the FAA, was under consideration by the ARD study, and has been partially implemented.

### Noise Benefits

RNAV procedures define flight trajectories based on a series of three-dimensional points in space, rather than by visual or ground-based navigation aids. Combined with on-board Flight Management Systems that can adjust the flight track to account for wind variation, aircraft fly more precise paths, reducing the width of the flight corridor. This reduction in the width of the corridor also reduces the dispersion of noise. The implementation of this measure would not directly reduce the number of persons within the DNL 65 dB noise exposure contour, however it could be expected to provide single event noise level reductions.

### Other Benefits

RNAV procedures have the potential to increase safety by reducing the workload of air traffic controllers. Improved access and flexibility for point to point operations also help to reduce fuel burn and emissions. Where RNAV procedures are present, there has been a reduction in delays due to the increase in precision terminal area procedures.

### Drawbacks

One major obstacle to widespread use of RNAV procedures is the cost associated with equipping aircraft with the required avionics. Improvements in the availability of advanced avionics in aircraft may be slow and occur over a period of many years; however, most new aircraft are delivered to airlines and general aviation aircraft with advanced avionics.

In some cases when the fleet mix at the airport is diverse, air traffic control generally does not want some aircraft operating using RNAV procedures while other are not.

Also, while reducing the spread of flights along a corridor and condensing them along a single track may reduce noise emissions to a larger area, it may also subject the people under or near the track to more over-flights. And, to the extent that reduced separation permits more operations, the noise benefits might be offset by the increase in operations.

### Noise Abatement Measures
Implementation Details

Responsible Implementing Party: Ultimately, the PHL ATCT and pilot are responsible for the safe operation of aircraft. Similar to the implementation of other flight procedures, detailed implementation steps would be taken by the FAA. Testing of each procedure for both noise reduction effectiveness and air traffic control management would need to occur, with an airline or airport user willing to share the development costs. ATCT staff and airline pilots would require training to fly new arrival procedures. The PHL Noise Abatement Program Manager would monitor the utilization of existing and newly created RNAV procedures to evaluate potential noise benefits.

Schedule of Implementation: Implementation of RNAV procedures is ongoing.

Costs associated with Implementation/Funding: The FAA would incur costs in the development of new RNAV procedures. Additionally, it is anticipated that a partner airline would be involved in the flyability testing of the procedure prior to implementation, and that individual airlines would be required to train pilots and the FAA would need to train ATCT staff to utilize the procedures. No direct costs to PHL are identified with the implementation of RNAV procedures.

Relationship to Other Recommended Measures

Alternative NA-Q evaluated the arrival profile at specific navigation fixes, Alternative NA-R evaluated the use of the standard 3.0-degree arrival glide slope, Alternative NA-L evaluated RNAV procedures in use and proposed at PHL, Alternative NA-J evaluated maximizing the use of river corridor, and alternative NA-K evaluated Runway 27L & 27R departures.

Preliminary Recommendations

NA-6: Support efforts to implement RNAV procedures at PHL.
Recommended Noise Abatement Measure NA-7 (Alternative NA-Y)
Encourage Noise Attenuating Standards in Airport Development

**Description**

Throughout the PHL Master Plan process, Noise Abatement Measure NA-7, originally recommended in the 2003 Part 150 study, directs PHL to consider the potential of new airport development and its ability to reduce the transmission of ground noise. Measure NA-7 states:

Encourage noise attenuating standards in airport development.

Individual building location and construction could potentially reduce the transmission of ground-based noise from aircraft as they taxi, deice, perform engine maintenance run ups, or while idling at the gate. This measure directs the airport to consider the placement of buildings in such ways that the maximum noise reduction may occur. In this case, buildings could have the same effect as other mitigation efforts, such as noise barriers or berms.

This recommendation has been identified for continuation without modification.

**Relationship to PHL Noise Environment**

This measure was approved by the FAA in the 2003 ROA.

**Noise Benefits**

Final placement of structures is subject to Airport Layout Plan Approval and FAR Part 77 (airspace obstructions) analysis. The measure is intended to reduce intrusive ground noise events from aircraft that are on the ramp, taxiing, in ground roll before or after flight, or while being run up or otherwise being serviced. Plans for airport development should be evaluated for their potential to reduce ground noise throughout the planning process to assure design standards are maintained. It is not anticipated that the implementation of this measure would directly reduce the number of persons residing within the DNL 65 dB noise exposure contour.

**Other Benefits**

In addition to potential noise benefits, visual aesthetics may be a consideration when siting new airport development.

**Drawbacks**

In some cases, the noise abatement potential of new construction may not be the highest priority in design considerations. Other factors such as safety, building purpose and utility, property availability, and construction costs may have a higher priority.

**Implementation Details**

**Responsible Implementing Party:** PHL is responsible for the overall direction of the Master Plan and its associated development, although all final designs are subject to the FAA’s approval. Specific consideration would be given to FAR Part 77 analysis. As new development is proposed, PHL management could involve the PHL Airport Noise Abatement Program Manager for input on any potential noise issues or possible abatement. No further action is required at this time.

**Schedule of Implementation:** As this measure is part of the existing procedures in place at PHL, implementation is ongoing.
Costs associated with Implementation/Funding: New construction may have the potential to incur additional costs in order to facilitate noise abatement purposes. There are no additional direct costs to PHL, FAA, or other stakeholders associated with the continued implementation of this measure.

Relationship to Other Recommended Measures

Alternative NA-N evaluated potential locations suitable for the construction of a noise berm or wall.

Preliminary Recommendations

NA-7: Encourage noise attenuating standards in airport development.
Recommended Noise Abatement Measure NA-8 (Alternative NA-E)
Support the Development of Continuous Descent Arrivals

Description

Arrival procedures at major airports typically utilize a “step down” method, whereby an aircraft gradually descends then levels off and maintains that altitude until air traffic control instructs the aircraft to descend again. While this procedure assists air traffic control in maintaining safe separation between aircraft, when an aircraft must level off the aircrew must make adjustments to flap and thrust settings, thereby potentially using more fuel to maintain level flight, increasing both noise and emissions.

A Continuous Decent Approach (CDA) or Optimum Profile Descent allows an aircraft to perform a continuous descent at idle power from a high altitude to glide slope intercept on the final approach to the runway. While ICAO is currently working on a manual to standardize CDAs, presently there is no agreed upon international procedural definition of a CDA; however the intent of the procedure is to reduce the segments of level flight that cause thrust variations that in turn cause noise impacts over land.

In North America, the Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) conducted the first full test of a CDA procedure at Louisville International Airport, in conjunction with United Parcel Service in 2002. The use of CDA procedures requires onboard Flight Management System (FMS) for a managed idle descent and is most effective when aircraft are also RNAV capable for lateral trajectory management. While most newer aircraft are equipped, older aircraft may require upgrades to meet minimum required performance.

Continuous descent approach procedures are still in the early stages of development, and are not yet anticipated to be implemented on a large, nation-wide scale. However, as part of the ARD, the use of CDA procedures was included as part of the mitigation plan at PHL. The ARD study included a mitigation plan, which considered the implementation of CDA procedures during low-traffic times at PHL. The mitigation plan included an operational analysis which indicated that CDA procedures were most appropriate for aircraft arriving from the north, northwest, and southwest, and that it was expected that the procedures could be used during the entire nighttime period (10:00 p.m. to 7:00 a.m.). In the figure below, CDA procedures are depicted along with the ARD arrival flight tracks.
Since the implementation of CDA procedures is already anticipated to occur, PHL should support the FAA, ATCT, and aircraft operators to quickly implement procedures that may have specific noise benefits. The creation of new procedures, especially those that require FAA, ATCT, and airline coordination and on-board aircraft equipage, is beyond the scope of PHL. Therefore, this measure recommends that PHL actively support the creation and implementation of CDA procedures to the extent practical. During the development stage, the PHL Airport Noise Abatement Program Manager could offer important input regarding nearby noise-sensitive development.

Relationship to PHL Noise Environment

Measure NA-8 is a new measure in the PHL NCP.

Noise Benefits

An increase in the distance between source and receiver (airplane and ground) coupled with idle power settings on descent produce a reduction in noise exposure under the approach path prior to glide slope intercept. The tests at Louisville International Airport produced noise reductions of approximately 30%, or about 6 dBA noise reduction below 6,000 feet with the most notable reductions in single event noise levels at distances of 7-15 nautical miles from the runway end. The implementation of this measure would not directly reduce the number of persons within the DNL 65 dB noise exposure contour, however the eventual implementation of CDA procedures could be expected to provide single event noise level reductions.

Other Benefits

The benefits of CDAs extend beyond noise abatement and include reduced emissions and fuel burn, hence, providing an economic benefit to the air carriers. The reduced engine stress produced by idle thrust approaches may also contribute to lower maintenance costs during the life cycle of aircraft engines.

Drawbacks

The most significant constraint to widespread implementation of CDA procedures is the increased required separation of arriving traffic. Traditional approach procedures include a series of step-down procedures with ATCT personnel maintaining sequencing in part by adjusting aircraft speeds, while a CDA implies a constant speed during descent. However, different aircraft at idle thrust levels travel at different speeds due to the aerodynamics of the aircraft. As such, currently, CDA procedures are generally used during periods of low aircraft activity, often at night, when safe separation can be maintained.

Implementation Details

**Responsible Implementing Party:** Ultimately, the PHL ATCT and pilot are responsible for the safe operation of aircraft. Similar to the implementation of other flight procedures, detailed implementation steps would be taken by the FAA. Testing of the procedure for both noise reduction effectiveness and air
traffic control management would need to occur, with an airline or airport user willing to share the development costs. ATCT staff and airline pilots would require training to fly new arrival procedures.

**Schedule of Implementation:** It is anticipated that the implementation of CDA procedures would occur in the later stages of the implementation of the Airspace Redesign (approximately 2012 or beyond).

**Costs associated with Implementation/Funding:** The FAA would incur costs in the development of new arrival procedures. Additionally, it is anticipated that a partner airline would be involved in the testing of the procedure prior to implementation and all airlines would be required to train pilots to fly the procedures. No direct costs to PHL are identified with the implementation of CDA procedures.

**Relationship to Other Recommended Measures**

Alternative NA-Q evaluated the arrival profile at specific navigation fixes, Alternative NA-R evaluated the use of the standard 3.0-degree arrival glide slope, and Alternative NA-L evaluated RNAV procedures in use and proposed at PHL.

**Preliminary Recommendations**

*NA-8: Support efforts to implement CDA procedures at PHL.*