

APPENDIX B NOISE ABATEMENT AND LAND USE ALTERNATIVES

During the course of the Part 150 Study Update for T.F. Green Airport, the following Noise Abatement and Land Use alternatives were evaluated. The status of each, relative to the recommended Noise Compatibility Program is indicated in the listing. Program Management measures are an outgrowth of the other alternatives and are not evaluated as separate alternatives, but rather are developed as implementation tools for other measures.

NOISE ABATEMENT ALTERNATIVES

Noise abatement alternatives are those actions that may be implemented by the users or controllers of aircraft in flight or on the ground. They consist of measures that have been previously approved as part of the Noise Compatibility Program, or are new alternatives that may or may not prove beneficial to the overall operational and abatement program of the airport. The first fourteen measures listed below represent aircraft-related measures that were included in the airport's original Noise Compatibility Program prepared and adopted in 1986. Several have been implemented and completed; others have not been enacted. Fifty-eight additional noise abatement measures were evaluated for their feasibility to reduce the effects of noise conditions present.

Adopted Noise Abatement Program Measures

Alternative NA-1: *Construct fillet at intersection of Runways 5R/23L and 10/28.* Before construction of the fillet, aircraft made a 180-degree turn on the runway just north of the intersection of Runway 5R/23L with Runway 16/34. This turn required the application of additional thrust, which increased ground noise exposure in adjacent areas. The construction of the fillet allowed landing aircraft to quickly exit Runway 5R with less power. This measure is complete. The alternative is included to maintain numeric consistency and to retain the origin of the action.

Recommendation: Completed measure no further action.

Alternative NA-2: *Construct parallel taxiway serving Runway 5R/23L.* The construction of a taxiway parallel to and serving the takeoff end of Runway 5R would reduce taxi-related noise levels in portions of the Strawberry Field Road area by increasing aircraft-to-receiver distance. This measure has been incorporated into the Airport Master Plan for development, but has not yet been constructed.

Recommendation: Retain measure without modification.

Alternative NA-3: Construct noise barrier parallel to Runway 5R extension. The barrier has been constructed. A barrier parallel to Runway 5R/23L in the Strawberry Field Road West area, designed to shield residential areas exposed to noise resulting from nearby ground operations, pre-takeoff run-ups, and aircraft departing on Runway 5R, was included in the 1986 NCP. The alternative is included to maintain numeric consistency and to retain the origin of the action.

Recommendation: Completed measure, no further action.

Alternative NA-4: Incorporate noise barrier consideration in the design of proposed air cargo building. The air cargo building with which this measure was associated was not constructed where anticipated. Therefore this measure is no longer appropriate for inclusion in the NCP. The measure number is included to maintain numeric consistency.

Recommendation: Withdraw measure from NCP.

Alternative NA-5: Displace landing threshold on Runway 5L. A displacement of the landing threshold for Runway 5L by 1,070 feet was recommended to reduce noise levels under the approach to that runway from the south, over the residential area also benefited by measure NA-3. The displacement was accomplished and the measure is in effect. It will be recommended for continuation. The alternative is included to maintain numeric consistency.

Recommendation: Completed measure, no further action.

Alternative NA-6: Physical isolation of maintenance run-ups. When the Rhode Island Air National Guard operated out of the airport, maintenance run-ups were a problem, particularly for residents of neighborhoods off the east end of Runway 10/28 (no longer in use). When the Guard was relocated to Quonset Airport in 1980, the majority of the maintenance run-ups were eliminated. While the relocation of the Guard pre-dated the adopted NCP, the measure was included to assure that should any future maintenance base for airline, general aviation or military users be located at the airport in the future, the measure would be in place and apply. Specific locations were not indicated.

Recommendation: Continue as an implemented measure.

Alternative NA-7: Voluntary nighttime restrictions for scheduled air carrier operations. The adopted NCP called for a voluntary program in which no airline takeoffs or landings would be scheduled between midnight and 6:30 a.m. The measure has been partially implemented through a 1996 Memorandum of Understanding between the Airport Corporation and the City of Warwick to apply the voluntary restriction of scheduled arrival and takeoff times to the hours between midnight and 6:00 a.m. The measure does not prohibit the use of the airfield during the voluntary "curfew" period.

Recommendation: Continue as an implemented measure.

Alternative NA-8: Auxiliary power unit restrictions. The 1986 NCP recognized that the use of auxiliary power units (APUs) was not then a source of annoyance at the Airport since their use occurred at the terminal or north of the cargo building. An Airport Operations Directive was issued to assure the restriction of APU usage to these locations. This measure is being continued.

Recommendation: Continue as an implemented measure.

Alternative NA-9: Restrictions on aircraft repositioning under power. The 1986 NCP found that a restriction on aircraft repositioning under power would be beneficial only on the south apron at the airfreight building in the Evans Avenue area. An Airport Operations Directive was issued to assure the restriction of repositioning under power at this location.

Recommendation: Continue as an implemented measure.

Alternative NA-10: Pre-takeoff run-up restrictions. The 1986 NCP designated pre-flight run-up locations for takeoffs from Runways 5L, 28, and 34 to increase the distance between such activity and adjacent neighborhoods. In each case, the designated run-up area resulted in a reduction of 6 to 10 decibels during the event. Subsequent to the 1986 NCP, Runway 28 was closed and the associated run-up location has been eliminated.

Recommendation: Modify the measure to remove citations referencing Runway 10-28. Continue measure for Runway 5L and 34 takeoffs.

Alternative NA-11: Informational program on reverse thrust. An informational program to inform pilots of the effects of reverse thrust on the annoyance to residents of communities immediately adjacent to the airport was included in the 1986 NCP. The NCP suggested the preparation of leaflets for distribution to all jet pilots operating at the airport, as well as posters to be mounted in crew lounges. Pilots were asked to voluntarily reduce the application of reverse thrust, consistent with safety.

Recommendation: Continue as an implemented measure and renew efforts.

Alternative NA-12: Rotational runway use program. A program of rotational runway use, calling for the alternating use of each runway, consistent with safety, was recommended and adopted as part of the 1986 NCP. In practice, the measure was found to be generally impractical, owing to the short lengths of the runways and the desire for operation on the runway most directly aligned into the wind. Consequently, the use of a rotational use system could not be consistently implemented. It is not recommended for continuation, but the measure number is included to maintain numeric consistency.

Recommendation: Withdraw measure from NCP.

Alternative NA-13: Helicopter operation procedures. This adopted measure called for helicopters using the airport to cross the airport boundary at or above 1,000 feet MSL during arrivals and departures. The relocation of an Army Guard helicopter unit to Quonset Airport reduced the annoyance associated with helicopter operations. This measure is not considered to be a safe or efficient operation for the locally-based helicopter operations because of their placement on the north boundary of the airfield, particularly for those aircraft bound to the north. In order to comply with the measure, the northbound

helicopter operations would have to hover towards the south airfield, turn, and fly back north to cross the airport boundary at or above 1,000 feet MSL. This measure is being withdrawn from the 1998 NCP. The measure number is being retained to maintain numeric consistency.

Recommendation: Withdraw measure from NCP.

Alternative NA-14: *Restrictions on 180 degree turns on runway, unless operationally necessary.* The original measure was adopted to address the noise impacts associated with aircraft turning around on Runway 5R after missing an exit at Runway 16/34. Since adoption, a fillet has been constructed (see NA-1) and the problem addressed by the measure has been resolved. Nevertheless, the measure is recommended for continuation to discourage the use of 180 degree turns on the runway, except when required by taxiway closure and/or maintenance.

Recommendation: Continue as an implemented measure.

Additional Noise Abatement Program Measures

Alternative NA-A-1: *Request the airlines and other operators to observe a voluntary curfew of flight operations between 10:00 p.m. and 7:00 a.m.* A voluntary curfew would not be subject to Part 161 review if compliance with it were strictly at the option of the user. The current voluntary curfew extends from midnight to 6:00 a.m. The summer 1998 schedule indicated that the air carriers scheduled 14 landings between 10:00 p.m. and midnight and 17 takeoffs between 6:00 a.m. and 7:00 a.m. The rescheduling of these operations into the period between 7:00 a.m. and 10:00 p.m. would likely result in the loss of connections to other cities through the first departure bank at each carrier's hub and the loss of late connections into the area from the carriers last banks. This would impact upon the ability of local businesspersons to conduct same day business at remote locations. Because the airport is an end-of-the-line airport, there is little likelihood that the schedules could be adjusted to accommodate the proposed curfew times and still maintain the level of service now available. Further, as the measure is voluntary, it is likely that the curfew would not be substantively followed.

Recommendation: Discontinue consideration.

Alternative NA-A-2: *Implement and enforce a mandatory curfew on flight operations between 10:00 p.m. and 7:00 a.m.* This measure would have the same disadvantages as the previous alternative, as well as be subject to review under FAR Part 161. The airport believes the disadvantages associated with this measure would result in disruption of the local economy as well as the ability of local businesses to compete in a larger marketplace. The time required to prepare Part 161 documentation would assure that the measure would apply only to Stage 3 jets and prop/turboprop aircraft (Stage 2 aircraft will be phased out by December 31, 1999).

Recommendation: Discontinue consideration.

Alternative NA-A-3: *Implement and enforce adopted Measure NA-7 as a mandatory curfew on all flight operations between midnight and 6:30 a.m.* This measure would make mandatory the voluntary curfew approved as Measure NA-7 of the adopted NCP. The

imposition of penalties and fines associated with enforcement of the curfew would make it subject to the provisions of Part 161. A mandatory restriction on flight operations would not allow for late arrivals caused by weather or mechanical delays and could impose a significant inconvenience to arrivals that would otherwise be legal. Further, it would eliminate eight current departures scheduled between 6:00 a.m. and 6:30 a.m. This action is considered to be a restraint on interstate travel and trade.

Recommendation: Discontinue consideration.

Alternative NA-A-4: *Implement and enforce as mandatory the currently practiced voluntary curfew between midnight and 6:00 a.m.* The voluntary curfew now in place at the airport is acceptable because it is strictly voluntary and no penalties are imposed for breach of the curfew period. However, if made mandatory, it would be subject to the restrictions of FAR Part 161.

Recommendation: Discontinue consideration.

Alternative NA-A-5: *Discourage engine maintenance run-ups during the period of the voluntary nighttime flight operations curfew of NA-7.* The airport has operating policies that preclude the use of late-night engine maintenance run-up activity. The NCP could formalize this restriction to reflect the hours of any adopted curfew. This action would have little effect on maintenance run-ups, unless they impacted directly on the ability of an aircraft to be used for an early morning flight.

Recommendation: Discourage engine maintenance run-ups during the midnight to 6:00 a.m. voluntary curfew period for scheduled operations.

Alternative NA-A-6: *Implement a noise level restriction that prohibits aircraft having certified noise levels above a selected level.* The imposition of a restriction of the use of the airport by aircraft that exceed a predetermined noise level, whether defined by Part 36 stage or by certified decibel level would require the completion and adoption of a Part 161 study. Restrictions that affected Stage 3 aircraft would also require FAA approval of the study.

Recommendation: Discontinue consideration.

Alternative NA-A-7: *Implement a moratorium on new flights for a minimum of 20 years.* The imposition of any measure that limits the number of operations at the airport is, by definition and specification, subject to the provisions of FAR Part 161. Furthermore, a moratorium on new flights could adversely impact upon the potential sustained economic growth. Lack of adequate or competitive air transportation connections to other areas is frequently cited as a reason for corporations to abandon communities for better-situated cities. This measure runs counter to the RIAC's responsibilities to advance the economic development of the state.

Recommendation: Discontinue consideration.

Alternative NA-A-8: *Restrict scheduled operations to aircraft originally designed to Stage 3 noise standards; eliminate retrofit Stage 3 aircraft.* Aircraft which have been modified and certified as meeting Stage 3 noise levels are, under the requirements set forth by Part

36, Stage 3. Whether they are a loud or quieter Stage 3 aircraft is not at issue under the provisions of Part 36. Impositions of restrictions on retrofit or re-engined Stage 3 aircraft would trigger the requirement for an FAR Part 161 study, the results of which would require FAA approval before implementation. In many cases, retrofit Stage 3 aircraft actually produce lower noise levels than aircraft originally designed to meet Stage 3 noise levels. Consequently, the restriction of modified Stage 3 aircraft would discriminate against a specific group of aircraft and is unlikely to be approved by the FAA.

Recommendation: Discontinue consideration.

Alternative NA-A-9: *Establish a passenger capacity limit based on the number of annual passengers served. Set limits for each year or at a maximum of six million passengers annually.* The number of passengers served by an airport bears only an indirect relationship to the amount of noise generated by the aircraft that move those passengers. Six million annual passengers can be transported on approximately 16.5 fully loaded 747's per day, on 55 fully loaded MD80s per day, or on 257 fully loaded 32-passenger turboprop aircraft. The noise characteristics and exposure patterns of each of these conditions are significantly different. At any airport, the mix of aircraft used to serve the passenger demand is a function of the aircraft in the carrier fleet, the number of tickets sold to specific destinations or along specific routings, the scheduled time of operation, and the total number of passengers. There is no effective way to limit passenger use without limiting the number of aircraft using the airport. Limitations on operations are discriminatory and subject to Part 161 evaluations. Consequently, the measure is not considered feasible for noise abatement.

Recommendation: Discontinue consideration.

Alternative NA-A-10: *Move all military, cargo and general aviation activity to other airports such as Quonset and North Central.* Part 161 requirements are triggered when a category of user is discriminated against by a specific formal action of the airport. Further, the RIAC is developing facilities at supplemental airports in an attempt to make them more attractive to non-scheduled users. Even so, general aviation and cargo operators are expected to continue to use T.F. Green until such time as the airport becomes crowded enough to force them to other facilities. It is unlikely that any such development will occur within the time frame indicated by the five-year projection of the Part 150 evaluation that would result in a substantive reduction in noise levels at PVD.

Recommendation: Discontinue consideration.

Alternative NA-A-11: *Discourage, when safe and practicable, engine start-ups and auxiliary power unit starts prior to the end of the nighttime voluntary curfew.* The restriction on run-up activity recommended for inclusion in the NCP under measure NA-A-5 could be extended to include pre-flight run-ups and aircraft power unit (APU) starts within the curfew period. If extended to include these actions, scheduled flights by turboprop aircraft could be delayed during the colder months when engines must be warmed up before flight. Such warm-up periods might take as much as 20 to 30 minutes during the coldest weather and could result in delays of that length for the earliest scheduled turboprop departures. The FAA has recently mandated pre-flight engine warm-ups during sub-freezing temperatures to assure smooth continuous engine operation during

flight. During summer months, much less warm-up time is necessary and it is unlikely that this measure would result in significant delays. The measure would be less necessary during the cold months, because nearby residents would presumably have their windows closed early in the morning, while during the warmer spring, summer and fall months, windows would be more likely to be open. Consequently, seasonal application of the measure could be reasonable.

Recommendation: Discourage, when safe and practicable, engine start-ups and auxiliary power unit starts prior to the end of the nighttime voluntary curfew.

Alternative NA-B-1: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 5R by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria. The evaluation of Close-In departure procedures for use from Runway 5R indicates that for the near term (until 2000), noise levels will be reduced by approximately 1.5 DNL for the fleet and by as much as 4 decibels for individual Stage 2 aircraft and Stage 3 retrofit aircraft. Use of the Close-In procedure would result in a reduction of 266 dwellings within the 65 DNL contour for 1998 conditions, and virtually no change in the impacts for 2003 conditions. The table below indicates the noise level differences between standard and close-in procedures at a point 19,000 feet from the start of takeoff roll and along the extended departure centerline of the runway. Use of the Close-In procedures by Stage 3 aircraft were shown to have little to no benefit over the standard Distant procedures in use by the carriers operating from the airport.

Aircraft type	Close-In NADP - Rwy 5R	Standard Departure - Rwy 5R
727-200 (Stage 2)	95.9	98.3
737-200 (Stage 2)	85.2	86.7
737-200 (Stage 3)	80.8	82.8
DC9-30 (Stage 3)	83.8	82.6

Recommendation: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 5R by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria.

Alternative NA-B-2: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 23L by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria. The evaluation of Close-In departure procedures for use from Runway 23L indicates that for the near term (until 2000), noise levels will be reduced by approximately one DNL for the fleet and by as much as 3 decibels for individual Stage 2 aircraft and Stage 3 retrofit aircraft. Use of the Close-In procedure would result in a reduction of 281 houses within the 65 DNL noise contour for 1998 conditions, and virtually no change in the impacts for 2003 conditions. The table below indicates the noise level differences between standard and close-in

procedures at a point 19,000 feet from the start of takeoff roll and along the extended departure centerline of the runway. Use of the Close-In procedures by Stage 3 aircraft were shown to have little to no benefit over the standard Distant procedures in use by the carriers operating from the airport.

Aircraft type	Close-in NADP - Rwy 23L	Standard Departure - Rwy 23L
727-200 (Stage 2)	96.4	98.8
737-200 (Stage 2)	85.5	87.1
737-200 (Stage 3)	81.1	83.2
DC9-30 (Stage 3)	86.9	85.6

Recommendation: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 23L by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria.

Alternative NA-B-3: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 16 by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria. The evaluation of Close-In departure procedures for use from Runway 16 at the airport indicates that for the near term (until 2000), noise levels for the fleet will not be noticeably reduced, but individual Stage 2 aircraft and Stage 3 retrofit aircraft will experience reductions of as much as 3.5 decibels. Use of the Close-In procedure would result in a reduction of 14 houses within the 65 DNL noise contour for 1998 conditions, and virtually no change in the impacts for 2003 conditions. The table below indicates the noise level differences between standard and close-in procedures at a point 19,000 feet from the start of takeoff roll and along the extended departure centerline of the runway. Use of the Close-In procedures by Stage 3 aircraft were shown to have little to no benefit over the standard Distant procedures in use by the carriers operating from the airport.

Aircraft type	Close-In NADP - Rwy 16	Standard Departure - Rwy 16
727-200 (Stage 2)	96.2	99.3
737-200 (Stage 2)	86.1	87.7
737-200 (Stage 3)	81.7	83.7
DC9-30 (Stage 3)	86.6	85.3

Recommendation: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 16 by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria.

Alternative NA-B-4: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 34 by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria. The evaluation of Close-In departure procedures for use from Runway 34 at the airport indicates that for the near term (until 2000), noise levels will be reduced by less than one DNL for the fleet, but by as much as three decibels for individual Stage 2 aircraft and Stage 3 retrofit aircraft. Use of the Close-In procedure would result in a reduction of 10 houses within the 65 DNL noise contour for 1998 conditions, and virtually no change in the impacts for 2003 conditions. The table below indicates the noise level differences between standard and close-in procedures at a point 19,000 feet from the start of takeoff roll and along the extended departure centerline of the runway. Use of the Close-In procedures by Stage 3 aircraft were shown to have little to no benefit over the over the standard Distant procedures in use by the carriers operating from the airport.

Aircraft type	Close-In NADP - Rwy 34	Standard Departure - Rwy 34
727-200 (Stage 2)	97.1	100.2
737-200 (Stage 2)	86.6	88.3
737-200 (Stage 3)	82.2	84.4
DC9-30 (Stage 3)	87.6	86.2

Recommendation: Designate FAR 91-53 Close-In Noise Abatement Departure Procedures (NADP's), as developed and applied by each carrier for its own system-wide needs, as the airport's preferred procedure for takeoffs on Runway 34 by Stage 2 jet aircraft and Stage 2 jet aircraft modified to meet Stage 3 noise criteria.

Alternative NA-B-5: Designate FAR 91-53 Distant Noise Abatement Departure Procedures (NADPs), as developed and applied by each carrier for its own system-wide needs, as the Airport's preferred procedure for takeoffs on Runway 34 by jets weighing more than 75,000 pounds. Although the Close-In procedure would result in a slight reduction in the number of persons within the 65 DNL noise contour to the northwest of the airport for 1998 conditions, it would result in increased noise levels beyond the 65 DNL noise contour over more densely populated land uses. The Distant procedure would result in a reduction of noise over areas exposed to cumulative noise levels less than 65 DNL. It would include more persons within the 65 DNL noise contour than would the Close-In procedure. For consistency of operation and to avoid the potential introduction of confusion, it is advisable to maintain a single departure procedure as preferred from all runways.

Recommendation: Discontinue consideration.

Alternative NA-B-6: Request that all operators of all air carriers and business jets use maximum climb procedures for takeoffs from Runway 34. While the use of a maximum climb procedure from Runway 34 would theoretically result in more distance between departing aircraft and noise sensitive land uses under the takeoff path, the retention of takeoff power for longer periods necessary to reach higher altitudes before thrust reduction

would result in higher noise levels. Furthermore, the measure would introduce a non-standard departure procedure for local use. Such procedures are precluded by FAA Advisory Circular 91-53A. Therefore, the measure would not benefit noise reduction or be feasible.

Recommendation: Discontinue consideration.

Alternative NA-B-7: *Request that all jet operators use one engine to taxi between the runways and parking positions.* The use of a single-engine to taxi between the ramp parking position and the runway end (whether after landing or before takeoff) is a measure which could cut taxi noise by three decibels for two-engine aircraft, 4.7 decibels for three-engine aircraft, and by six decibels for four-engine aircraft. Prior to takeoff, all engines must be warm and checked for proper operation, so this measure will require that engine checks be conducted at the runway end before takeoff, rather than at the gate as is now conducted. After landing, checks on engine operation are not a deterrent to safe operation. However, aircraft engines can not be safely shut down immediately after landing and exiting the runway. Due to the relatively short taxi distance between the runways and the terminal area this action would have little or no effect on noise exposure since engine shut down would occur very close to the terminal area.

Recommendation: Discontinue consideration.

Alternative NA-B-8: *Limit the use of reverse thrust by landing aircraft to idle power and require the use of the full length of the runway for landing.* Owing to the relatively short lengths of the two principal runways, any formal restriction on the use or amount of reverse thrust used is likely to adversely impact on the safety of some landing operations.

Recommendation: Discontinue consideration.

Alternative NA-C-1a: *Departing Runway 5R, all southbound jet aircraft turn right to a 100 degree heading until reaching 2.5 DME (from the PVD VORTAC), passing over Passeonkquis Cove, Gaspee Point Beach and Narragansett Bay before being vectored to assigned heading.* This measure is intended to route all jet traffic to the Block Island departure gate away from the more densely-populated residential and public use areas located along the extended centerline of Runway 5R departures to a course that more quickly reaches the compatible Narragansett Bay. Propeller aircraft could be assigned divergent headings by ATCT for separation. The route expected for this operation passes over the less intensely undeveloped open spaces along Passeonkquis Cove. This alternative, in combination with Alternative NA-C-3 is expected to reduce the number of dwellings within the 65 DNL noise contour north of the airport by approximately 145 units. This reduction is largely achieved by the reduction of the area of flight dispersion present under existing conditions through a concentration of those flights into a more focused area of overflights.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-1b. *Departing Runway 5R, all jets bound to Putnam fix turn right as soon as practicable after passing runway end to a 100 degree heading until reaching 2 DME (from the PVD VORTAC), passing over Passeonkquis Cove and Gaspee Point Beach before turning to assigned heading to departure fix. This measure is intended to route jet traffic to the Putnam departure gate away from the more densely-populated residential and public use areas located along the extended centerline of Runway 5R departures to a course that more quickly reaches the compatible Narragansett Bay. The route expected for this operation passes over the less intensely undeveloped open spaces along Passeonkquis Cove. The measure calls for jet aircraft to turn left after reaching the shoreline, a procedure which would require aircraft to cross the missed approach course from Runway 5R, creating potential airspace conflicts. Furthermore, the measure would route significant portions of departure traffic over neighborhoods not previously overflowed and into airspace reserved for Boston approaches. Because of these disadvantages, the measure is not considered beneficial to noise abatement.*

Recommendation: Discontinue consideration.

Alternative NA-C-2. *Departing Runway 5R and passing runway end, all turboprops and piston prop aircraft bound to Block Island (7WH fix) turn right as soon as practicable after passing runway end to a 195 degree heading, turning over Occupessatuxet Cove and Narragansett Bay. This measure is a companion to Measure NA-C-1a, and provides for an intended separation of prop and turboprop traffic from the jet aircraft using the procedure set forth by NA-C-1a. An immediate turn to a 195-degree heading from Runway 5R will result in a turn to overfly less developed residential areas east of the Airport. However, evaluations by the ATCT have indicated that this alternative would result in a conflict with Runway 5 and Runway 34 arrivals. It is more operationally feasible to use the same route for propeller aircraft, with a divergent heading, as the jet aircraft.*

Recommendation: Discontinue consideration.

Alternative NA-C-3. *Departing Runway 5R, all jet aircraft turn left as soon as practicable after passing runway end to fly a 360 degree heading until reaching 2.8 DME (from the PVD VORTAC); then fly direct to Putnam. This measure is intended to route all traffic to the Putnam departure gate away from the more densely populated residential and public use areas located along the extended centerline of Runway 5R departures to a course which flies over the more compatibly developed commercial and industrial areas along U.S. Highway 1. Propeller aircraft may be assigned a divergent heading by ATCT for separation. This measure, in combination with Measure NA-C-1a is expected to reduce the number of dwellings within the 65 DNL noise contour north of the airport by approximately 145 units. This reduction is largely achieved by the reduction of the area of flight dispersion present under existing conditions through a concentration of those flights into a more focused area of overflights.*

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-4. *Departing Runway 5R and passing runway end, all turboprops and piston prop aircraft bound to Putnam fix turn left as soon as practicable after passing runway end and fly direct to Putnam. This measure is intended to route Putnam bound*

prop and turboprop traffic away from the more densely-populated residential and public use areas located along the extended centerline of Runway 5R and to a course that flies over the more compatibly developed commercial and industrial areas along SR-37. An evaluation of this measure by ATCT has concluded that this measure is not necessary and that it is more operationally feasible to route the propeller aircraft on the same route, with a divergent heading, as the jet aircraft.

Recommendation: Discontinue consideration.

Alternative NA-C-5: *Departing Runway 23L, all jets turn left at 1.2 DME to intercept a 3 DME arc from the PVD VORTAC, to cross the 185 radial; then direct to Block Island (7WH fix).* This measure is intended to route both Putnam and Block Island jet departures from Runway 23L over the middle of Greenwich Bay. The measure routes Putnam traffic directly away from the most desirable route, while it routes Block Island departures generally away from the departure fix. More importantly, the measure would route departure traffic into and through the downwind approach stream to the active runway (23L), located east, and southeast of the airport. Because of this conflict, the measure is not considered implementable without significant disruption to air traffic control and efficiency.

Recommendation: Discontinue consideration.

Alternative NA-C-6: *Departing Runway 23L, all jet aircraft bound to Block Island (7WH fix) turn left as soon as practicable after passing runway end to a 160 degree heading until reaching 5 DME (from the PVD VORTAC); then direct to Block Island (7WH fix).* Prop and turboprop departures would continue to fly runway heading or turn to divergent courses at the discretion of Air Traffic Control. This measure is intended to route all jet departures from Runway 23L over Greenwich Bay and the middle of Goddard Memorial State Park. Many of the complaints about aircraft in the environs are associated with departures over residential areas along the extended centerline of Runway 23L beyond the 65 DNL contour. Residents have pleaded for relief from both departure noise and arrival noise from Runway 5R approaches. While it is virtually impossible to relocate instrument approaches from the area, it is possible to provide relief by redirecting departure traffic to more compatible areas. This measure would turn Runway 23L takeoffs bound to the Block Island area to a compatible course over Greenwich Bay and over Goddard Memorial State Park prior to turns on course. The route would result, in association with Measure NA-C-8, in a reduction of noise on hundreds of homes beyond the 65 DNL contour.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-7: *Departing Runway 23L, all Block Island (7WH fix) jet departures turn right as soon as practicable after passing runway end to a 240 degree heading until reaching 4 DME (from the PVD VORTAC); then direct to assigned course.* This measure is intended to direct jet departures, below approximately 3,000 feet, over the compatible land uses adjacent to I-95, near SR-4. At the same time, the desirable separation between jet and prop traffic would be left to the discretion of the FAA Air Traffic Control. While this measure would likely result in a reduction in the number of dwellings overflown in the area beyond the 65 DNL contour south of the airport, the shift in location is not sufficient

enough to be perceived as a significant change. Furthermore, the route described (and necessary in this case to focus on compatibly used areas) would fly directly toward the principal descent area for most arrivals into the airspace. Consequently, the measure is not considered to be implementable.

Recommendation: Discontinue consideration.

Alternative NA-C-8: *Departing Runway 23L, all Putnam jet departures turn right as soon as practicable after passing runway end to a 280 degree heading until reaching 3 DME (from the PVD VORTAC); then direct to Putnam.* This measure is intended to direct jet departures, below approximately 3,000 feet, over areas of compatible land use in downtown Apponaug and along the I-95 and SR-115 corridors. A right turn as soon as practicable from Runway 23L would direct Putnam departures by jet aircraft toward the desired departure, and generally over more compatible commercial and open space areas to the west-southwest of the airport. The traffic would be removed from a broad area of residential usage south of Apponaug. The aircraft would overfly an area of schools west of I-95, well beyond the area of 60-65 DNL noise contour. At the same time, the desirable separation between jet and prop traffic would be left to the discretion of the FAA Air Traffic Control. Owing to the substantial benefits accruing to the residential areas of Cowesett and Chepiwanoxet from this measure, its implementation is considered advantageous to the general noise reduction in the area. The route would result, in association with Measure NA-C-8, in a reduction of noise on hundreds of homes beyond the 65 DNL noise contour.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-9a: *Departing Runway 34, all Block Island (7WH fix) jet departures turn left as soon as practicable after passing runway end to a 200 degree heading until crossing the 250 Radial (from the PVD VORTAC); then direct to assigned course.* This measure is intended to direct jet departures, below approximately 3,000 feet, over the compatible land uses adjacent to the I-95 and I-295 corridors. Departures from Runway 34 have the advantage of overflying generally compatible land until reaching points approximately 1.5 miles from the end of the runway. Further, much of the land immediately west of the airport is developed as industrial, transportation and open space uses compatible with the aircraft noise. Consequently, a procedure that takes advantage of the presence of such uses will reduce general noise exposure on non-compatible uses. This measure results in a focusing of jet departure traffic to the south from Runway 34 along a course designed to fly over these compatibly used lands. Evaluations conducted by ATCT indicate that this measure would create conflicts with the arrival flows to Runway 5R and Runway 34 and is not feasible to safely implement.

Recommendation: Discontinue consideration.

Alternative NA-C-9b: *Departing Runway 34, all Block Island (7WH fix) jet departures turn right to a 360 degree heading until reaching a position 2 DME northeast of the PVD VORTAC, then direct to assigned course.* This measure is intended to direct jet departures, below approximately 3,000 feet, over the compatible land uses adjacent to the I-95 Pawtuxet River corridors. Departures from Runway 34 have the advantage of overflying

generally compatible land until reaching points approximately 1.5 miles from the end of the runway. Reviews late in the planning process indicated that left turns from Runway 34 would result in airspace conflicts between traffic departing Runway 34 direct to Block Island and arriving traffic into the Runway 5R or 34 approaches. Consequently, a procedure that turns aircraft away from these inbound flows is required. This measure results in a focusing of jet departure traffic to the south from Runway 34 along a north circling course designed to fly over compatibly used lands along the highway and river. At the same time, the desirable separation between jet and prop traffic would be left to the discretion of the FAA Air Traffic Control.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-10: *Departing Runway 34, all Putnam jet departures turn left as soon as practicable after passing runway end to a 330 degree heading until reaching 4 DME (from the PVD VORTAC); then direct to Putnam.* This measure is intended to direct jet departures below approximately 3,000 feet over areas of compatible use along SR-37 and I-295. A slight turn to the left from the extended centerline of the runway (by 10 - 20 degrees) would move Putnam departures from directly over large residential areas of Cranston to over large compatible areas along the two highways for approximately four miles from the runway end. The measure would, in combination with Measure NA-C-9a, result in a reduction of 28 houses located within the 65 DNL noise contour, as well as many more houses located beyond the 65 DNL noise contour. This reduction is largely the result of a focusing of traffic along procedural routes and a limitation on the dispersion of traffic present under current operating conditions.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-11a: *Departing Runway 16, all Block Island (7WH fix) jet departures turn right as soon as practical to a 180 degree heading until reaching 3 DME (from the PVD VORTAC); then direct to assigned course.* This measure is intended to direct jet departures, below approximately 3,000 feet, over areas of more compatibly used land along Brush Neck Cove and Greenwich Bay. Runway 16 is infrequently used for jet departure operations (approximately two to four percent). Therefore, any measure which changes the jet departure procedures from Runway 16 will have little effect on the noise contours southeast of the airport. This measure would redirect jet departure traffic bound to the Block Island area along a course 23 degrees to the right of the extended centerline, passing over Warwick Park and Brush Neck Cove before reaching Greenwich Bay. This measure would result in an increase in the number of houses within the 65 DNL noise contour by 65, but would eliminate southbound overflights above large areas of residential usage located on Warwick Neck which receive noise levels of less than 60-65 DNL.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-11b: *Departing Runway 16, all Putnam jet departures turn right as soon as practical to a 180 degree heading until reaching 3 DME (from the PVD VORTAC); then direct to assigned course.* This measure continues the turn initiated by

Measure NA-C-11a for jet aircraft bound to the Putnam fix northwest of the airport. The measure would result in the continued overflight of Greenwich Bay until aircraft are at altitudes generally above 3,000 to 4,000 feet when they cross back over the shoreline near the Potowomut River south of Goddard Memorial State Park. The measure is generally used today for Putnam departures from Runway 16, but turns are now made much earlier than would be provided for by the use of a 3 DME fix for turns, and overfly developed areas south of the airport.

Recommendation: Discontinue consideration.

Alternative NA-C-12a: *Departing Runway 16, all Putnam jet departures turn left as soon as practicable to a heading of 090 degrees until reaching 3 DME (from the PVD VORTAC); then direct to assigned course.* This measure is intended to place traffic over commercial properties and open space along Buckeye Creek, north of SR-117. The alternative would require turns of 70 degrees at relatively low altitudes to achieve the desired effect of placing traffic over the most compatible areas. Once reaching the shoreline of Narragansett Bay, aircraft would continue their left turns to assigned headings to reach the Putnam fix. This course may encroach upon the commonly used airspace shared with Boston which lies northeast of the airport. Furthermore, the compatible area is a narrow corridor sandwiched by larger areas of residential use. The effect would be comparable to threading a needle to achieve noise abatement -- an approach that is typically unsuccessful in meeting its desired goal. The measure is not considered implementable and is not assured of noise level reduction over incompatible areas.

Recommendation: Discontinue consideration.

Alternative NA-C-12b: *Departing Runway 16, all Block Island (7WH fix) jet departures turn left as soon as practicable to a heading of 090 degrees until reaching 2.5 DME (from the PVD VORTAC), crossing the shoreline of Narragansett Bay, then turn right direct to assigned heading.* This measure is intended to apply the initial course established by Alternative NA-C-12a to those jets bound to the south. The alternative would require turns of 70 degrees at relatively low altitudes to achieve the desired effect of placing traffic over the most compatible areas. Once crossing the shoreline, aircraft would turn back to the right by approximately 100 degrees to exit the area. Furthermore, the compatible area is a narrow corridor sandwiched by larger areas of residential use. The effect would be comparable to threading a needle to achieve noise abatement -- an approach that is typically unsuccessful in meeting its desired goal. The measure is not considered implementable and is not assured of noise level reduction over incompatible areas.

Recommendation: Discontinue consideration.

Alternative NA-C-13: *Departing from all runways, all jets maintain runway heading until reaching 3 DME (from the PVD VORTAC) before turning to assigned heading. All prop and turboprop aircraft turn right or left as soon as practicable to assigned divergent courses and fly assigned courses to enroute fixes.* This measure is intended to limit the dispersion of jet overflights from broad areas off the end of each runway and concentrate the activity along narrow corridors from each runway end. This measure is likely the easiest to achieve of those evaluated, but would result in increases in the number of dwellings within the 65 DNL noise contour by a total of 59 houses.

Furthermore, it would continue direct overflights of densely populated areas beyond the 65 DNL contour without relief from current noise conditions. Finally, the restriction of departures to a single course from each runway would reduce the flexibility now available to air traffic controllers to achieve an efficiency of flight operations.

Recommendation: Discontinue consideration.

Alternative NA-C-14: *Approaching Runway 5R, establish a visual approach course which flies over the middle of Greenwich Bay and intercepts the final approach course over Apponaug Cove (one mile south of the runway threshold).* This measure suggests the development of an approach course over the middle of Greenwich Bay that would intercept the final approach course near Arnolds Neck at Apponaug Cove. While the desired procedure, if extensively used, would remove much of the noise impact from approaches from the Cowesett and Chepiwanoxet communities, it is unlikely that turns of 90 degrees or more within two miles of the landing threshold would ever be accepted by pilots of large aircraft if other measures are available. Furthermore, the desired approach course would potentially conflict with recommended departure procedures from Runway 5R. Therefore, the measure is not considered safe or implementable.

Recommendation: Discontinue consideration.

Alternative NA-C-15: *Approaching Runway 23L, jet aircraft establish downwind approaches over Narragansett Bay and the Providence River and intercept final approach course beyond the shoreline.* This measure is the general instrument approach procedure to Runway 23L today, although it currently requires the overflight of East Providence to establish final approach courses. The maintenance of overflights solely over Narragansett Bay and the Providence River would require acute turns onto final approaches of approximately 120 degrees. Without course guidance, this procedure would result in frequent overshoots of the final approach and incursions into neighborhoods north and northwest of Roger Williams Park, which have not been frequently overflown by approaches in the past. Consequently, the maintenance of the "downwind" portion of the approach above the river is not considered feasible or beneficial to noise abatement. Continuation of the existing instrument approach procedure is recommended.

Recommendation: Discontinue consideration.

Alternative NA-C-16: *Approaching Runway 34, jet aircraft intercept the final approach course before crossing the shoreline at Rocky Point beach on Warwick Neck (4 DME from PVD VORTAC).* Radar evaluations of approaches to Runway 34 indicate that final courses are intercepted at varying distances from the landing threshold, and frequently within the shoreline at Warwick Neck. This measure would assure that all jet aircraft intercept and follow a single instrument (ILS) approach course along the extended centerline of the runway from beyond the shoreline. The result would be a concentration of approach traffic into a single predictable corridor of impact that may then be mitigated under eligibility standards.

Recommendation: Request that FAA develop procedures to implement the alternative.

Alternative NA-C-17: Approaching Runway 23L, establish a visual approach course which intercepts the final approach course 1 mile north of the runway threshold. Radar data indicates that the final courses of many approaches to Runway 23L are made within one to two miles of the landing threshold. The use of visual approach courses in excellent weather conditions would likely not reduce the number of persons or dwellings impacted by aircraft noise, but they may potentially spread the impact over a broader area. The course envisioned for the procedure would direct aircraft in visual contact with the airport to cross over the shoreline at Rock Island and Slater Grove Memorial Park to intercept the final approach south of Posneganset Pond. Testing of this procedure by FAA Air Traffic resulted in the removal of this procedure because air carrier aircraft could not make the desired turn.

Recommendation: Discontinue consideration.

Alternative NA-C-18: Approaching Runway 5R, establish a charted visual approach with an initial VOR/DME approach course along the 210 Radial of the PVD VORTAC, sidestepping at 3 DME to intercept the final approach course. The intent of this visual approach procedure is to provide a course for aircraft over Greenwich Cove, east of East Greenwich, until the aircraft reaches a position where a sidestep to final approach would be required. The suggested Radial is 17 degrees off of the final approach course, and turns of this amount should be achievable without significant difficulty. The effect of the measure is to move low level overflights from above residential areas of Cowesett and Chepiwanoxet to more compatibly used water and vacant areas under the Radial course. Evaluations by the Air Traffic Control Tower have found that this procedure would be virtually impossible to implement while maintaining efficiency and safety in the airspace.

Recommendation: Discontinue consideration.

Alternative NA-D-1: Implement a preferential runway use program which designates Runway 34, extended to the southeast by 2,100 feet, as preferred for use when tail winds are 3 knots or less and cross winds do not exceed 15 knots. Implementation of a runway use program which concentrates both landing and takeoff traffic into a northwesterly flow by extending the runway 2,100 feet to the southeast would significantly reduce the number of dwellings within the 65 DNL (and likely achieve the comparable results within lower noise levels) by 1,034 units. The net change in dwelling units is indicated in the following table for each direction from the airport.

Noise Contour Area	2003 Noise Contour with Alternative NA-D-1	Change from 2003 Baseline
Northeast	58	- 805
Southeast	514	+ 345
Southwest	67	- 785
Northwest	368	+ 211
Total within 65 DNL	1,007	- 1,034

While the preferential runway use procedure would benefit noise reduction in the community, the extension of the runway would be difficult to achieve on noise benefits alone. While only 7,100 feet of useable pavement is required to make Runway 16-34 the longest runway on the airport, and thus preferred for air carrier jet operations, an extension of 2,100 feet to the current 6,081 foot long runway would be required. The runway does not have a standard 1,000-foot runway safety area at its northwest end. New construction would remove the grandfathered waiver of this condition presently at T.F. Green, and any modification of the length of the runway may require that the standard length requirements be met. Therefore, the full length of the runway must be extended beyond 8,100 feet to achieve the status of longest runway and meet standard safety area requirements. Southeast of the runway is an area of 20 acres of wetlands that would need to be replaced as part of the construction project. The cost of constructing the runway and replacing the wetlands is estimated at in excess of \$58 million. The combination of new impacts to the southeast and northwest, coupled with the wetland impacts and the cost of the project appear to make the measure unlikely to be accomplished, particularly in the five-year projected term of the Part 150 study. However, the noise benefits are sufficient enough to warrant further study in a Master Plan or Runway Rehabilitation Study.

Recommendation: Discontinue as Noise Abatement Alternative. Recommend further study as part of Master Plan or Runway Rehabilitation Study.

Alternative NA-D-2a: *Implement a preferential runway use program which designates Runway 34, extended to the southeast by 600 feet and to the northwest by 500 feet (plus a 1,000 foot safety area), as preferred for use when tail winds are 3 knots or less and cross winds do not exceed 15 knots. This measure is similar to measure NA-D-1, except that the wetland impacts are reduced significantly from those of the previous measure by limiting construction to the southeast to the area now present within the runway safety area. A runway use program which concentrates both landing and takeoff traffic into a northwesterly flow by extending the runway 600 feet to the southeast and 1,500 feet to the northwest (including a 1,000 foot safety area) would significantly reduce the number of dwellings within the 65 DNL noise contour (and likely achieve the comparable results within lower noise levels) by 1,034 units. The net change in dwelling units is indicated in the following table for each direction from the airport.*

Noise Contour Area	2003 Noise Contour with Alternative NA-D-2	Change from 2003 Baseline
Northeast	47	- 816
Southeast	364	+ 195
Southwest	70	- 782
Northwest	381	+ 224
Total within 65 DNL	862	- 1,179

By constructing 500 feet of runway and an additional 1,000 feet of safety area to the northwest, the construction cost of the project would increase significantly. Airport Road, an east-west arterial on the north boundary of the airport would need to be relocated northward around the safety area. U.S. Highway 1 (Post Road) would need to be relocated

westward adjacent to the AMTRAK rail tracks, and numerous businesses and residences would have to be acquired to compile the land necessary for the project. The land includes a major shopping center located directly under the centerline. The cost of land acquisition and construction is estimated to exceed \$118 million. Therefore, the measure is not considered to be feasible or cost-effective within the current five-year planning horizon for noise mitigation purposes.

Recommendation: Discontinue consideration.

Alternative NA-D-2b: *Implement a preferential runway use program which designates Runway 34, extended to the southeast by 600 feet and to the northwest by 500 feet (plus a 1,000 foot safety area), as preferred for takeoffs when tail winds are 3 knots or less and cross winds do not exceed 15 knots. This measure is identical to that of NA-D-2b with the exception that the preference for Runway 34 would be applied only to takeoffs. Landings would be continued to all runways in their current use levels. The net change in dwelling units is indicated in the following table for each direction from the airport.*

Noise Contour Area	2003 Noise Contour with Alternative NA-D-2b	Change from 2003 Baseline
Northeast	92	- 771
Southeast	169	No change
Southwest	270	- 582
Northwest	379	+ 222
Total within 65 DNL	910	- 1,131

Obviously, the limitation of the runway use program to departure only will have little effect on the noise exposure pattern in the airport environs. There is no benefit to be gained from construction cost reduction through the measure and the amount of wetlands impacted by this measure remains the same as for NA-D-2a. The measure is not considered feasible for development.

Recommendation: Discontinue consideration.

Alternative NA-D-3: *Implement a preferential runway use program which designates Runway 34, at its present length, as preferred for takeoff when cross winds do not exceed 15 knots and no tail wind is present. This alternative considers the benefit for noise abatement that would be present if Runway 34 were not extended but were still designated as preferred for all takeoff operations. The use of this procedure was tested by FAA Air Traffic and was found to not be feasible because of the length of Runway 16/34. Air carrier aircraft would not typically use the runway; and when the smaller aircraft did use the runway, it created potential conflicts on the ground and in the air.*

Recommendation: Discontinue consideration unless Runway 16/34 was extended to a length equal to or greater than Runway 5R/23L.

Alternative NA-D-4: Regularly vary runways used for touch-and-go training activity. The use of a runway for touch-and-go training operations is dependent upon the winds and on activity present on other runways. The purpose of a short parallel runway is to provide a safer runway for training operations, separated from the itinerant activity using the other runways. To deviate from the focused use of Runway 5L-23R for training activity would introduce less safety into the system by creating a greater mix of aircraft types and by reducing efficiencies of air traffic flow. The measure will have little to no effect on the location of the noise exposure contours. After Runway 5L-23R is reopened, its pattern will be non-standard and located principally over compatibly used lands west of the airport.

Recommendation: Discontinue consideration.

Alternative NA-E-1: Add a high-speed exit from Runway 23L, which exits to Taxiway D. This measure was designed to accomplish two noise-reducing functions. First, the construction would allow aircraft landing on Runway 23L to quickly exit the runway, with consequent improvements in capacity and potentially reduced application of reverse thrust to slow to make a sharper exit turn. Second, the exit would reduce the number of landings that use the full length of the runway and reduce ground noise levels in the south portions of the Strawberry Field Road neighborhood. Evaluations of runway and taxiway design standards found that the location of a high-speed exit would not afford any noise benefits due to the short length of the runway.

Recommendation: Discontinue consideration.

Alternative NA-E-2: Extend existing noise barrier south to the Runway 5R safety area boundary. The extension of the existing noise barrier west of the departure end of Runway 5R by five hundred feet to the south would reduce single event noise levels on additional residences in the Strawberry Field Road neighborhood. A 500-foot extension of the existing berm and wall barrier on the west side of the departure end of Runway 5R would result in a reduction on the properties on the west side of the barrier of only two to four decibels from northbound departures. The measured attenuation between the runway end and points behind the barrier farther to the north was approximately eight to 12 decibels. Care must be taken to assure that the berm is not extended into the critical Part 77 surfaces at the runway end or that it does not encroach upon the Glide Slope Critical Area for the Runway 5R approach. The cost of construction is estimated to be approximately \$300,000 based on the cost of construction for the existing barrier.

Recommendation: Incorporate this measure into the ALP and extend the existing barrier along the west boundary of the airport to attenuate noise from runway operations on Runway 5R.

Alternative NA-E-3: Construct a noise barrier (wall or earthen berm) along the east side of the airport between Airport Road on the north and the lower Buckeye Brook to the south. A berm similar to that constructed under Measure NA-3, and topped by a seven foot width T-wall, located along the east side of the airport would provide several decibels of noise reduction. If extended from the northwest corner of the neighborhood west of Warwick Pond to the intersection of Airport Road and Buckeye Brook, noise levels from departures on Runway 23L on the Hoxsie neighborhood could be reduced by six to 12

decibels. If extended along the west and southwest portions of the neighborhood west of Warwick Pond, between the residences and the noise created by departures on Runway 23L and 34, and reverse thrust from landings on those same runways, noise levels could be reduced by eight to 12 decibels, dependant on location. If a berm were extended to reduce the noise impacts from departures at the southeast end of Runway 34, the noise levels over adjacent residences along Lake Shore Drive could be reduced by approximately nine to 15 decibels, dependent on the height of the barrier. In general, noise attenuation is a function of the height of the barrier (berm and wall), with overall heights of 24 feet achieving about twice the benefit of a barrier 12 feet high. The estimated cost for construction of the barrier along the east side of the airport is approximately \$3,700,000, based on the construction cost of the existing barrier. The measure would benefit approximately 195 homes on the west side of Warwick Pond and approximately 70 homes north of Warwick Pond. The homes that would benefit most from this berm/wall fall within the current sound insulation program boundary.

Recommendation: Incorporate this measure into the ALP and construct a 24-foot barrier (combination berm and wall, with T-section top) along the east boundary of the airport to attenuate noise from runway operations on Runways 23L and 34.

Alternative NA-E-4 Construct a 1,500-foot noise barrier on the east side of Warwick Industrial Drive north of SR-113 from Strawberry Field Road south to the Runway 5R safety area boundary. This berm would provide noise reduction benefits from pre-flight run-ups, taxi movements at the runway end, and initial takeoff thrust application to residences east of the berm location. It is estimated that the reduction of these single events would approximate eight decibels, based on the achieved reduction from the berm on the west side of the runway. The cost for construction of a 24-foot high barrier is estimated to be \$720,000. The measure would benefit approximately 154 houses in the neighborhood. Care must be taken to assure that the berm is not extended into the critical Part 77 surfaces at the runway end or that it does not encroach upon the Glide Slope Critical Area for the Runway 5R approach. The homes that would benefit most from this berm/wall fall within the current sound insulation program boundary.

Recommendation: Incorporate this measure into the ALP and construct a 24-foot barrier (combination berm and wall, with T-section top) along the east boundary of the airport to attenuate noise from runway operations on Runways 5R.

Alternative NA-E-4a: Construct a 1,600-foot long, 12-foot high noise wall parallel to and on the north side of Strawberry Field Road West along the Airport property line. This wall would provide noise reduction benefits from pre-flight run-ups, taxi movements at the runway end, and initial takeoff thrust application to residences east of the berm location. It is estimated that the reduction of these single events would approximate eight decibels, based on the achieved reduction from the berm on the west side of the runway. The cost for construction of a 24-foot high barrier is estimated to be \$720,000. The measure would benefit approximately 154 houses in the neighborhood. The homes that would benefit most from this berm/wall fall within the current sound insulation program boundary.

Recommendation: Incorporate this measure into the ALP and construct a 12 foot barrier along the south boundary of the airport along Strawberry Field Road to attenuate noise from runway and taxiway operations.

Alternative NA-E-5: Construct vegetative barriers (trees and heavy shrubbery) around the airport where noise barriers are desirable. Research has indicated that for heavy vegetation to achieve significant noise reduction, the growth area must be several hundred feet wide to achieve the same level of reduction provided by barriers. There is insufficient land area to accommodate such plantings on the airport.

Recommendation: Discontinue consideration.

Alternative NA-E-6: Construct run-up enclosures or hush-houses for aircraft engine maintenance run-up operations. The construction of special structures for run-up noise abatement, costing in excess of \$1,000,000, would not be very effective when there is significant distance between the run-up location and the affected residences. The barrier construction of Measures NA-E-3 and NA-E-4 would achieve the same effect, and also attenuate noise from other sources on the airfield. The attenuation of run-up noise is more cost-effectively addressed through the techniques of Alternative NA-E-7.

Recommendation: Discontinue consideration.

Alternative NA-E-7: Designate a run-up position and orientation for maintenance run-up activity. A specific location and orientation of aircraft for run-ups could reduce noise by physically locating the aircraft away from nearby incompatible uses, and if properly oriented, the flow of noise from the source could be reduced. The loudest noise levels around an aircraft undergoing a run-up are typically found in front and 45 degrees from the direct rear of the aircraft. The selection of a preferred run-up location in the center of the airfield (say on a pad constructed south of Taxiway V near the VORTAC) would isolate run-ups in the center of the airfield. An orientation with the aircraft aligned parallel to Runway 5-23 or east/west would direct the majority of the noise away from the nearby residential areas. The cost of the measure would be associated with taxiing to the location and paint for the marking of the location on the taxiway pavement and if necessary constructing a run-up pad (\$100,000).

Recommendation: Modify the ALP and establish the location for maintenance run-ups. Revise airport operating policies directing maintenance run-ups are conducted at the specified location.

Alternative NA-E-8: Designate helicopter operating routes to and from the airport. The helicopter measure of the adopted NCP is non-specific in that it merely requires that helicopters depart the airfield at or above 1,000 feet MSL. While this is an accomplishable measure for aircraft bound to the south, west or east from the north-side helicopter operations area, it is unsafe for aircraft bound to the north. Discussions with the helicopter pilots, the Air Traffic Control Tower and the RIAC resulted in an agreement to publish an Airport Facility Directive requesting helicopter pilots to overfly non-residential areas as safety allows. In addition, local helicopter routes were defined and will be made part of a "fly-quiet" publication for pilots. Maps of the local routes will also be made available through RIAC's noise abatement office. The lack of large numbers of helicopter flights and the fact that the intent of this measure is better served outside of the Part 150 process has led to the measure being removed from consideration in the NCP.

Recommendation: Discontinue consideration as individual measure. Incorporate the intent of the measure into other measures where applicable.

Alternative NA-F-1: *Impose fines for deviations (violations) of the Part 150 NCP.* Any measure that imposes fines based on deviations from voluntary measures makes those mandatory. Consequently, if made mandatory and applied to the voluntary curfew, they would become subject to the provisions of Part 161. If associated with flight corridor usage and deviations from it, the imposition of fines is virtually impossible to police. Consequently, fines are not functional for flight measures or possible for access-based restrictions.

Recommendation: Discontinue consideration.

Alternative NA-F-2: *Implement a sliding scale landing fee surcharge based on the hours of scheduled activity or type of aircraft flown.* A variable landing fee based on hours of operation or noise level (aircraft type) would be directly subject to Part 161 evaluations. It is likely that any such measure would be considered discriminatory and potentially in restraint of trade. Consequently, such measures are not considered feasible.

Recommendation: Discontinue consideration.

Alternative NA-F-3: *Provide landing fee credits for use of "quiet" aircraft during more sensitive times (i.e., early morning).* The provision of landing fee credits for quiet aircraft is a measure that once established, would be difficult to cancel. Based on the phase out of all Stage 2 aircraft in scheduled service by the end of 1999, it is not believed that this measure would accomplish any of the desired noise abatement effects.

Recommendation: Discontinue consideration.

LAND USE ALTERNATIVES

Land use mitigation actions are those measures that attempt to mitigate the impacts of noise on incompatible land uses left within the higher noise levels after implementation of the air traffic actions of the Noise Compatibility Program. Land use measures are by nature either preventive, attempting to prevent future incompatible uses by using land use controls, or corrective, which attempt to mitigate incompatible land uses. The first six measures listed below represent land use measures that were included in the airport's original Noise Compatibility Program prepared and adopted in 1986. Several have been implemented and completed; others have not been enacted. Thirteen additional land use measures were evaluated for their feasibility to enhance the compatibility of the airport environs.

Alternative LU-1: *Rezone selected residential properties within the 70-75 DNL noise contour.* This measure in the approved 1986 NCP was recommended so that properties acquired by the airport were rezoned to compatible use. In addition, it recommended the rezoning of the Hillsgrove neighborhood west of the airport to limited business or commercial zoning. Rezoning this area would eliminate any further development of residential land uses and noise-sensitive public facilities from the noise-impacted area. Since property owned by the RIAC is not subject to zoning, this measure is no longer applicable.

Recommendation: Withdraw measure from NCP.

Alternative LU-2: Amend the subdivision regulations within noise impacted areas. This is a previously approved measure to prevent encroachment of non-compatible uses in the airport noise impact area by requiring mitigation measures to be included in the design of a structure as a condition of approval from the Warwick Planning Board. Changing subdivision regulations would have to occur at the State level. Since the potential for new subdivision development occurring within the 65 DNL noise contour is extremely low, this measure is not recommended for continuation.

Recommendation: Withdraw measure from NCP.

Alternative LU-3: Amend the State of Rhode Island Building Code to require that new construction and major additions within or immediately adjacent to the 2003 Noise Exposure Map, based on the 65 DNL noise contour of the 2003 NCP, meet an interior noise standard through the use of sound insulation techniques. This alternative is a continuation of a previously approved measure to require new construction to meet an interior noise standard of 45dB. Implementation of this measure would ensure that new residential development would be compatible with airport noise. Building code amendments are needed to comply with proposed FAA policy to prohibit FAA funds to be used for mitigation of homes built after the publication of the Noise Exposure Maps.

Recommendation: Retain as an approved measure. Work with the State of Rhode Island and the City of Warwick to amend the building codes.

Alternative LU-4: Voluntary acquisition of residential structures located within the 70 DNL noise contour. All residential structures within the 75 DNL noise contour of the 1986 NCP have been offered acquisition. This measure would extend the voluntary acquisition program to the 70 DNL of the 2003 NCP contour. There are approximately 210 housing units located with or adjacent to the 70 DNL contour.

Recommendation: Continue with modification.

Alternative LU-5: Sound insulate schools within the 65 DNL noise contour. The 1986 Part 150 Study recommended the sound insulation of all schools within the 65 DNL and has been completed. The following schools were sound insulated under this program: Holliman Elementary; Wickes Elementary; Pilgrim High School; Veterans High School; and St. Rose of Lima Elementary. No schools are located within the 65 DNL of the 2003 noise contour and therefore, the measure is recommended to be withdrawn from the 1998 NCP.

Recommendation: Measure completed.

Alternative LU-6: Provide sound insulation for single-family houses, on a voluntary basis, within the 2003 Noise Exposure Map, based on the 65 DNL contour of the 2003 NCP. It is recommended that RIAC offer sound insulation to homeowners whose homes are within the 2003 NEM boundary, based on the 65 DNL contour of the 2003 NCP. The sound insulation program will provide mitigation for incompatible land uses while maintaining the integrity and stability of the residential neighborhood. As a condition of receiving sound insulation, avigation easements would be attached to the property deed. Sound insulation is being used successfully as part of the 1986 NCP to make incompatible houses into compliance with the FAA's standards for noise compatibility.

Recommendation: Retain as an implemented measure.

Alternative LU-A: Continue Measure LU-1 to rezone selected residential properties between 70-75 DNL. See LU-1 for discussion.

Recommendation: Discontinue consideration.

Alternative LU-B: Continue Measure LU-2 to amend the subdivision regulations within noise impacted area. See LU-2 for discussion.

Recommendation: Discontinue consideration.

Alternative LU-C: Continue Measure LU-3 to amend the State Building Code within noise impacted area. See LU-3 for discussion.

Recommendation: Retain as an approved measure. Work with the State of Rhode Island and the City of Warwick to amend the building codes.

Alternative LU-D: Create a noise overlay zoning district to regulate land use development in noise-sensitive areas. An overlay zone may be placed over existing zoning to add, modify, or eliminate one or more conditions while not affecting the conditions of the existing zone. Implementation of this measure could enhance the compatibility of land uses surrounding the airport. However, evaluation by the City of Warwick concluded that adoption of a Noise Overlay Zone would be difficult. The City recommended that creating such a zone could be construed as a confiscatory taking and that the purposes and potential benefits of a zone could be incorporated into an update of the city's Comprehensive Plan.

Recommendation: Discontinue consideration.

Alternative LU-E: Implement a formal Fair Disclosure Policy whereby the State of Rhode Island amends the Fair Disclosure Policy legislation to require formal disclosure of noise levels on residential property located within a 65 DNL noise contour and is supplemented by information on aircraft noise levels distributed by airport staff within the community and among the citizens, neighborhood associations, developers, real estate agencies, and lenders. RIAC should institute a policy to advise potential developers, real estate agents, lenders, and buyers of properties that certain areas may be impacted by aircraft noise and overflights. The policy would provide actual, or constructive, disclosure to potential residents in the airport vicinity. Such disclosure is intended to advise a prospective buyer where the property is located in relation to current noise exposure contours; allowing the prospective buyer to make an informed decision.

Since all existing residential property in the noise impact area will be sound insulated by RIAC, most potential buyers may find these properties acceptable. Most importantly, they will do so with full knowledge of aircraft noise levels prior to committing to their purchase.

The key to a formal disclosure policy is that legal requirements will be imposed upon the developers, real estate agents, lenders, and buyers. It is RIAC's desire to institute legislation to change the real estate disclosure notices in the State of Rhode Island to include language that would inform the prospective buyer that a home is located inside of a 65 DNL noise contour. In addition, information about the disclosure should be

disseminated to the developers, real estate agents, lenders, and buyers by airport staff. The main responsibility for implementing the program should fall to the Noise Program Manager, in concert with other staff members. There are several methods of disseminating the information necessary for the formal Fair Disclosure Policy. While many techniques may evolve over a period of time by the RIAC's staff, a number of key actions may be initiated including public progress reports, noise program bulletins, direct contacts with Federal Housing Administration and Veterans Administration and presentations to organizations.

Recommendation: Implement a formal Fair Disclosure Policy whereby the State of Rhode Island amends the Fair Disclosure Policy legislation to require formal disclosure of noise levels on residential property located within a 65 DNL noise contour and is supplemented by information on aircraft noise levels distributed by airport staff within the community and among the citizens, neighborhood associations, developers, real estate agencies, and lenders.

Alternative LU-F: Establish notification system to inform residents of impending zoning changes around the airport. This alternative was designed to keep the community surrounding the airport, the airport, and the City of Warwick in close contact when zoning changes were being considered around the airport. It was determined through the Technical Advisory Committee meetings that this alternative would be difficult to implement and would cause an undue burden on the City of Warwick Planning.

Recommendation: Discontinue consideration.

Alternative LU-G: Negotiate and coordinate all future property acquisition with property owner and local neighborhood association. This alternative would be an inappropriate violation of the property owners' rights in negotiating a real estate transaction.

Recommendation: Discontinue consideration.

Alternative LU-H: Establish a planning subcommittee with RIAC, the City of Warwick, and citizens for review and approval of any new or rezoning efforts. This alternative was designed to keep the community surrounding the airport, the airport, and the City of Warwick in close contact when zoning changes were being considered around the Airport. It was determined through the Technical Advisory Committee meetings that this alternative would be difficult to implement and would cause an undue burden on the City of Warwick Planning.

Recommendation: Discontinue consideration.

Alternative LU-I: Establish a 50-50 grant program to provide funds to sound attenuate homes, schools, daycare, and pre-schools within the 60 DNL noise contour. Federal and State funding priority for such a grant would extremely low thus could not be implemented in a reasonable timeframe.

Recommendation: Discontinue consideration.

Alternative LU-J: RIAC should work with the City of Warwick to redevelop acquired land to compatible land use. This measure would enhance the compatibility of surrounding land use by rezoning all acquired land to compatible use once it has been determined it has no aviation use. The City of Warwick indicated that this alternative is not practical, but the intent of it could be incorporated into the Comprehensive Plan process to encourage compatible use within the 65 DNL noise contour.

Recommendation: Discontinue consideration.

Alternative LU-K: The City of Warwick's Comprehensive Plan should be updated to address airport influence on the surrounding community; and where appropriate to encourage compatible land uses within the 2003 Noise Exposure Map boundary, based on the 65 DNL noise contour of the 2003 NCP. The City of Warwick's Comprehensive Plan is an important tool for establishing policies to guide future development around the airport. Within this plan, the city is divided into separate planning districts. The city's Planning Board is responsible for conducting updates of the Comprehensive Plan. The Warwick City Council is responsible for adopting the Comprehensive Plan updates conducted by the city Planning Board. The city's Planning Board and the city council should consider one of two options for addressing the impact of the airport. The first option is to create a new planning district (noise impact planning district) based on the 2003 NEM boundary. The other option is to address the airport's impact on existing planning districts, again based on the 2003 NEM boundary.

In both cases, the Comprehensive Plan should identify the 2003 NEM boundary, based on the 65 DNL noise contour of the 2004 NCP, as the airport's minimum area of influence. Within this area, the Comprehensive Plan should address informal and formal fair disclosure policies, encourage amendments to the building code, and where appropriate recommend zoning that is compatible with the airport.

The Technical Advisory Committee addressed this issue and suggested that the Permanent Board which "district" option should be pursued in planing for the impact of the airport.

Recommendation: RIAC should work with the City of Warwick to update the Comprehensive Plan to address airport influence on the planning districts.

Alternative LU-L: Initiate formal study to evaluate the noise levels at various schools located under heavily used flight paths for eligibility for sound insulation. A formal study would be conducted to evaluate the noise levels at the following schools: John Brown Francis School, and E.G. Robertson School. In order to more accurately assess the impact of noise on schools, the study would focus on the aircraft events occurring during typical school hours. The results of the analysis could lead to recommendation for sound insulating some or all of the schools.

Recommendation: Contract to have study prepared on the noise impacts of schools under heavily used flight tracks.

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