FINAL FAA RNAV and RNP Procedures at Denver International Airport, Centennial Airport and Rocky Mountain Metropolitan Airport Environmental Assessment and

Finding of No Significant Impact (FONSI) / Record of Decision (ROD)

August 2012

Federal Aviation Administration

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Finding of No Significant Impact (FONSI)
&
Record of Decision (ROD)

For the Implementation of RNAV/RNP Procedures at Denver International Airport, Centennial Airport, and Rocky Mountain Metropolitan Airport

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I. INTRODUCTION

This document serves as the Federal Aviation Administration's (FAA) Finding of No Significant Impact and Record of Decision (FONSI/ROD) and provides final agency determinations and approvals for the proposed action, namely utilization of Performance-Based Navigation (PBN) by implementing new Area Navigation (RNAV) procedures, including Required Navigation Performance (RNP) and Optimized Profile Descent (OPD), in the Denver Complex Airspace which includes Denver International Airport (DEN) and two satellite airports, Centennial Airport (APA) and Rocky Mountain Metropolitan Airport (BJC). The proposed routes and procedures are designed to improve the safety and efficiency of the Denver Complex Airspace which includes the Terminal Radar Approach Control (TRACON) airspace as well as in high-altitude Air Route Traffic Control Center (ARTCC) airspace. This FONSI/ROD is based on the information and analysis contained in the Final Environmental Assessment (Final EA) dated August 2012 attached hereto.

Furthermore, this FONSI/ROD:

- Completes the FAA's required environmental review and decision-making process. It is prepared and issued to announce and document certain Federal actions and decisions

in compliance with the National Environmental Policy Act of 1969 (NEPA) [42 U.S.C. Section 4321, et seq.], the implementing regulations of the Council on Environmental Quality (CEQ) [40 CFR Parts 1500-1508] and FAA directives [Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures* (Mar. 20, 2006)]. This FONSI/ROD is also used by the FAA to demonstrate and document its compliance with the several procedural and substantive requirements of aeronautical, environmental, programmatic, and other statutes and regulations that apply to FAA decisions on proposed actions;

- Provides the final Federal determinations and approvals based on environmental analysis and findings in the attached Final EA. The FAA's decisions are based on the information and analysis contained in the Final EA and all other applicable documents which were available and considered, and which constitute the administrative record; and
- Approves certain Federal actions associated with implementation of the proposed RNAV/RNP procedures. Implementation of the Preferred Alternative will result in no airport-related development and will not change flight patterns in the immediate vicinity of any airport.

In reaching its determination, FAA has given consideration to 49 U.S.C. 40101(d)(4), which governs FAA's responsibility to carry out its mission while considering safety and the public interest when controlling the use of navigable airspace and regulating civil and military operations in that airspace in the interest of safety and efficiency of both of these operations. Additionally, consideration has been given to 49 U.S.C. 40103(b)(2) which authorizes and directs the FAA Administrator to prescribe air traffic rules and regulations governing the flight of aircraft, for the navigation, protection, and identification of aircraft, and the protection of persons and property on the ground, and for the efficient utilization of the navigable airspace, including rules as to safe altitudes of flight and rules for the prevention of collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects.

Furthermore, the FAA has given careful consideration to: the aviation safety and operational objectives of the project in light of the various aeronautical factors and judgments presented; the need to enhance efficiency of the national air transportation system; and the potential environmental impacts of the project.

II. PROPOSED ACTION

The FAA is in the process of implementing NextGen, the FAA's plan to modernize the National Airspace System (NAS) through 2025. NextGen is a complex program intended to develop and implement new technologies and adapt the air traffic management system to a new way of operating. NextGen represents an evolution from an air traffic control system that is primarily ground-based to a system that is satellite-based, and will allow the FAA to guide and track air traffic more precisely and efficiently. To achieve NextGen goals, the FAA is implementing new Area Navigation (RNAV) and Required Navigation Performance (RNP)-based air traffic routes and instrument procedures around the country that leverage emerging technologies and aircraft

navigation capabilities. The implementation of RNAV and RNP enable the use of other PBN technology in the NAS, including Optimized Profile Descents (OPD).

The current design and operation of the Denver Complex Airspace does not adequately accommodate today's level of air traffic. As operations are expected to grow in the NAS and the Denver Complex Airspace, efficiency will further deteriorate and delays will build. To improve safety and efficiency of operations in the Denver Complex Airspace, and to improve and accommodate future needs of air travel, the FAA proposes implementation of PBN and advanced technologies that are in line with the FAA's NextGen goals.

The Proposed Action evaluated in the attached Final EA is the implementation of new RNAV procedures, inclusive of RNP and OPD, for Denver International Airport (DEN), Centennial Airport (APA) and Rocky Mountain Metropolitan Airport (BJC) in order to improve the safety and efficiency of the Denver Complex Airspace. DEN, APA, and BJC are the airports in the Denver Complex Airspace that will best leverage the capabilities of new RNAV procedures, inclusive of RNP and OPD, for the most comprehensive enhancement within that airspace. The Preferred Alternative includes 17 RNAV STARs (inclusive of RNP approaches) and 16 RNAV SIDs procedures at DEN, four RNAV STARs for aircraft arriving to APA and BJC each, and one RNAV SID for APA and BJC each, as described in Section 2.3 of the Final EA.

III. PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to accommodate current and future air traffic in an efficient manner by leveraging PBN through use of RNAV procedures, inclusive of RNP and OPD, to address the specific inadequacies of the Denver Complex Airspace and thereby improve the NAS. The Proposed Action is needed because the current Denver Complex Airspace does not adequately accommodate today's level of air traffic. As air traffic continues to grow, the adequacy of the Denver Complex Airspace will become more inadequate and delays will build. PBN technology is needed because the majority of the current procedures were designed without benefit of satellite-based navigation and the current and projected prevalence of PBN-capable aircraft is increasing.

The need for the Proposed Action is both nationally and locally based because DEN is a hub airport. DEN provides connections to numerous destinations for millions of passengers annually. Therefore, inefficient operations at DEN cause inefficiencies throughout the NAS.

IV. ALTERNATIVES

Alternatives that involved utilizing other modes of transportation, use of other airports, or changes in airport were not considered because these alternatives did not meet the purpose and need for the Proposed Action. The alternatives considered within the attached Final EA included the use of improved Airport Traffic Control (ATC) technology (Traffic Management Systems, Center/TRACON Automation Systems (CTAS), and the Free Flight Program) and

specific RNAV/RNP alternatives for the Study Area airports. While the potential exists for these technologies to allow controllers to better manage airspace, they will not by themselves accommodate growth and enhance the safety and efficiency of the system. Improved ATC technologies are dependent on a flexible and relatively unconstrained airspace structure that does not currently exist. ATC technology as a stand-alone alternative did not meet the purpose and need and was dismissed from further consideration.

A series of Proposed Action Alternatives (Alternatives 1 through 4) were developed and analyzed. For DEN, 17 RNAV STARs (inclusive of RNP approaches) and 16 RNAV SIDs procedures were proposed, consistent among the alternatives. Detailed descriptions of the RNAV STAR and SID combinations associated with each alternative can be found in Chapter 2 and Appendix D of the attached Final EA. The alternatives evaluated in the attached Final EA are summarized below:

- Alternative 1 includes all DEN RNAV STARs and SIDs, plus four RNAV STARs for aircraft arriving to APA and BJC each. Under Alternative 1, most RNAV STARs to APA and BJC share routing with DEN RNAV STAR procedures.
- Alternative 2 includes all procedures included in Alternative 1, and adds RNAV SID procedures from the runways to 10,000 feet MSL for APA and BJC.
- Alternative 3 includes all DEN RNAV STARs and SIDs, provides increased separation of the RNAV STAR procedures for APA and BJC from the DEN RNAV STAR procedures, and adds RNAV SID procedures from the runway to 20,000 feet MSL for APA and BJC.
- Alternative 4 includes all DEN RNAV STARs and SIDs, includes a variation of RNAV STARs for APA and BJC in common with routing for DEN arrivals, and includes RNAV SID procedures from the runways to 10,000 feet MSL.

Following the detailed environmental analysis and coordination with the public and agencies (see Chapters 4 and 5 of the attached Final EA), the FAA selected Alternative 2 as the Preferred Alternative to be carried forward for implementation. Like all alternatives, Alternative 2 provides RNAV STAR and SID procedures to every runway at DEN allowing extensive use of PBN. Alternative 2 allows the separation of traffic arriving to APA from the southeast and southwest in keeping with the purpose and need for the project to provide separation of satellite facility traffic from DEN traffic. Alternative 2 also includes four RNAV STARs and an RNAV SID for APA and BJC each, which allows RNAV-capable jets to use RNAV technology immediately upon departure. Alternative 2 provides the safest and most efficient RNAV system that can be integrated into the Denver Complex Airspace while considering environmental concerns expressed during the EA process.

V. AFFECTED ENVIRONMENT

The Study Area was defined using the standards applicable for determining noise impacts. According to FAA Order 1050.1E, Appendix A, Section 14.5e, the altitude ceiling for environmental consideration regarding airspace actions is 10,000 feet above ground level (AGL). Additionally, FAA Order JO 7400.2J [Chapter 32, Section 2, 32-2-1(b)(2)(e)]

recommends considering proposed changes between 10,000 feet and 18,000 feet AGL when the proposed changes are over a National Park or Wildlife Refuge. Because changes could occur over RMNP, the cut-off elevation used to determine the Study Area was 18,000 feet AGL.

The Study Area encompasses approximately 6,900 square miles and includes all or part of 17 counties in the State of Colorado, and is depicted in Figure 1-1 of the attached Final EA. The Study Area encompasses the geographic areas where the concentrations of aircraft procedures would occur below 18,000 feet AGL; roughly a 30 nautical mile (NM) radius around the three airports for which procedures were being developed, in addition to the entire footprint of Rocky Mountain National Park (RMNP) as well as Indian Peaks, James Peak and Mount Evans Wilderness Areas.

VI. ENVIRONMENTAL CONSEQUENCES

The potential environmental impacts from the Preferred Alternative were evaluated in the attached Final EA for each of the following impact categories. No significant impacts to the quality of the human or natural environment were identified for any of the categories. Therefore, no Environmental Impact Statement is required to be, or has been, prepared.

Noise

Noise exposure was modeled for each of the Proposed Action Alternatives. The Preferred Alternative would not result in a 1.5 decibel (dB) increase in noise levels within populated census block centroids that would experience noise levels of 65 Day-Night Average Sound Level (DNL) or higher. The concentration of noise exposure over areas directly underneath the proposed RNAV procedures would result in increases to some population centroids and decreases to others, and as such, implementation of the Preferred Alternative would result in reportable change in some DNL ranges, namely areas that would experience increases or decreases of 5 dB above 45 DNL. Overall, under the Preferred Alternative, 81,113 fewer persons would experience noise levels of 45 DNL or higher, while 87,304 additional persons would experience noise levels above 45 DNL. The Preferred Alternative would result in 5,964 fewer persons exposed to noise levels between 50 and 55 DNL, and 65 fewer persons exposed to noise levels between 55 and 60 DNL. An additional 428 persons would be exposed to noise levels above 60 DNL, although none of these persons would experience an increase of 3.0 DNL. Thus, the Preferred Alternative will not cause significant noise impacts as the change in noise exposure does not exceed the threshold of significance. Accordingly, no mitigation is warranted per 1050.1E, App. A, para. 14.4c.

Compatible Land Use

Because the Preferred Alternative is not expected to have significant noise impacts (as measured by change in noise exposure in populated census block centroids), there will be no impacts to compatible land use. Additionally, existing non-compatible land uses currently exposed to noise levels greater than or equal to 65 DNL will not experience significant increases in noise levels as a result of the Preferred Alternative.

Socioeconomic Impacts and Environmental Justice

The Preferred Alternative will not involve any construction of physical facilities or change in noise exposure levels in excess of the applicable thresholds of significance. There would be no acquisition of real estate, no relocation of residents or community businesses, no disruption to local traffic patterns, no loss in community tax base, and no changes to the fabric of the community. Accordingly, there would be no socioeconomic impacts.

Because there are no significant impacts as a result of the Preferred Alternative, there are no adverse human health or environmental effects associated with the Preferred Alternative (including the noise, air quality, water quality, hazardous materials, and cultural resource categories), which would exceed applicable thresholds of significance. As such, no persons of low income or minority populations would be affected at a disproportionately higher level than would other population segments. Accordingly, there would be no significant environmental justice impacts.

Children's Environmental Health and Safety Risks

There are no impacts associated with the Preferred Alternative (including the noise, air quality, water quality, hazardous materials, and cultural resource categories) which would exceed applicable thresholds of significance. The Preferred Alternative would not affect products or substances that a child is likely to come into contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately affect children. Accordingly, there would be no significant impacts related to children's environmental health and safety risks.

Secondary or Induced Impacts

The Preferred Alternative does not involve development, and would not be expected to result in shifts in population and growth, increased demand for public services, or changes in business and economic activity. Therefore, there would be no potential for secondary or induced impacts.

Historical, Architectural, Archaeological, and Cultural Resources

The Preferred Alternative involves ATC routing changes for airborne aircraft only and does not involve any ground-based impacts. Therefore, there would be no direct impacts on properties listed on or eligible to be listed on the National Register of Historic Places. The Proposed Action Area of Potential Effect (APE), which is the same as the NEPA Study Area, encompasses approximately 6,900 square miles. Seven hundred and seventy-six data points were analyzed for 677 listed historic resources, including places designated as historic by the State of Colorado. No historic properties would experience a 1.5 DNL increase in areas of noise exposure of 65 DNL or higher in 2012 or 2017. While some historic resources may experience increases in noise exposure, none of these historic resources include a quiet setting as a generally recognized feature or attribute of the resource's significance.

According to FAA Order 1050.1E, Appendix A, the visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact, per Order 1050.1E, Change 1, Appendix A, Paragraph 12.2b. Changes in aircraft routes associated with the Preferred Alternative would generally occur at altitudes above 3,000 feet AGL; therefore, the visual sight of aircraft and aircraft lights would not be considered intrusive over historic resources. Consequently, the Proposed Action would not result in significant visual impacts.

Thus, there will be no adverse effects to historic properties resulting from implementation of the Preferred Alternative. Appendix H provides the State Historic Preservation Officer's written concurrence with both the definition of the APE and the finding of no adverse effect, in accordance with the Section 106 of the National Historic Preservation Act.

Department of Transportation Act Section 4(f), and Land and Water Conservation Fund Act Section 6(f)

Noise exposure levels were calculated for grid points at 0.25 NM intervals throughout the larger Section 4(f) properties. For Section 4(f) properties that were not covered by the grid interval (i.e., smaller parks and monuments), noise exposure was calculated as a single point located in the center of the park. No Section 4(f) resources located in areas of noise exposure of 65 DNL or higher would experience a 1.5 dB an increase in noise exposure, according to the criteria of significance listed in Section 4.6 of the attached Final EA. Reportable increases would occur under the Preferred Alternative as shown in Table 4.18 in the attached Final EA.

Fish, Wildlife, and Plants

In compliance with Section 7(c) of the Endangered Species Act of 1973 (ESA), as amended, (16 U.S.C. § 1531 et seq.), the US Fish and Wildlife Service provided a list of threatened, endangered, candidate, and proposed species by county in June 2010 in response to scoping. The Preferred Alternative involves ATC routing changes for airborne aircraft only and does not involve any ground-based impacts. Thus, it will not destroy or modify critical habitat for any species. Therefore, there are no significant impacts to fish, non-avian wildlife, and plants which would exceed the threshold of significance defined in FAA Order 1050.1E, Appendix A, Section 8. Additionally, no species that meets the definition of an invasive species will be introduced in the project area due to the Preferred Alternative. Generally, any changes to flight paths/patterns due to the Preferred Alternative would occur above 3,500 feet AGL, at a higher altitude than where the majority of bird strikes occur. Additionally, the Preferred Alternative generally will not change the arrival and departure flows at DEN, APA and BJC so the approaches and departures are not expected to differ from those today. Therefore, based on the available information from the FAA's National Wildlife Strike Database, it is concluded that any impacts to birds resulting from the Preferred Alternative would be minimal.

Air Quality

The U.S. EPA has established National Ambient Air Quality Standards (NAAQS) for ambient (i.e., outdoor) concentrations of a number of "criteria pollutants". On July 30, 2007, the FAA

issued a list of actions "presumed to conform" under General Conformity [72 Fed.Reg. 41565 (July 30, 2007)]. In the aforementioned notice, the FAA summarized documentation and analysis which demonstrated that certain actions will not exceed the applicable *de minimis* emissions levels for nonattainment and maintenance areas as specified under 40 CFR 93.153(b). The FAA includes air traffic control activities and adopting approach, departure and enroute procedures for air operations in their list of "presumed to conform" actions thereby indicating that these types of actions will not exceed *de minimis* emissions levels.

The Preferred Alternative includes airspace and air traffic actions (e.g., changes in routes, flight patterns, and arrival and departure procedures) above the mixing height (generally 3,000' AGL) that are needed to enhance safety and increase the efficient use of airspace by reducing congestion, balancing controller workload and improving coordination between controllers handling existing air traffic. The FAA's "presumed to conform" list is therefore applicable to the Preferred Alternative. Since the Preferred Alternative is presumed to conform and would have a negligible effect on vehicle traffic no further analysis is required.

Climate

The CEQ has indicated that climate should be considered in NEPA analyses. No criteria for determining significance exists. Implementation of the Preferred Alternative would result in a net decrease in greenhouse gas emissions. In 2012, Alternative 1 would represent a decrease of 7.13 percent in CO_2 emissions. Aircraft fuel burn would be reduced from 663,617 kg (2012 No Action Alternative) to 616,309 kg. The equivalent amount of CO_2 emissions for the 2012 Alternative 1 is 1,944,453 kg, less than the 2,093,713 kg for the 2012 No Action Alternative. Implementation of the Preferred Alternative for DEN in 2017 will decrease aircraft fuel burn from 783,628 kg (2017 No Action Alternative) to 725,798 kg. The equivalent amount of CO_2 emissions for the Preferred Alternative at DEN in 2017, is 2,289,892 kg, less than the 2,472,348 kg for the 2017 No Action Alternative. Based on these data, GHG emissions associated with the Preferred Alternative at DEN in 2017 would represent a decrease of 7.38 percent.

Cumulative Impacts

Multiple airport improvements are scheduled for DEN, APA and BJC (e.g. runway/taxiway rehabilitations, construction of new taxiways, etc.) within a five-year planning timeframe; however the only project that has the potential to have cumulative impacts when combined with the Preferred Alternative is the addition of another runway at DEN. The location and orientation of the runway, along with the procedures that will be used to and from this runway, have yet to be determined. Once the need and timeframe for a new runway has been identified, it will be evaluated within a subsequent environmental impact evaluation. Consultation with DEN TRACON staff was undertaken and concluded no reasonably foreseeable future airspace actions are anticipated. As such, no cumulative impacts are associated with the Preferred Alternative.

Inapplicable Impact Categories

Implementation of the Preferred Alternative involves aircraft route changes, and does not involve any physical construction activities. As such, many of the resource impact categories listed and described in FAA Order 1050.1E, Chapter 4, Paragraph 403, Impact Categories, and Appendix A, Analysis of Environmental Impact Categories, would not be affected. A brief description of the categories and the rationale for dismissing the impact category is provided in Chapter 3, Section 3.2, Table 3.6. The impact categories excluded from analysis of the Preferred Alternative's potential effects to the environment include Coastal Resources, Construction Impacts, Farmlands, Floodplains, Hazardous Materials, Pollution Prevention, Solid Waste, Light Emissions and Visual Impacts, Natural Resources and Energy Supply, Water Quality, Wetlands, and Wild and Scenic Rivers. Due to the nature and location of the Preferred Alternative, it is the FAA's determination that the Preferred Alternative would not have any significant effect on the above-noted impact categories.

Other Considerations

The Preferred Alternative involves ATC routing changes for airborne aircraft only. The United States Government has exclusive sovereignty of airspace in the United States. 49 U.S.C. §40103(a). Congress has provided extensive and plenary authority to the FAA concerning the efficient use and management of the navigable airspace, air traffic control, air navigation facilities, and the safety of aircraft and persons and property on the ground. 49 U.S.C. Section 40103(b)(l) & (2). Therefore, any applicable community planning initiatives may be preempted by Federal law. To the extent applicable, and as there are no significant impacts under noise or compatible land use, the Proposed Action is consistent with the plans, goals and policies for the area and with the applicable regulations and policies of Federal, State and local agencies.

Mitigation

Thresholds of significance for any environmental impact category will not be exceeded due to the Preferred Alternative, therefore, no mitigation is being proposed as part of this project.

VII. PUBLIC INVOLVEMENT

Public participation occurred throughout the duration of the project. Federal, State and local agencies received scoping letters describing the project and requesting comments in February 2011, and an Agency Scoping Meeting was held on March 9th, 2011 at Rocky Mountain Metropolitan Airport. Public Scoping Meetings were held at three different locations on March 8th, 9th, and 10th, 2011, with each meeting location in proximity to one of the three airports included in the Proposed Action. A total of 26 written comments were received during the scoping period. Additionally, the FAA met with the National Park Service, Colorado State Parks representatives, the Centennial Noise Round Table, and staff from the DEN Planning and Noise Office.

Prior to issuance of the Draft EA, the FAA again met with interested agencies on March 15th, 2012. Following the release of the Draft EA on June 8th, 2012, three public information meetings were held over the course of three days (June 26th through June 28th, 2012), at Rocky

Mountain Metropolitan Airport, the Denver Marriott South at Park Meadows, near APA, and the Crowne Plaza Denver International Airport, respectively. Approximately 30 people attended the Draft EA public meetings over the course of the three days. The Draft EA was made available 18 days prior to the first public information meeting, and was available for a total of 33 days prior to the conclusion of the comment period. A total of 29 written comments were received, from local jurisdictions (cities, towns, and counties); elected officials, commissioners, city council members and airport roundtable representatives; neighborhood associations; airport staff; and agencies. Of Native American Tribes solicited for comment, one responded that no further consultation was necessary. All agency and public correspondence, including comments received on the Draft EA, is included in Appendix H of the attached Final EA. Section 106 consultation is also included. All comments received are included in Appendix H, and comments pertaining to the Proposed Action were addressed in the Final EA (See Chapter 5).

VIII. THE AGENCY'S FINDINGS

A. Environmental Findings:

The environmental findings are based upon a careful review of the attached Final EA, comments on the Draft EA, the supporting administrative record and appropriate supporting information.

1. **The FAA has given the Preferred Alternative the independent and objective evaluation required by the Council on Environmental Quality (40 CFR Section 1506.5).** The FAA's environmental process included the rigorous exploration and objective evaluation of reasonable alternatives and probable environmental consequences, and regulatory agency and Native American consultations, and public involvement. FAA furnished guidance and participated in the preparation of the EA by providing input, advice, and expertise throughout the planning and technical analysis, along with administrative direction and legal review of the EA. FAA has independently evaluated the EA, and takes responsibility for its scope and content.

2. **The Preferred Alternative does not result in a significant noise impact over noise sensitive areas.** There are no noise sensitive areas exposed to DNL 65 or higher that experience a 1.5 DNL increase.

3. **The Preferred Alternative does not include a direct or constructive use of any resources protected under Sections 4(f) ad 6(f) of the DOT Act.** No physical development or land acquisition is associated with the Preferred Alternative, thus there is not potential for direct use of any Section 4(f) or 6(f) resource. Although the noise impact was determined to be insignificant, there is some noise increase over some 4(f) properties as a result of the Preferred Alternative. However, none of the areas that receive reportable noise are located in areas for which a quiet setting is a recognized feature of the property. Therefore, the FAA determined that the

Preferred Alternative would not cause any constructive use of any 4(f) or 6(f) resource.

4. **The Preferred Alternative does not affect any Historical, Architectural, Archaeological or Cultural Resources.** There is no significant noise impact as a result of the Preferred Alternative. No historic properties located in an area which reports a notable change in noise as a result of the Preferred Alternative include a quiet setting as a recognized feature or attribute of the resources' significance. Therefore the FAA determined that there is no effect on any Historical, Architectural, Archaeological or Cultural Resources.

5. **The Preferred Alternative does not have a significant impact on Air Quality.** The Preferred Alternative is listed as presumed to conform, under General Conformity [FR 41565]. Therefore the Preferred Alternative has already been demonstrated to have *de minimis* emission levels under 40 CFR 93.153(b). The GHG emissions associated with the Preferred Alternative at DEN in 2017 would represent a decrease of 7.38 percent, when compared to the No Action Alternative.

6. **All practicable means to avoid or minimize environmental harm from the Preferred Alternative have been adopted.** The PBN design process took place over several years, with the proposed final RNAV, inclusive of RNP and OPD procedures were ultimately finalized for DEN in January of 2012. As part of the design process, FAA worked with the City and County of Denver as well as representatives of Colorado State Parks and the National Park Service to consider noise sensitive resources.

B. Findings Pursuant to the Purpose and Need:

In establishing the Preferred Alternative, the Denver Complex Airspace would be managed more efficiently, adequately accommodating today's level of air traffic and positioning the Denver Complex Airspace to better accommodate future levels of air traffic.

Based on the Final EA prepared for the proposed action, this FONSI/ROD is issued. Both the Final EA and the FONSI/ROD are hereby incorporated into this decision.

IX. DECISIONS AND ORDERS

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal action, namely the Preferred Alternative, is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and is not a major federal action significantly affecting the quality of the human environment or otherwise, including any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

I, the undersigned, have reviewed the attached Final EA including the evaluation of the purpose and need that this Proposed Action would serve, the alternative means of achieving the purpose and need, and the environmental impacts associated with these alternatives. I find the Proposed Action described in the Final EA is reasonably supported and issuance of a finding of no significance is appropriate. Therefore, an environmental impact statement will not be prepared.

I have carefully considered the FAA's statutory mandate under 49 U.S.C. §40103 to ensure the safe and efficient use of the national airspace system as well as the other aeronautical goals and objectives discussed in the Final EA.

Accordingly, under the authority delegated to me by the Administrator of the FAA, I approve and direct that actions be taken which will enable implementation of the Preferred Alternative. This consists of the development of RNAV and RNP procedures, including OPD procedures, to establish and maintain safe and efficient handling and movement of traffic into and out of the Denver Complex Airspace.

Approved: _____ 8/29/12
Ronald G. Beckerdite
Director
Western Service Center
Date

RIGHT OF APPEAL

This FONSI/ROD constitutes a final order of the FAA Administrator and is subject to exclusive judicial review under 49 U.S.C. § 46110 by the U.S. Circuit Court of Appeals for the District of Columbia or the U.S. Circuit Court of Appeals for the circuit in which the person contesting the decision resides or has its principal place of business. Any party having substantial interest in this order may apply for review of the decision by filing a petition for review in the appropriate U.S. Court of Appeals no later than 60 days after the order is issued in accordance with the provisions of 49 U.S.C. § 46110. Any party seeking to stay implementation of the ROD must file an application with the FAA prior to seeking judicial relief as provided in Rule 18(a) of the Federal Rules of Appellate Procedure.

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Chapter One:

PROJECT BACKGROUND AND PURPOSE AND NEED FOR THE ACTION

As part of its effort to achieve Next Generation Air Transportation System (NextGen) goals, the Federal Aviation Administration (FAA) proposes to implement new Performance-Based Navigation (PBN) flight routes and procedures in the vicinity of Denver International Airport (Denver Complex Airspace). NextGen, the FAA's plan to modernize the National Airspace System (NAS) through 2025, will use satellite-based navigation to allow aircraft to fly more direct routes and navigate around inclement weather with the intent to increase airspace capacity and reduce delays.

The FAA proposes to use PBN to implement new Area Navigation (RNAV) procedures, inclusive of Required Navigation Performance (RNP) and Optimized Profile Descent (OPD), in the Denver Complex Airspace including procedures for Denver International Airport (DEN) and two satellite airports, Centennial Airport (APA) and Rocky Mountain Metropolitan Airport (BJC). The proposed routes and procedures were designed by the FAA to improve the safety and efficiency of the Denver Complex Airspace.

1.1 Introduction

The Denver Complex Airspace management structure is currently operationally cumbersome and complex. The inadequacies of the existing airspace design limit air traffic controllers' ability to manage air traffic as efficiently as possible. The purpose of the proposed FAA action is to address the problems identified with the existing airspace, while ensuring that the implementation of new RNAV procedures, inclusive of RNP and OPD, will maintain and improve airspace system safety, reduce controller and pilot workload, and increase system flexibility and predictability.

To develop the Proposed Action, technical specialists with in-depth knowledge of the inadequacies and inefficiencies within the Denver Complex Airspace as well as technical specialists with a detailed understanding of PBN and the NAS were brought together. This group of technical specialists formed the Denver RNAV Workgroup which worked for over two years on the procedures that form the Proposed Action.

The FAA prepared this Environmental Assessment (EA) to assess the potential impacts of the implementation of the aforementioned procedures in accordance with the National Environmental Policy Act of 1969 (NEPA). NEPA requires environmental review of federal actions. In this case, the implementation of new flight procedures is considered a federal action.

This EA is prepared pursuant to the requirements and standards of the Council on Environmental Quality (CEQ) regulations

(40 CFR Part 1500) and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures.* This EA addresses the potential impacts of the Proposed Action on environmental resource categories, as required by federal laws and regulations.

The FAA proposes to initiate implementation of the procedures in the fall of 2012. The conditions evaluated as part of this EA therefore include 2010 as the base year (existing condition), with 2012 and 2017 (five years after initial implementation) as the future years of analysis.

The format of this EA is as follows: **Chapter One** provides information on the project background and the purpose and need for the Proposed Action. **Chapter Two** evaluates the alternatives for the Proposed Action. **Chapters Three and Four** provide full disclosure of existing conditions and potential environmental impacts, respectively, associated with implementation of the Proposed Action. **Chapter Five** provides a summary of public and agency involvement. **Chapter Six** lists the EA preparers, and **Chapter Seven** provides a list of study acronyms, abbreviations, and a glossary of terms used in this EA. Supporting material is contained within appendices.

1.2 Study Area

A study area is defined as the geographic area potentially environmentally impacted by a proposed action. FAA Order 1050.1E and FAA Order JO 7400.2J were used to establish the Study Area for the Proposed Action evaluated in this EA.

According to FAA Order 1050.1E, the altitude ceiling for environmental consideration regarding airspace actions is 10,000' above ground level (AGL). Additionally, FAA Order JO 7400.2J recommends considering proposed changes between 10,000' and 18,000' AGL when the proposed changes are over a National Park or Wildlife Refuge. Because changes could occur over Rocky Mountain National Park (RMNP), the cut-off elevation used to determine the Study Area was 18,000' AGL. The Study Area was therefore created to encompass the geographic areas where the proposed changes to aircraft procedures would occur below 18,000' AGL; roughly a 30 nautical mile (NM) radius around the three airports for which procedures are being developed, in addition to the entire footprint of RMNP. Other noise sensitive areas adjacent to the 30 NM radii are also included in the Study Area, namely Indian Peaks, James Peak and Mount Evans Wilderness Areas. **Figure 1-1** illustrates the Study Area for this project.

1.3 Background

The Federal Aviation Act of 1958 delegates to the FAA responsibility for managing the use of the navigable airspace and regulating civil and military aircraft operations in that airspace in the interest of maintaining both the safety and efficiency of operations. The current design and operation of the Denver Complex Airspace does not adequately accommodate today's levels of air traffic. In 2010, DEN was the fifth busiest airport in the United States and the tenth busiest airport in the world with an estimated 52.2 million passengers and over 630,000 annual operations. The operations at DEN are expected to grow to over 643,000 in 2012 and over 731,000 in 2017.

DEN, APA and BJC are the airports in the Denver Complex Airspace that will best

leverage the capabilities of new RNAV procedures, inclusive of RNP and OPD, for the most comprehensive enhancement of the Denver Complex Airspace. The FAA focused on development of procedures at DEN, APA and BJC due to the greater number of operations and RNAV capability of the aircraft using these airports.

As air traffic continues to grow in the NAS and the Denver Complex Airspace, efficiency will further deteriorate and delays will build. In order to improve safety and efficiency of operations in the Denver Complex Airspace, and to improve and accommodate future needs of air travel, the FAA proposes implementation of PBN and advanced technologies that are in line with the FAA's NextGen goals.

The next sections provide background information on the NAS and regional air traffic facilities, as well as a brief background of NextGen.

1.3.1 National Airspace System

The NAS is the common network of air navigation facilities, equipment and services; airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures; technical information; and manpower and material that serve to provide for the safe and efficient movement of aircraft. This section presents a brief overview of the NAS as related to the air traffic management of transport category air carrier aircraft.

Air Traffic Control's (ATC) primary purpose is to provide for the safe separation of Instrument Flight Rules (IFR) aircraft from other IFR or Visual Flight Rules (VFR) aircraft. ATC maintains aircraft separation by directing IFR aircraft by means of a specific route, altitude and/or airspeed. The ATC system is composed of three types of facilities with different purposes. Airport Traffic Control Towers (ATCT) manage aircraft that are on the ground and airborne aircraft within a few miles of an airport. ATCTs sequence arriving and departing aircraft on an airport's runways. Primarily, ATCTs use sight to identify and track aircraft. Terminal Radar Approach Control (TRACON) facilities and Air Route Traffic Control Centers (ARTCC) manage air traffic that is not within the immediate vicinity of an airport and thus use radar to identify and track aircraft. TRACONs generally manage air traffic during a flight's arrival or departure phase, when the aircraft is within approximately 50 miles of an airport. ARTCCs generally manage air traffic during the cruise portion of a flight, when the aircraft is at a high altitude. The ATC facilities at DEN are identified and discussed next.

Responsible Facilities at DEN

Denver Terminal Radar Approach Control (D01 TRACON), Longmont Air Route Traffic Control Center (ZDV ARTCC) and DEN Airport Traffic Control Tower (DEN ATCT) are the facilities responsible for handling air traffic at and around DEN, and are the facilities most involved and affected by the establishment of RNAV and RNP procedures within the Denver Terminal Area. Terminal Area is a general term used to describe airspace in which approach control service or airport traffic control service is provided.

ZDV ARTCC controls air traffic within 285,000 square miles encompassing parts

of nine states. A map of ZDV ARTCC airspace is depicted on **Figure 1-2**.

D01 TRACON underlies ZDV ARTCC and controls air traffic within the Denver Terminal Area, within a 42 NM radius of DEN, from the surface up to and including 23,000' mean sea level (MSL) and encompassing four controlled satellite airports. Satellite airports are non-primary airports that provide airfield services to corporate and general aviation. The D01 TRACON airspace is also depicted in Figure 1-2.

DEN ATCT (Denver Tower) controls air traffic into and out of DEN, including airspace within an eight NM radius of the airport, from the surface up to and including 10,000' MSL. The BJC ATCT (Metro Tower) controls air traffic into and out of BJC, including airspace within a five NM radius of BJC and including 8,000' MSL. The APA ATCT (Centennial Tower) controls air traffic into and out of APA, including airspace within a five NM radius of APA and including 8,000' MSL.

1.3.2 Next Generation Air Transportation System (NextGen)

The FAA is in the process of implementing NextGen, the FAA's plan to modernize the NAS through 2025. In basic terms, NextGen represents an evolution from an air traffic control system that is primarily ground-based to an air traffic management system that is satellite-based.

NextGen is a complex program intended to develop and implement new technologies and adapt the air traffic management system to a new way of operating. NextGen will allow the FAA to guide and track air traffic more precisely and efficiently. Ultimately, more aircraft will safely fly closer together on more direct routes, reducing delays and providing unprecedented benefits for the environment and the economy through reductions in carbon emissions, fuel consumption and noise.

NextGen is needed because the existing air traffic management system will not be able to accommodate future levels of air traffic. According to the *FAA Aerospace Forecast Fiscal Years 2011-2031* released in February 2011, air travel will more than double in the next 20 years. In a related press release, the U.S. Secretary of Transportation Ray LaHood stated, "Innovative NextGen technology will help meet the demands of the future by getting passengers to their destinations safely and more quickly."[1]

To achieve NextGen goals, the FAA is implementing new RNAV and RNP-based air traffic routes and instrument procedures around the country that leverage emerging technologies and aircraft navigation capabilities. The implementation of RNAV and RNP enable the use of other PBN technology in the NAS, including OPD. With the implementation of NextGen, the FAA is building the capability to guide and track air traffic more precisely and efficiently to save fuel and reduce noise and pollution.[2]

The capabilities of RNAV, RNP and OPD are discussed below. **Figure 1-3** illustrates a comparison of conventional routes versus RNAV and RNP routes.

Area Navigation (RNAV)

RNAV enables aircraft to fly without relying solely on ground based navigation aids. Aircraft can fly on any desired flight path

within the coverage of ground- or space-based navigation aids, within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.

Required Navigation Performance (RNP)

RNP is RNAV with the addition of on-flight monitoring of the airplane's performance. The pilot receives an alert if the aircraft is not performing in accordance with the requirements for a specific procedure.

Optimized Profile Descent (OPD)

OPD is a component of the FAA's Trajectory-Based Operations (TBO) initiative. OPD flight procedures use the capabilities of the aircraft Flight Management System to fly a continuous descent from the top of descent to touchdown without level segments, based on the actual performance of the aircraft under current flight conditions. Benefits of OPD include fuel savings and noise and emissions reduction by keeping aircraft at higher altitudes and at lower thrust levels than traditional step-down approaches. Because the procedures are simplified, OPD also reduces radio transmissions between pilots and controllers.

1.4 Proposed Action

The Proposed Action evaluated in this EA is the implementation of new RNAV procedures, inclusive of RNP and OPD, for DEN, APA and BJC in order to improve the safety and efficiency of the Denver Complex Airspace. The RNAV and RNP procedures would be used by RNAV/RNP-capable aircraft.

While separate RNAV and RNP procedures into and out of the other airport facilities in the Study Area are not provided as part of this Proposed Action, the other airports within the Study Area would benefit from the RNAV Standard Terminal Arrival Routes (STARs) associated with DEN. As aircraft flying into and out of the other airports enter into D01 TRACON airspace, applicable jet activity would use these STARs until routed onto the initial approach to a runway at each individual airport.

The Proposed Action is limited to changing aircraft flight paths and does not require any new infrastructure. The Proposed Action would not increase the number of aircraft operations in the Denver Complex Airspace beyond the levels forecast based on market demand for air travel; rather, it would minimize the delays associated with the inadequate airspace. Specifically, the Proposed Action would not include any physical changes or development of facilities, nor would it require local or state actions. Therefore, no physical alteration to any environmental resource would occur and no permits/licenses would be required. Additionally, the Proposed Action would not require changes to any Airport Layout Plan or funding of infrastructure.

1.5 Purpose and Need

This EA evaluates the potential environmental impacts of the Proposed Action. FAA Order 1050.1E requires that an EA include a description of the purpose of a proposed action and why it is needed. An EA must also consider potential alternatives based on the alternatives' ability to meet the purpose and need of the proposed action (See Chapter 2, *Alternatives*).

The Purpose and Need are identified by describing the problems being addressed and the proposed solutions. Defining the

Purpose and Need is essential in documenting a sound justification for a proposed action.

The Purpose of the Proposed Action is to:

> Accommodate current and future air traffic in an efficient manner by leveraging PBN through use of RNAV procedures, inclusive of RNP and OPD, to address the specific inadequacies of the Denver Complex Airspace and thereby contribute to improvements to the NAS.

The Need for the Proposed Action is because:

> The current Denver Complex Airspace does not adequately accommodate today's levels of air traffic. As air traffic continues to grow, the adequacy of the Denver Complex Airspace will become more inadequate and delays will build. PBN technology is needed because the majority of the current procedures were designed without benefit of satellite-based navigation and current and projected prevalence of PBN capable aircraft.
>
> In further detail, the need for the Proposed Action is both nationally and locally based because DEN is a hub airport. DEN provides connections to the ultimate destination for millions of passengers annually. Therefore, inefficient operations at DEN cause inefficiencies throughout the NAS.

The following sections provide more detail about the need for the Proposed Action from a national and local perspective.

1.5.1 National Airspace Needs

The impacts of increased levels of air traffic and limited airspace accommodations are being experienced at national, regional and local levels. Major metropolitan areas such as Denver have experienced increased air traffic demand resulting from influences such as population growth and the use of regional jets. As a result, the NAS is currently experiencing deficiencies that are evident to both users (e.g., the public, commercial airlines, general aviation and the military) and the FAA. Deficiencies materialize in the form of delays, lengthier routings, complex ATC procedures and airspace saturation. According to the FAA's 2010 National Airspace Procedures Plan, "Over the next two decades the FAA will face major challenges meeting future demand while improving safety, reducing delays, and protecting the environment."[3]

Although the ATC system provides a high level of safety, the growth in air traffic volume results in increased delays as air traffic controllers work to maintain the safe separation of aircraft. As the volume of aircraft within the NAS increases, longer routings, slower airspeeds and delayed departures are used to manage air traffic and maintain safe separation. Thus, the existing airspace structure can become inadequate at high traffic volumes and as a result costly delays can increase substantially.

Additionally, most existing airspace procedures are not designed to accommodate use of advanced aircraft flight management and navigation systems (e.g., satellite navigation such as GPS) that offer the potential for efficiency improvements due to more direct and flexible routings. Currently, aircraft are often routed on

indirect paths due to the existing structure of the NAS routes. Improvements to the airspace structure and use of available technology (i.e. PBN) are needed to achieve the full efficiency benefits that are possible with advanced avionics systems.

The FAA, aeronautical users and airport operators have worked to keep pace with the growing volume of aircraft traffic and advances in aircraft avionics through advances in air traffic control technology, improved scheduling and coordination, and airport/runway improvements. However, inefficiencies continue to occur and will increase as traffic levels rise unless further improvements are made.

1.5.2 Denver Complex Airspace Needs

The current Denver Complex Airspace does not adequately accommodate today's level of air traffic. The air traffic at D01 TRACON has grown to a point that the original airspace design is no longer able to adequately support current operational levels. The number of operations handled by the TRACON in 2010 exceeded 882,000 operations, whereas in 1995 when DEN opened in its new location, operations were approximately 585,000. The traffic flow design for the current airspace has limits and needs to be redesigned to safely accommodate projected levels of air traffic. As air traffic continues to grow, efficiency will further deteriorate and delays will build.

Approximately 15 percent of the operations that the D01 TRACON manages daily are air traffic into and out of APA and BJC. The satellite facilities are currently subject to the DEN air traffic flows which forces satellite aircraft to perform inefficiently (i.e. remain at low altitudes and slower speeds) at great distances from their destinations and also creates a need for sequencing with DEN air traffic.

In 2009, in response to growing operations and increased airspace inadequacies, an initial airspace evaluation was undertaken by the MITRE Corporation's Center for Advanced Aviation System Development (CAASD) as requested by the FAA to review the airspace serving the Denver Complex Airspace and to provide an initial evaluation of the airspace. The review concluded that more efficient airspace is needed to deliver aircraft through the terminal airspace and to make more efficient use of STARs and altitudes. Many of the problems identified in the 2009 MITRE study are included in the specific need for the Proposed Action and are identified in **Table 1.1**.

In summary, the existing procedures within the Denver Complex Airspace do not take full advantage of PBN technology and aircraft design. The air traffic flows in the existing TRACON airspace do not feed the runways efficiently and higher crossing-fix entry altitudes are needed to increase efficiency and accommodate future growth.

Table 1.1

Local Need for the Proposed Action

Specific Problem/Need to be Addressed in the Denver Complex Airspace by the Proposed Action
During some demand conditions, TRACON arrival throughput is insufficient to accommodate ARTCC delivery of aircraft or the runway configuration being used.
Use of existing STARs is inefficient and thereby hampers ATC's ability to direct aircraft to multiple runways.
The existing published procedures include inefficient altitudes for both arrivals and departures.
The use of one arrival corner post to direct arrivals to two runway ends is not managed properly.
Airports adjacent to DEN share arrival flows and certain arrival flows hamper departures to the west.
Arrivals into DEN experience extensive leveling off and in some situations additional miles are flown.
Satellite arrivals are required to fly at a lower altitude than optimal and thereby experience turbulence and low altitude level flight.

Sources:
1) MITRE/CAASD, Denver Metropolitan Area Airspace Problem Characterization and Initial Evaluation, 2009.
2) Denver RNAV Workgroup.

1.6 Implementation

The Proposed Action is expected to be implemented in a phased manner. Beginning in the fall of 2012, STARs and SIDs for DEN will begin to be implemented. Additionally, STARs for APA and BJC will begin to be implemented. The FAA expects that the STARs and SIDs will be implemented on an east to west basis.

Implementation of the Proposed Action could require revisions to Letters of Agreement and Facility Orders for all ATCT, TRACON and ARTCC facilities affected by the Proposed Action. Letters of Agreement are formulated when operational and procedural needs require the cooperation and concurrence of more than one ATC facility. Letters of Agreement typically delegate airspace and responsibilities, specify ATC procedures, and standardize operating methods. Individual ATC facilities may also set forth policies and procedures through a local Facility Order.

Implementation of the Proposed Action would also require the FAA to establish new ATC procedures and revoke or modify existing procedures that would be inconsistent with the new procedures. Establishing or changing ATC procedures includes training of air traffic controllers and publication of the procedures.

Endnotes

[1] FAA, *Press Release – FAA Forecast Predicts Air Travel to Double in Two Decades*, February 15, 2011, https://www.faa.gov/news/press_releases/news_story.cfm?newsId=12439, accessed May 26, 2011.

[2] FAA, *Why NextGen Matters*, March 17, 2011, http://www.faa.gov/nextgen/why_nextgen_matters/, accessed May 4, 2011.

[3] FAA, *National Airspace and Procedures Plan*, 2010, p. 1.

CHAPTER 2:
ALTERNATIVES

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Chapter Two: ALTERNATIVES

As described in Chapter One, the Proposed Action considered in this EA is the implementation of new RNAV, RNP and OPD procedures at DEN and two satellite airports, APA and BJC. The purpose of these procedures is to accommodate current and future air traffic in the Denver Complex Airspace in an efficient manner by leveraging advances in technology through use of RNAV and RNP procedures. The current Denver Complex Airspace does not adequately accommodate today's levels of air traffic.

Alternatives analysis is key to the NEPA process. Federal guidelines concerning the environmental review process require that reasonable alternatives that might accomplish the project purpose and need be rigorously explored and objectively evaluated. This chapter documents the narrowing process used in consideration of the potential and reasonable alternatives, including:

- Identification of potential alternatives;
- Elimination of alternatives that do not meet the purpose and need; and
- Evaluation of reasonable alternatives.

2.1 Identification of Potential Alternatives

This section identifies potential alternatives that might accomplish the Purpose and Need for the Proposed Action. In order to merit further consideration, it is necessary that potential alternatives accommodate current and future growth in the Denver Complex Airspace by leveraging performance based navigation. Because the Proposed Action is needed in order to address the procedural inadequacies of the Denver Complex Airspace, only procedural alternatives are considered. Alternatives that involve other modes of transportation, use of other airports, or changes in airport use may have the potential to decrease air travel or shift traffic to other airports, but these alternatives do not meet the project's Purpose and Need for the Proposed Action.

The assessment of potential alternatives documents the reasons for elimination of a particular alternative if it is found to be infeasible and therefore unreasonable. The following types of potential alternatives are considered:

- Improved ATC Technology - use of new technologies to improve the inadequacies of the Denver Complex Airspace; and
- Specific RNAV/RNP Alternatives – use of airspace routes and altitudes to direct aircraft to and from DEN, APA and BJC in a more efficient manner.

2.2 Alternatives Eliminated

Each potential alternative was analyzed for its ability to meet the Purpose and Need for the Proposed Action. The following alternatives were eliminated from further consideration as they did not meet the Purpose and Need for the Proposed Action.

2.2.1 Improved ATC Technology

A number of technological advancements are available, or in development, that have the potential to reduce the inadequacies of the Denver Complex Airspace by improving airspace efficiency. Examples of alternatives within this category of technological improvements that are currently in development or are being implemented are discussed in the following paragraphs.

Currently in use, the Traffic Management System (TMS) involves the use of computer systems that allow air traffic management coordinators to see aircraft activity on a national scale, identifying traffic surges, gaps, and volumes. Traffic managers can see the projected flow into specific airports or airspace sectors and take action to ensure that traffic demand does not exceed system capacity. The FAA is developing, testing, and implementing additional technologies to improve TMS. These upgrades are known as the Enhanced Traffic Management System (ETMS) and will expedite communication on traffic flow strategies; the Denver Complex Airspace is in the process of implementing ETMS.

The Center/TRACON Automation System (CTAS) includes software for accurately computing and predicting aircraft trajectories in real time and for scheduling aircraft landing times to achieve the least possible delay. CTAS will assist ATC in sequencing, spacing, and merging departing aircraft into the en route traffic system. The system incorporates radar flight track data and weather data and provides controllers with graphic displays. CTAS benefits controllers by reducing stress and workload, and benefits air travelers by reducing delays and enhancing safety. Components of CTAS are undergoing testing at several ATC facilities nationwide.

The Free Flight Program is intended to create an IFR operating environment where aircraft operators have considerable flexibility in planning and flying their routes to minimize flight times and, ultimately, operational costs. Traditionally, aircraft operating under IFR have been subject to positive control by ATC throughout their flight and, thus, required to fly specific routes in the sky. This system of aircraft separation has been required to ensure operational safety for the many aircraft using the airspace. In recent years, numerous technologies have been developed that provide pilots and ATC with much more accurate and complete information about the operating environment and aircraft positions. These technologies promise to afford much greater flexibility and freedom to aircraft operators while maintaining safety and enhancing efficiency. While free flight is not available in the terminal airspace, it will promote more efficient and coordinated staging of aircraft in the en route airspace for unimpeded transfer into the terminal airspace. The initial phases of the Free Fight Program are being used in the airspace above 29,000' MSL. Further development of the Free Flight Program is ongoing.

While the potential exists for these technologies to allow controllers to better manage airspace, they will not by themselves accommodate growth and enhance the safety and efficiency of the system. Improved ATC technologies are dependent on a flexible and relatively unconstrained airspace structure that does not currently exist. ATC technology as a stand-alone alternative will not meet the

Purpose and Need and is therefore not considered further.

2.2.2 DEN PBN Alternatives

The number of viable PBN alternatives is not unlimited for the airports considered in this EA. This is because changes made to horizontal and vertical placement of procedures as well as travel speed often causes adverse domino effect changes to other procedures. This can lead to the requirement for multiple procedure changes to accommodate an individual procedure. Additionally PBN procedures must be acceptable to the users. As such, PBN procedural design teams are limited in the scope of alternatives available to them. They must seek to solve inadequacies within their area of responsibility without negatively affecting adjacent procedures and such that the proposed procedures will be embraced by the users.

The PBN design process took place over several years. The FAA first attempted a PBN design effort with the goal of improving the Denver Complex Airspace efficiency in 2007 that included RNAV SIDs and STARs with ingress and egress points that overlaid the legacy routes within the Denver TRACON/Denver ARTCC airspace boundary. This early design also included some basic satellite airport RNAV STARs into APA and BJC. The following sections provide an overview of the DEN STAR and SID options developed between 2007 and 2009, and the satellite airport STARs developed in 2010 and 2011, along with reasons for dismissal as final alternatives.

2.2.2.1 DEN STAR Option 2007-2009: Primary STAR / Offload STAR

The "Primary STAR / Offload STAR" concept was developed in late 2007 and remained the favored option for DEN STARs until February 2009. The concept was abandoned for the following reasons:

- Each arrival gate would have one RNAV STAR and one conventional STAR, thereby creating increased complexity in both Terminal and En Route airspace.
- With only one RNAV STAR per arrival gate, the efficiency of the airspace would decrease, thereby decreasing the ability to meet the arrival demand.
- The design did not improve the ability to deliver aircraft to all landing runways.

2.2.2.2 DEN SID Option 2007-2009: No VNAV

The "No VNAV" (vertical navigation) concept was developed in late 2007 and remained the favored option for DEN SIDs until February 2009. The concept was abandoned for the following reasons:

- Each SID was designed without any VNAV, thereby forcing the route to be placed in present day "Radar Vector" based airspace. This resulted in leg lengths that were too short in some places and too long in others.
- The design would not allow for future VNAV placement because the leg lengths did not provide enough distance for departures to climb above arrivals.

- The design required intervention by Air Traffic Controllers to prevent a severe flying miles penalty from being incurred.

Although the overall design alternatives were an improvement over the conventional "Radar Vector" based system, the effort described in Sections 2.3.2.1 and 2.3.2.2 was abandoned due to perceived inefficiencies associated with the design of the STARs. Specifically, the route structure of the "Short Side" STARs was not acceptable because it was inefficient.

A second redesign effort began in November of 2009. The design draft was completed in January 2010. The draft design included the "Long Side" DEN STAR structure from the previous design, "Long Side" refers to the STARs delivering aircraft onto the downwind leg. The "Short Side" DEN STAR structure, which refers to the STARs delivering aircraft onto the base leg, was redesigned with two parallel routes delivering aircraft all the way to the final approach course of the landing runways. The DEN SID structure was also redesigned. During the course of the design effort, RNP procedures were proposed by various stakeholders as providing added benefit to the proposed procedure re-design. Ultimately 12 RNP approach procedures were designed.

Over the course of the two years of procedure design, this vetting process occurred over and over again until the proposed final RNAV, inclusive of RNP and OPD procedures were developed for DEN in January of 2012.

As described, the procedures developed for DEN as part of the Proposed Action evolved over several years and underwent multiple revisions to satisfy the needs of ATC and airlines as well to consider potential environmental impacts. Numerous alternatives were considered and rejected during the design process based on their relative merits to implement PBN procedures. As part of the design process ATC worked with the CCD as well as representatives of Colorado State Parks and the National Park Service (NPS) to consider noise sensitive resources. Therefore other PBN procedures for DEN do not meet the Purpose and Need of the Proposed Action and will not be considered further.

2.2.3 Satellite STAR Options 2011

The Satellite STAR structure was also redesigned during the second redesign effort and a Satellite SID structure was designed for the first time to serve departures from APA and BJC. Additionally, a set of Instrument Approaches for APA were developed (ILS and RNAV) during this timeframe.

During 2010 several satellite airport STAR options into BJC and APA were analyzed. Listed below are the options studied and the reasons they were discarded as not viable.

- BJC WEEEL STAR: This STAR was dismissed due to the proximity to the turbulent airspace on the leeward side of the front range, the increased flying distances, and the increased complexities that would be introduced into the airspace.

- BJC and APA NVIRO STAR: This STAR was dismissed because it forced aircraft down into precipitous terrain and forced jet aircraft to mix with turboprops and single engine aircraft at low altitudes. It increased complexity in the airspace.

- BJC and APA BIGES STAR: This STAR was dismissed because it forced a significant increase in flying distances and placed arrivals into conflict with departures.

- BJC and APA BROADMORE STAR: This STAR was dismissed because it conflicted with Special Use Airspace and placed arrivals into conflict with departures.

- APA LOOOP STAR: This STAR was dismissed because it placed APA arrivals into conflict with DEN arrivals, as well as placing APA arrivals into conflict with APA departures.

The development of SIDs for APA and BJC was initiated after the STAR alternatives were well formed, two alternatives considered for APA and BJC are included in the alternatives carried forward.

2.3 Alternatives Carried Forward for Environmental Review

The No Action Alternative is carried forward as required by NEPA per CEQ regulations. Relative to PBN procedures for APA and BJC, the FAA also considered multiple PBN procedures at each airport. Four alternatives which include a combination of STARs and SIDs were proposed for implementation at APA and BJC and were carried forward for detailed review. All four of these alternatives include the PBN procedures defined for implementation at DEN, and the ILS and RNAV Instrument Approaches developed for APA. The No Action Alternative is described first.

2.3.1 No Action Alternative

The existing airspace structure in place at DEN, APA and BJC (the No Action Alternative) is based on conventional STARs and SIDs (not RNAV STARs and SIDs) and relies on a system of fixes, routes and procedures to direct aircraft through Denver Terminal Area airspace. The basic structure of the Denver Terminal Airspace is shown in **Figure 2-1**. Four arrival gates are situated in a corner-post alignment (Northeast, Northwest, Southeast, Southwest), while four departure gates are aligned with the four cardinal directions (North, South, East, West).

Standard Terminal Arrival Routes (STARs)

The arrival structure in place is based on eight STARs; two for each arrival gate. The current STARs that serve DEN, APA and BJC are listed in **Table 2.1**.

The method of transitioning DEN, APA, and BJC arrival aircraft from the STARs to the arrival runways is through radar vectors issued by the D01 TRACON to join the assigned instrument approach (or to approach a runway visually if conditions allow). This radar vector structure has resulted in a set of historically established arrival flight tracks within the Denver Complex Airspace. These flight tracks are referred to as conventional arrival flight tracks.

Table 2.1

DEN, APA and BJC Standard Terminal Arrival Route Listing

TOMSN	Northwest Arrival Gate
RAMMS	Northwest Arrival Gate
LANDR	Northeast Arrival Gate
SAYGE	Northeast Arrival Gate
DANDD	Southeast Arrival Gate
QUAIL	Southeast Arrival Gate
POWDR	Southwest Arrival Gate
LARKS	Southwest Arrival Gate

Source: Denver TRACON, June 2011.

Standard Instrument Departures (SIDs)

Four pilot navigation SIDs are in place: one for each departure gate. In addition to pilot navigation SIDs, there is a SID based on radar vectors and a SID developed for use by stage two jets to mitigate noise. The SIDs are listed in **Table 2.2.**

The method of transitioning DEN, APA, or BJC departure aircraft from the takeoff runways to the assigned SID is by the airport's ATCT assigning headings to be flown after takeoff, followed by radar vectors issued by D01 TRACON to join the assigned SID, and ZDV ARTCC ensuring the aircraft's transition into the enroute environment and the NAS jet airway structure.

Table 2.2

DEN, APA and BJC Standard Instrument Departure Listing

YELLOWSTONE FOUR	Pilot Navigation	North Departure Gate
PIKES FIVE	Pilot Navigation	South Departure Gate
PLAINS FOUR	Pilot Navigation	East Departure Gate
ROCKIES FIVE	Pilot Navigation	West Departure Gate
DENVER FIVE	Radar Vector	All Departure Gates
DECI-BELLE TWO	Pilot Navigation	South Departure Gate (Noise)

Note: FAA periodically updates the SID procedures in a sequential process (i.e. revisions to YELLOWSTONE FOUR would result in the procedure being identified as YELLOWSTONE FIVE).

Source: Denver TRACON, June 2011.

This radar vector structure has resulted in a set of historically established departure flight tracks within the framework of the Denver Complex Airspace. These flight tracks are referred to as conventional departure flight tracks.

Figures 2-2 through **2-7** illustrate the arrival and departure routes used in the existing airspace structure. The No Action Alternative includes no changes to the existing flight procedures. RNAV, inclusive of RNP and OPD, procedures would not be published or implemented at DEN, APA or BJC. The No Action alternative would not meet NextGen goals. The Denver Complex Airspace would not be enhanced by leveraging the emerging RNAV and RNP technologies and aircraft navigation capabilities.

Consideration of the No Action alternative is required by NEPA per CEQ regulations, as it serves as a basis for comparison to the Proposed Action alternatives.

2.3.2 PBN Alternatives

The following sections describe and illustrate each PBN alternative. Each PBN alternative is comprised of RNAV STARs and RNAV SIDs. The RNAV STARs include OPDs. Aircraft that are assigned to any of the STARs can be routed to the airfield in the following ways:

- Visual Vectors – Aircraft would be given continuous instructions to navigate to the runways, once it has exited the RNAV STAR procedure. Vectoring would occur when the weather minimums are VFR conditions and may occur prior to the termination of the RNAV STAR procedure.

- RNP Procedures – A number of RNP approaches, which begin while the aircraft is on a downwind approach parallel to the runway, are included for DEN. This procedure would only be assigned to aircraft that have specific navigation equipment and training to be able to fly this procedure.

- RNAV/RNP VMC – An RNAV procedure that mimics the RNP procedure that would enable the RNP equipped airlines/aircraft to fly a comparable flight path to the actual RNP procedures.

- ILS Procedures – An aircraft would be assigned an ILS procedure once they exit the RNAV STAR procedure. ILS procedures are used in periods of adverse weather with limited visibility.

- RNAV Visuals – An aircraft would be assigned an RNAV Visual procedure, which is a charted RNAV Visual Flight Procedure (RVFP), prior to exiting the RNAV STAR procedure.

DEN PBN Procedures, which are common to the four alternatives reviewed in this EA, are described first.

2.3.2.1 DEN PBN Procedures - All Alternatives

The DEN RNAV STARs from each arrival gate are described in the following sections.

- Four RNAV STARs for aircraft arriving into TRACON airspace from destinations from the northwest (MOLTN, TSHNR, FRNCH, KAILE). MOLTN (long-side) and TSHNR (short-side) overfly the existing RAMMS arrival fix, while FRNCH (long-side) and KAILE (short-side) are proposed to overfly the existing TOMSN arrival fix. Aircraft would be assigned one of the two procedures that overfly a common fix depending on the operational configuration of DEN at the time.

- Four RNAV STARs for aircraft arriving into TRACON airspace from destinations from the northeast (ANCHR, KIPPR, KOHOE, WAHUU). ANCHR (long-side) and KIPPR (short-side) would overfly the existing LANDR arrival fix, while KOHOE (long-side) and WAHUU (short-side) would overfly the existing SAYGE arrival fix.

- Aircraft arriving from the southeast would use one of four RNAV STARs: JAGGR, PURRL, ZPLYN, or BOSSS. The arrival fix DANDD serves JAGGR (long-side) and PURRL (short-side), while the arrival fix QUAIL would serve ZPLYN (long-side) and BOSSS (short-side).

- Arrivals from the southwest routed over POWDR would use the RNAV STAR

CREDE (long-side) or TELLR (short-side), while aircraft routed over LARKS would use PEEEK (long-side) or LDORA (short-side).

Figure 2-8 depicts the proposed RNAV STARs for DEN. **Table 2.3** provides a summary of each proposed procedure and the runways for which it is designed to serve.

Additionally, there are 16 RNAV SIDs proposed for implementation at DEN. Similar to the RNAV STARs, each RNAV SID would overfly a waypoint located either east, west, north, or south of DEN. To the east, there are four proposed RNAV SIDs (EMMYS, EEONS, EPKEE, and EXTAN), while four RNAV SIDs are proposed to the west (CONNR, BAYLR, COORZ, ZIMMR).

Each of these procedures roughly corresponds to existing departure procedures. To the north, existing procedures to fixes including YAMMI, YALES, and YOKES would be replaced with RNAV SIDs YAMMI, RIKKK, BRYCE, and YOKES, while to the south, SPAZZ, STAKR, and SOLAR would be implemented. The RNAV SID JMPRS serves aircraft departing DEN to Colorado Springs (COS). The proposed RNAV SIDs for DEN are shown in **Figure 2-9.**

Table 2.3
Summary of Proposed DEN RNAV STARs and Runway Transitions

Direction	RNAV STAR	Arrival Fix	Short/ Long	Runways											
				07	08	16L	16R	17L	17R	25	26	34L	34R	35L	35R
Northwest	MOLTN	RAMMS	Long	X						X	X	X	X	X	X
	TSHNR		Short			X	X		X						
	FRNCH	TOMSN	Long		X					X	X	X	X	X	X
	KAILE		Short			X	X		X						
Northeast	ANCHR	LANDR	Long	X	X						X	X	X	X	X
	KIPPR		Short			X	X	X	X						
	KOHOE	SAYGE	Long	X							X	X	X	X	X
	WAHUU		Short			X	X	X	X						
Southwest	JAGGR	DANDD	Long	X	X	X	X	X	X	X					
	PURRL		Short											X	X
	ZPLYN	QUAIL	Long	X	X	X	X	X	X	X	X				
	BOSSS		Short									X	X	X	X
Southeast	LDORA	LARKS	Long									X		X	X
	PEEEK		Short	X	X		X	X	X	X	X				
	TELLR	POWDR	Long									X	X	X	X
	CREDE		Short	X		X	X	X	X	X	X				

Source: DEN RNAV Workgroup, 2012.

2.3.2.2 Alternative 1

APA PBN Procedures

Four RNAV STARs were proposed for implementation at APA, including the PUFFR RNAV STAR for aircraft arriving from the northeast, the SKARF RNAV STAR for aircraft arriving from the northwest, the DUNNN RNAV STAR for aircraft originating from the southeast gate, and the ZOMBZ RNAV STAR for aircraft

arriving from the southwest. Aircraft arrivals would approach the runways either through visual approaches or newly designed/modified instrument approaches (RNAV to 35R, ILS to 35R and RNAV to 17L) instrument approaches (to Runways 35R or 17L). RNAV STARs proposed for APA are depicted in **Figure 2-10.**

- The PUFFR RNAV STAR (northeast) coincides with portions of the KOHOE RNAV STAR serving DEN, as both overfly the SAYGE fix.

- The SKARF RNAV STAR would share an en route flight track location with the DEN FRNCH RNAV STAR. Both would overfly the TOMSN waypoint, although APA arrivals would be vectored off of the procedure to reach Runways 17L and 35R at APA at various locations.

- A new approach route would be able to be implemented from the southeast. Aircraft arriving to APA from the southeast would use the DUNNN RNAV STAR, which would allow the separation of DEN and APA arrivals to Runways 17L and 35R.

- The southwest gate would allow for the development of a separate RNAV STAR to APA. The ZOMBZ RNAV STAR serves APA aircraft arrivals to Runway 17L and 35R originating from the southwest.

BJC PBN Procedures

Four RNAV STARs proposed for implementation at BJC include the KIPPR RNAV STAR for aircraft arriving from the northeast, the FRNCH RNAV STAR for aircraft arriving from the northwest, the DUNNN RNAV STAR for aircraft originating from the southeast gate, and the CREDE RNAV STAR for aircraft arriving from the southwest. RNAV STARs proposed for BJC are depicted in **Figure 2-11**.

- From the northeast, the BJC KIPPR RNAV STAR would share flight track location with the DEN KIPPR RNAV STAR, both of which enter TRACON airspace along a common route overflying the LANDR fix. The procedure is designed to Runways 29R and 11L for arriving aircraft to BJC.

- From the northwest, the BJC FRNCH RNAV STAR would share a common route with DEN arrivals on the DEN FRNCH RNAV STAR. Both would overfly the TOMSN fix, prior to BJC arrivals being vectored off of the procedure to either Runway 11L or 29R.

- The DUNNN RNAV STAR from the southeast would include runway transitions to both Runways 11L and 29R at BJC. Arrivals to BJC would share a common route with arrivals to APA between an altitude of 25,000’ or greater to approximately 12,000’, at which point the procedure would split to either airport.

- Arrivals from the southwest would use the CREDE RNAV STAR, common to arrivals to DEN which overfly the POWDR arrival fix. The CREDE RNAV STAR is designed to both Runways 11L and 29R at BJC.

Overall, the 2017 Alternative 1 condition includes approximately 82% of all operations at DEN using RNAV STAR and SID procedures. At APA, approximately 3% of overall operations are modeled using the

RNAV STAR procedures, while 3% of all operations to BJC are modeled on the applicable RNAV STAR procedures.

Table 2.4
Summary of Proposed Alternative 1 APA and BJC RNAV STARs

Airport	RNAV STAR/SID	Procedure Name	Description
APA	STAR	PUFFR	NE Arrival
APA	STAR	SKARF	NW Arrival
APA	STAR	DUNNN	SE Arrival
APA	STAR	ZOMBZ	SW Arrival
BJC	STAR	DUNNN	SE Arrival
BJC	STAR	FRNCH	NW Arrival
BJC	STAR	KIPPR	NE Arrival
BJC	STAR	CREDE	SW Arrival

Note: No SIDs are proposed.

Source: DEN RNAV Workgroup, 2012.

2.3.2.3 Alternative 2

Alternative 2 includes two RNAV SID procedures from the runway end for APA and BJC. These procedures (LOOOP Hybrid and WEEEL Hybrid) would allow RNAV-capable jet departures from APA and BJC to utilize RNAV technology immediately upon departure. The "Hybrid" RNAV SID procedures do not allow for full RNAV SID navigation within the Study Area, but would provide RNAV capabilities until the aircraft reaches 10,000', at which point aircraft would turn on course. Alternative 2 RNAV STARs (identical to Alternative 1 RNAV STARs) are depicted in **Figures 2-12** and **2-13**, and Alternative 2 RNAV SIDs are depicted in **Figures 2-14** and **2-15**.

- For aircraft departures from APA, the LOOOP Hybrid RNAV SID would provide navigation from Runways 17L and 35R. The LOOOP Hybrid RNAV SID is designed to allow RNAV navigation from the runway until the aircraft reaches 10,000' MSL. The design of the procedure close to APA represents the routing needed for RNAV departures to avoid conflicting with DEN arrivals and departures. Aircraft would depart from either Runway 17L or 35R from APA and follow the procedure to the west, maintaining an altitude of 10,000' MSL at the LOOOP or WP01 waypoints.

- For aircraft departures from BJC, the WEEEL Hybrid RNAV SID would route departures to the same fixes, but differs again in its design close to the airport. Under the WEEEL Hybrid RNAV SID, all RNAV jet departures from Runways 11L and 29R would immediately upon departure turn to the northeast, converge at the TRIKO waypoint and share a common route approximating a 180-degree turn until they reach the WEEEL waypoint at an altitude of 12,000' MSL, then proceed along branches of the procedure to a departure fix.

With the implementation of RNAV SIDs at APA and BJC, the overall use of RNAV procedures increases at APA and BJC, to 8% of overall operations at APA and 7% of operations at BJC. DEN usage of the RNAV procedures remains at 82%.

Table 2.5
Summary of Proposed Alternative 2 APA and BJC RNAV STARs and SIDs

Airport	RNAV STAR/SID	Procedure Name	Description
APA	STAR	PUFFR	NE Arrival
APA	STAR	SKARF	NW Arrival
APA	STAR	DUNNN	SE Arrival
APA	STAR	ZOMBZ	SW Arrival
APA	SID	LOOOP HYBRID	Departure
BJC	STAR	DUNNN	SE Arrival
BJC	STAR	FRNCH	NW Arrival
BJC	STAR	KIPPR	NE Arrival
BJC	STAR	CREDE	SW Arrival
BJC	SID	WEEEL HYBRID	Departure

Source: DEN RNAV Workgroup, 2012.

2.3.2.4 Alternative 3

Alternative 3 represents the most mature and complete RNAV utilization for APA and BJC. Under Alternative 3, RNAV STAR procedures unique to APA and BJC would maximize the separation of aircraft arrivals between the DEN procedures and satellite airport operations. Aircraft arriving to APA and BJC would navigate on a dedicated set of procedures at higher altitudes. This alternative represents the most complex challenges to the airspace structure and capacity.

APA and BJC arrivals from the northwest would utilize the BUGGG RNAV STAR, northeast arrivals would utilize the BFFLO RNAV STAR, southeast arrivals to APA would utilize the DUNNN RNAV STAR (similar to Alternatives 1 and 2) and southeast arrivals to BJC would use the OTKST RNAV STAR. APA arrivals from the southwest would use the ZOMBZ RNAV STAR, and BJC arrivals from the southwest would use the CREDE RNAV STAR. RNAV SID procedures would allow full utilization of RNAV capabilities within the Study Area. Under this alternative, APA departures would use the LOOOP RNAV SID while BJC departures would use the WEEEL RNAV SID. Alternative 3 RNAV STARs are depicted in **Figures 2-16** and **2-17**, and Alternative 3 RNAV SIDs are depicted in **Figures 2-18** and **2-19**.

APA PBN Procedures

- From the northeast, APA jet arrivals would use the BFFLO RNAV STAR, which enters the Study Area separate from DEN arrivals. Once within the Study Area, APA arrivals would join portions of the DEN KOHOE and ANCHR procedures, prior to overflying APA and landing either Runway 17L or 35R.

- Aircraft arrivals from the northwest would utilize the BUGGG RNAV STAR. The BUGGG RNAV STAR would separate APA air traffic from DEN arrivals. APA arrivals would enter the Study Area from the northwest, fly directly over DEN, then follow a route similar to arrivals on the BFFLO RNAV STAR.

- The DUNNN RNAV STAR would serve aircraft arriving to APA from the southeast. Aircraft would be separated from southeast DEN and BJC arrivals.

- The ZOMBZ RNAV STAR would serve APA aircraft arrivals to Runway 17L and 35R originating from the southwest.

- For APA departures, the LOOOP RNAV SID would allow RNAV navigation from the runway to a point at which the aircraft would exit the Study Area. Aircraft would depart APA and be routed

to the east, continuing to climb, and following the procedure to the departure fix. The routing of the procedure to the west of APA allows aircraft to climb to an altitude such that safe separation from other air traffic is maintained.

BJC PBN Procedures

- From the northeast, BJC jet arrivals would use the BFFLO RNAV STAR, which enters the Study Area in between the LANDR and SAYGE fixes, thus separated from DEN traffic. Once within TRACON airspace, the BFFLO RNAV STAR would join with the KOHOE DEN RNAV STAR, and then turn towards the south to arrive on one of two runway ends at BJC.

- Aircraft arriving on the BUGGG RNAV STAR to BJC would be routed between the two existing fixes from the northwest (TOMSN and RAMMS), both of which would be overflown by DEN arrivals. Aircraft on the BUGGG RNAV STAR would remain separated from DEN traffic but follow a similar trajectory towards DEN. Aircraft would fly past BJC to a point at which they could cross above DEN arrivals and turn northwest to the Airport.

- Arrivals from the southeast would use the OTKST RNAV STAR. The OTKST RNAV STAR would route arrivals from the southeast to the northwest above DEN arrivals on JAGGR/PURRL/ ZPLYN/BOSSS to a point near DEN, then turn to the west prior to approaching BJC.

- Arrivals from the southwest would use the CREDE RNAV STAR. Aircraft would share a route with DEN arrivals until a point at which they would vector off to Runways 11L and 29R at BJC.

- For BJC departures, aircraft would fly the WEEEL RNAV SID, which routes them to the northeast immediately upon departure, turns them to the west to increase altitude, then towards the departure fix. The turn to the west allows sufficient increases in altitude to safely separate aircraft from DEN traffic, particularly for eastbound operations.

Alternative 3 represents approximately 82% of all operations at DEN using RNAV STAR and SID procedures. At APA, approximately 8% of operations are modeled using the RNAV STAR and SID procedures, and 7% of all operations to BJC modeled on the applicable RNAV STAR and SID procedures.

Table 2.6

Summary of Proposed Alternative 3 APA and BJC RNAV STARs and SIDs

Airport	RNAV STAR/SID	Procedure Name	Description
APA	STAR	BUGGG	NW Arrival
APA	STAR	BFFLO	NE Arrival
APA	STAR	DUNNN	SE Arrival
APA	STAR	ZOMBZ	SW Arrival
APA	SID	LOOOP	Departure
BJC	STAR	OTKST	SE Arrival
BJC	STAR	BUGGG	NW Arrival
BJC	STAR	BFFLO	NE Arrival
BJC	STAR	CREDE	SW Arrival
BJC	SID	WEEEL	Departure

Source: DEN RNAV Workgroup, 2012.

2.3.2.5 Alternative 4

Alternative 4 provides an alternative set of RNAV STARs for aircraft arriving to APA. The procedures in this alternative would mix traffic arriving to APA and DEN, which, while allowing aircraft to utilize RNAV capabilities, would also result in APA traffic sharing the DEN stream for a longer period of time and at lower altitudes. APA arrivals under Alternative 4 would include FRNCH (northwest), KOHOE (northeast), DUNNN (southeast), and LDORA/PEEEK (southwest). All but the DUNNN RNAV STAR are in common with DEN. Under Alternative 4, the RNAV STARs proposed for implementation in Alternative 2 would be utilized (reference Figure 2-3). The RNAV SIDs used in Alternative 2 would also be implemented (LOOOP Hybrid at APA and WEEEL Hybrid at BJC, reference Figures 2-4 and 2-5). **Figure 2-20** depicts the RNAV STARs for APA under this alternative.

- From the northeast, aircraft arrivals would use the KOHOE RNAV STAR, common with DEN arrivals. APA arrivals would be vectored off of the procedure at various locations (and in most cases sooner than DEN arrivals) or overfly DEN, prior to turning south to approach the Airport.

- Northwest arrivals would utilize the FRNCH RNAV STAR, in common with DEN arrivals on the same procedure. Aircraft would be vectored off of the procedure at various locations for arrival to Runways 17L or 35R at APA.

- Arrivals from the southeast would utilize the DUNNN RNAV STAR, similar to Alternative 3.

- From the southwest, aircraft arrivals would use the PEEEK and LDORA RNAV STARs, common to DEN arrivals.

Similar to Alternatives 2 and 3, approximately 82% of all operations at DEN, approximately 8% of operations at APA, and 7% of all operations at BJC are modeled on the applicable RNAV STAR and SID procedures.

Table 2.7
Summary of Proposed Alternative 4 APA and BJC RNAV STARs and SIDs

Airport	RNAV STAR/SID	Procedure Name	Description
APA	STAR	FRNCH	NE Arrival
APA	STAR	KOHOE	NW Arrival
APA	STAR	DUNNN	SE Arrival
APA	STAR	PEEEK/LDORA	SW Arrival
APA	SID	LOOOP Hybrid	Departure
BJC	STAR	DUNNN	SE Arrival
BJC	STAR	FRNCH	NW Arrival
BJC	STAR	KIPPR	NE Arrival
BJC	STAR	CREDE	SW Arrival
BJC	SID	WEEEL Hybrid	Departure

Source: DEN RNAV Workgroup, 2012.

2.3.3 Comparison of Alternatives

Table 2.8 provides a comparison of the alternatives carried forward for detailed review. Following the detailed environmental analysis and coordination with the public and agencies (see Chapters 4 and 5), the FAA determined that Alternative 2 is the Preferred Alternative to be carried forward for implementation. Alternative 2 provides RNAV STAR and SID procedures to every runway at DEN allowing extensive use of PBN. This alternative includes RNP, RNAV/RNP VMC and RNAV Visual approaches to the runways providing Air Traffic the ability to use PBN in multiple ways to multiple runways. Alternative 2 includes four RNAV

STARs and an RNAV SID for APA and BJC which allows RNAV-capable jets to use RNAV technology immediately upon departure. Alternative 2 allows the separation of DEN traffic arriving to APA from the southeast and southwest in keeping with the purpose and need for the project to provide separation of satellite facility traffic from DEN traffic. In summary Alternative 2 provides the safest and most efficient RNAV system that can be integrated into the Denver Complex Airspace while considering environmental concerns expressed during the EA process. See Chapter 4, Environmental Consequences for details on environmental considerations.

Table 2.8
Comparison of Alternatives

Review Factor	No Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Meets Purpose and Need					
Accommodates current air traffic efficiently	No	Yes	Yes	Yes	Yes
Accommodates future air traffic efficiently	No	Yes	Yes	Yes	Yes
Uses advanced technology, including RNAV and RNP	No	Yes	Yes	Yes	Yes
Enhances safety	No	Yes	Yes	Yes	Yes
Enhances operational efficiency	No	Yes	Yes	Yes	Yes
Addresses Specific Airspace Inadequacies	No	Yes	Yes	Yes	Yes
Environmental Considerations					
Significant Noise Impacts		No	No	No	No
Fuel Burn		Reduction	Reduction	Reduction	Reduction
Significant DOT 4(f) Resources Impacts		No	No	No	No

Source: DEN RNAV Workgroup and HNTB analysis, 2012.

CHAPTER 3:
AFFECTED ENVIRONMENT

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Chapter Three: AFFECTED ENVIRONMENT

The purpose of this chapter is to describe the character of the existing environment and the potentially affected environment for the Proposed Action. Characteristics of the surrounding area are given to familiarize the reader with the airport facilities and existing airspace, geography, land use, demography, and general environmental conditions potentially affected by the Proposed Action.

The following sections provide baseline conditions for the natural and social environment to be evaluated for potential impacts due to the Proposed Action Alternatives. Only the FAA Order 1050.1E impact categories that are potentially affected by the Proposed Action are discussed in this section. These include the following:

- Noise;
- Existing Land Use;
- Population and Demographics;
- Department of Transportation Section 4(f) and 6(f) Resources;
- Historic, Architectural, Archaeological, and Cultural Resources;
- Air Quality;
- Climate; and
- Threatened and Endangered Species and Migratory Birds.

3.1 Study Area Setting and General Conditions

This section provides general information on the Study Area, airport facilities, airspace and typical meteorological patterns (i.e., weather and climate).

3.1.1 Setting and Location

The Study Area, as described in Chapter 1, Section 1.2, *Study Area*, encompasses approximately 6,900 square miles and includes all or part of 17 counties in the State of Colorado. The 17 counties included in the Study Area are provided in **Table 3.1**.

Table 3.1
Counties Located in the Study Area

Adams	Gilpin
Arapahoe	Grand
Boulder	Jefferson
Broomfield	Larimer
Clear Creek	Morgan
Denver	Park
Douglas	Teller
El Paso	Weld
Elbert	

Source: HNTB analysis, 2011.

3.1.2 Airport Facilities

There are 72 airports in the Study Area according to the National Plan of Integrated Airport Systems (NPIAS); the majority of these airports are private facilities. This EA focuses on DEN as the primary airport and the two busiest satellite airport facilities, APA and BJC. Noise analysis specific to

APA and BJC is included in the EA because of the size and activity of their turbojet fleets. APA has approximately 75 based turbojets and BJC has close to 25 based turbojets.[1] From June 2010 until the end of May 2011, APA had 11,863 turbojet arrivals annually (approximately 33 daily) and BJC had 3,608 turbojet arrivals annually (approximately 10 daily).[2] Specific PBN alternatives have been designed for each of these three airports. Aircraft operating to other satellite airports may be able to take advantage of the RNAV STARs designed for DEN.

Figure 3-1 illustrates the airports in the Study Area and correlates with **Table 3.2**, which identifies the airports and the county and city in which the airport is located.

Table 3.2
Airports in Study Area

ID	Airport Name	Airport ID	County	City	Ownership
1	Elk Park Ranch	34CD	Larimer	Allenspark	Private
2	Buckley Air Force Base	BKF	Arapahoe	Aurora	Military
3	Simons	34CO	Arapahoe	Aurora	Private
4	Harrington Ranch	CO02	Arapahoe	Bennett	Private
5	Logan	96CO	Adams	Bennett	Private
6	Greggs Nr 1	0CO3	Adams	Bennett	Private
7	Hoy Airstrip	76CO	Adams	Bennett	Private
8	J & S	CD14	Adams	Bennett	Private
9	Yoder Airstrip	CD09	Adams	Bennett	Private
10	Young's Strip	87CO	Arapahoe	Bennett	Private
11	Lazy W	86CO	Larimer	Berthoud	Private
12	Pond's Field	CD39	Larimer	Berthoud	Private
13	Skylane Ranch	17CO	Weld	Berthoud	Private
14	Skywagon Ranch	6CO6	Larimer	Berthoud	Private
15	Athanasiou Valley	CO07	Gilpin	Blackhawk	Private
16	Boulder Muni	BDU	Boulder	Boulder	Public
17	Lemons Private Strip	CO10	Boulder	Boulder	Private
18	Brighton Van-Aire Estates	CO12	Adams	Brighton	Private
19	Flying E	22CO	Adams	Brighton	Private
20	Bijou Basin	CD17	Adams	Byers	Private
21	East Moore Field	8CO4	Arapahoe	Byers	Private
22	Sky Haven	CO17	Arapahoe	Byers	Private
23	Spickard Farm	5CO4	Arapahoe	Byers	Private
24	Kelgun	4CO8	Douglas	Castle Rock	Private
25	Meyer Ranch	5CO6	Jefferson	Conifer	Private
26	Centennial	APA	Arapahoe	Denver	Public
27	Denver Intl	DEN	Denver	Denver	Public
28	Front Range	FTG	Adams	Denver	Public
29	Rocky Mountain Metropolitan	BJC	Jefferson	Denver	Public
30	Ambrosich Field	4CO7	Douglas	Elbert	Private
31	Flying Lazy D Ranch	CO49	Elbert	Elbert	Private
32	Kelly Air Park	CO15	Elbert	Elbert	Private
33	Circle 8 Ranch	CO42	Elbert	Elizabeth	Private

Table 3.2
Airports in Study Area

ID	Airport Name	Airport ID	County	City	Ownership
34	D Bar D	9CO6	Elbert	Elizabeth	Private
35	Dietrichs	3CO7	Elbert	Elizabeth	Private
36	Flyin' B Ranch	CD45	Elbert	Elizabeth	Private
37	Pine View	8CO9	Elbert	Elizabeth	Private
38	Safer	2CD6	Elbert	Elizabeth	Private
39	Erie Muni	EIK	Weld	Erie	Public
40	Parkland	7CO0	Weld	Erie	Private
41	Marshdale	CO52	Jefferson	Evergreen	Private
42	Wings N Things Airpark & Museum	CO58	Weld	Firestone	Private
43	Kostroski	43CO	Douglas	Franktown	Private
44	Reed Hollow Ranch	CO96	Douglas	Franktown	Private
45	Easton/Valley View/	11V	Weld	Greeley	Private
46	Platte Valley Airpark	18V	Weld	Hudson	Private
47	Tall Timber	CD28	Jefferson	Indian Hills	Private
48	Horseshoe Landings	CO60	Weld	Keenesburg	Private
49	JJS	CO56	Adams	Keenesburg	Private
50	Land	CO82	Weld	Keenesburg	Private
51	The Farm	62CO	Weld	Keenesburg	Private
52	Beaugh	9CO7	Weld	Kersey	Private
53	Bijou Bottom Strip	9CO8	Elbert	Kiowa	Private
54	Chaparral	CO18	Elbert	Kiowa	Private
55	Comanche Creek	07CO	Elbert	Kiowa	Private
56	Fox Hole	0CD7	Boulder	Lafayette	Private
57	Perry Park	CO93	Dolores	Larkspur	Private
58	Vance Brand	LMO	Boulder	Longmont	Public
59	Dave's	0CO1	Boulder	Louisville	Private
60	Cartwheel	0CO8	Weld	Mead	Private
61	Rancho De Aereo	05CO	Weld	Mead	Private
62	Mountain View Ranch	52CO	El Paso	Monument	Private
63	Colorado Antique Field	8CO7	Boulder	Niwot	Private
64	Everitt	1CO8	Elbert	Parker	Private
65	Kugel-Strong	03CO	Weld	Platteville	Private
66	Tonga	1CD2	Weld	Platteville	Private
67	Air Dusters Inc	49CO	Weld	Roggen	Private
68	Westberg-Rosling Farms	74CO	Weld	Roggen	Private
69	Comanche Airfield LLC	CO38	Adams	Strasburg	Private
70	Comanche Livestock	59CO	Adams	Strasburg	Private
71	Comanche Springs Ranch	CO97	Arapahoe	Strasburg	Private
72	Van Slyke Field	9CO2	Arapahoe	Watkins	Private

Source: National Plan of Integrated Airports Systems (2011-2015).

3.1.3 Primary Airport

DEN is located in Denver County, Colorado about 23 miles northeast of downtown Denver. The City and County of Denver (CCD) owns and operates DEN under the management of the Department of Aviation. In 2010, approximately 618,300 annual aircraft operations were conducted at DEN. Fifteen (15) major scheduled airlines operate out of DEN. There are six runways at DEN, located on the airfield around the mid field terminal and concourses. The four north/south runways are as follows: 16R-34L is 16,000 feet long and 200 feet wide and 16L-34R, 17L-35R and 17R-35L are all 12,000 feet long and 150 feet wide. The east/west runways 07-25 and 08-26 are also 12,000 feet long and 150 feet wide. **Figure 3-2** illustrates the DEN layout and runway configuration.

3.1.4 Satellite Airports

APA is located in Arapahoe County, Colorado, about 13 miles south of downtown Denver and 19 NM southwest of DEN. APA is owned and operated by the Arapahoe County Public Airport Authority which is a political subdivision of the State of Colorado. In 2010, approximately 271,800 annual aircraft operations were conducted at APA**.** The Airport has three runways (two parallel runways and a crosswind runway) and is dominated by general aviation (GA) operations. **Figure 3-3** depicts APA.

BJC is located in Jefferson County, Colorado, about 17 miles northwest of downtown Denver and 21 NM from DEN. BJC is owned and operated by Jefferson County which is a division of the Jefferson County Development and Transportation Department. In 2010, approximately 117,700 annual aircraft operations were conducted at BJC. The Airport has three runways (two parallel runways and one crosswind runway). The Airport is dominated by GA operations and is a base to National Science Foundation (NSF) and National Center for Atmospheric Research (NCAR) flight operations in Colorado. **Figure 3-4** depicts BJC.

3.1.5 Airspace

The existing airspace structure, which is also the No Action Alternative, uses a system of navigational fixes, routes and procedures to route aircraft through the Study Area. Chapter 1, Section 1.3.1, *National Airspace System*, provides information on the ATC facilities in the Study Area which serve to manage and provide separation to aircraft operating under IFR. In addition, **Appendix A**, ***National Airspace System Overview***, provides an overview of the National Airspace System and the procedures used to direct and manage aircraft during the takeoff, cruise and landing phases of flight. Appendix A also provides information on the airspace classifications (i.e., Class B, C, D and E) which are designed primarily to manage visual flight rules (VFR) traffic in controlled airspace in order to ensure separation from IFR aircraft.

The intent of this section is to discuss the general flow of air traffic in the Study Area, in regard to the effect of aircraft routings on the affected environment (e.g., noise). Generally, most air carrier and GA jet aircraft flying within the Study Area are in the takeoff or landing phase of flight from a commercial service airport.

During the cruise phase of flight, these aircraft are usually flying above 18,000' AGL, and as such, are above the Study Area. Non-jet GA aircraft typically operate at lower altitudes, and are more apt to be in the cruise portion of flight within the Study Area.

To help understand the limitations in the existing airspace structure, consider the flows of air traffic in the Study Area. Fixed-wing aircraft must generally depart (takeoff) and arrive (land) into the wind, in order to increase aircraft performance (i.e., reduced takeoff and landing distance and increased climb gradient) and maintain safety. While runway use is generally determined by wind, other factors also play a role. For example, weather conditions such as low visibility and/or cloud ceiling can also affect runway selection, as some runways have enhanced Instrument Meteorological Conditions (IMC) capabilities and the availability of instrument approach procedures (e.g., Instrument Landing Systems, ILS). In the absence of wind and weather factors, operational necessity and traffic demand can determine runway selection as some runway flows have a higher operational capacity than others, due in part to runway layout. A runway use configuration is the combination and orientation of runways that aircraft use at a particular time in response to these factors.

Several runway use configurations are possible, based on the interaction of runways in use at each airport. Runway use and resulting arrival and departure routes from one airport may affect the arrival and departure routes at another airport. As a result, there are multiple airport/runway use interdependencies through the interaction of aircraft routes from different airports. DEN operates primarily in a north or south configuration: north on Runways 35L, 35R, 34L and 34R and south on Runways 16L, 16R, 17L and 17R. APA operates similarly, with the primary configurations being a north or south runway flow: north on Runways 35L and 35R and south on Runways 17L and 17R. BJC, however, operates slightly differently, with the primary configuration being northwest or southeast: northwest on Runways 29L and 29R and southeast on Runways 11L and 11R.

During the course of a day, the way that the airfield at DEN is operated may change multiple times depending on weather and traffic levels. However, there are prominent configurations for both arrival and departure flows at DEN which influence the flows into APA and BJC. Arrival flows into DEN are mostly in a true north or south configuration with arriving aircraft landing in a south configuration on Runways 16L, 16R and 17R or in a north configuration on Runways 34R, 35L and 35R. Less predominant flows include arrivals from the west and east in combination with north or south arrivals. **Figures 3-5** through **3-9** show the most prominent arrival flows used in the existing airspace structure at DEN, including flow into APA and BJC, for south, north, south and west, south and east, and north and west, flows, respectively.

Departure configurations at DEN are not predominately in a true north or south configuration but include departures to the east and west along with north and south departures. The four most predominate configurations include departures on Runways 34L, 34R, 8 and 25, Runways 34L, 34R and 25, and Runways 17L,17R, 8 and 25. **Figures 3-10** through **3-13** show the departure routes used in the existing

airspace structure at DEN, including APA and BJC for north and south, including east and west flows, respectively.

As previously stated, air traffic routes vary depending on the runway configuration in use at each airport. Departing aircraft are assigned to a departure runway that is based on the particular flow (e.g., north or south) in which the primary airport is operating, and the flight's destination which generally determines the initial departure fix to be navigated towards once airborne and all applicable in-close noise abatement procedures have been satisfied. Arriving aircraft are assigned to a route based upon the expected arrival runway, and the flight's origin and direction of approach to the destination airport. ATC operates in a systematic manner, such that flights between two airports (e.g., DEN and San Diego) will typically be assigned to the same route. This ensures that ATC operates in a safe and efficient manner and results in the establishment of the primary air traffic routes.

Figures 3-5 through 3-13 also depict the complexity of the current airspace structure and the interdependency of the airports with regard to aircraft routing. Although the existing airspace structure provides for the safe conveyance of aircraft, there are inherent limitations in its design which result in considerable inefficiencies.

3.1.6 Land Use

Figure 3-14 illustrates generalized land use within the Study Area, while **Figures 3-15**, **3-16** and **3-17** depict specific land use in the vicinity of DEN, APA and BJC, respectively. Land use in the Study Area includes low, medium and high intensity development in and around cities and metropolitan areas, with the largest concentration surrounding the City of Denver, which includes parts of Denver, Adams, Arapahoe and Jefferson counties. The majority of the western portion of the Study Area consists of evergreen and deciduous forest, with perennial snow/ice in and near Rocky Mountain National Park. To the south and southeast of Denver the land cover is characterized by natural or semi-natural herbaceous vegetation and is consistent with open space and rural land use. To the north and east of Denver in the Study Area, the land is classified as cultivated cropland, largely farmland that is managed for the production of food, feed or fiber.

Information on existing land use was obtained from the United States Geological Survey (USGS).

3.1.7 Demographics

Demographic data is used to assess potential impacts to people, socioeconomic impacts and impacts to minority and low-income populations under environmental justice considerations. This section describes the 2010 U.S. Census demographic statistics for the counties in which the airports are located; specifically Denver County for DEN, Arapahoe County for APA and Jefferson County for BJC. Although only the demographic data for the counties that the airports are within is provided in **Table 3.3**, the most current and projected demographic data was collected for all counties in the Study Area and was incorporated into the GIS database that was used to assess environmental consequences. Specifically, Adams, Boulder, Broomfield, Clear Creek, Douglas, El Paso, Elbert, Gilpin, Grand, Larimer, Morgan, Park, Teller and Weld counties were included in the GIS database.

Table 3.3 summarizes the demographic data in the vicinity of DEN, APA and BJC, including information on population, median income and employment. The counties are comparable in terms of population, income and households. All three counties have grown in population in the past 10 years (2000 to 2010), with Arapahoe County experiencing the highest percent growth (17.2 percent). Denver County had a population increase of 8.2 percent and Jefferson County's population increased by 1.4 percent. Population in the State of Colorado increased by almost 17 percent between 2000 and 2010. The per capita income in each of the counties is comparable to that of the State.

Tables 3.4 and **3.5** provide statistics on minority and low-income populations within Denver, Arapahoe and Jefferson Counties, as well as statewide and nationwide statistics for comparison purposes. The most recent data available from the U.S. Census Bureau were used.

The Department of Transportation Order on Environmental Justice defines low-income as "a person whose median household income is at or below the Department of Health and Human Services poverty guidelines."[3] Minority populations are defined as:

- Black - a person having origins in any of the black racial groups of Africa;
- Hispanic - a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race;
- Asian American - a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent or the Pacific Islands; or
- American Indian and Alaskan Native - a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition.[4]

Table 3.3

Demographic Statistics

Demographic Factor	County and Airport			Colorado
	Denver County, Colorado (DEN)	Arapahoe County, Colorado (APA)	Jefferson County, Colorado (BJC)	
Population				
2010 Population[1]	600,158	572,003	534,543	5,029,196
Per Capita Income[2]	$29,844	$31,808	$34,147	$29,679
Population, % Change (2000-2010)	8.2%	17.2%	1.4%	16.9%
Income				
Total Households[1]	285,797	238,301	229,967	1,869,276
Median Household Income (2009)[2]	$45,438	$58,968	$65,891	$55,735
Median Family Income[2]	$56,909	$73,086	$80,597	$69,591
Employment[2]				
In Labor Force (2005-2009)	301,714	298,948	302,232	2,643,932
Employment in civilian labor force	324,805	297,182	301,653	2,616,764
Employment in Armed Forces	538	1,766	579	27,168
Unemployment in civilian labor	22,574	17,543	18,177	162,296
Population not in labor force	135,768	119,583	121,211	1,134,480

Source: U.S. Bureau of the Census, Census 2000 and 2010.

Note: (1) 2010 U.S. Census Data available and used.
(2) American Community Survey, 2005-2009 (in 2009 inflation-adjusted dollars).

Table 3.4

Minority and Low-Income Population Statistics

Demographic Factor	County and Airport		
	Denver County, Colorado (DEN)	Arapahoe County, Colorado (APA)	Jefferson County, Colorado (BJC)
Minority Population Statistics, 2010 (percent)[1]			
% of Total County Population	31.1%	27.3%	11.6%
% of Total State Population	18.7%	18.7%	18.7%
% of Total National Population	27.6%	27.6%	27.6%
Persons below poverty level, 2009 (percent)[2]			
% of Total County Population	18.8%	12.3%	8.1%
% of Total State Population	12.6%	12.6%	12.6%
% of Total National Population	14.3%	14.3%	14.3%

Source: (1) U.S. Bureau of the Census, Census 2010. (2) American Community Survey, 2005-2009.

Table 3.5
Detailed Minority Statistics

	Colorado		Denver County, Colorado		Arapahoe County, Colorado		Jefferson County, Colorado	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Total Population	5,029,196	100%	572,003	100%	600,158	100%	534,543	100%
One race	4,856,740	96.5%	547,646	95.8%	575,599	95.9%	519,997	97.3%
White	4,089,202	81.3%	415,910	72.7%	413,696	68.9%	472,694	88.4%
Black or African American	201,737	4.0%	58,107	10.2%	61,435	10.2%	5,667	1.1%
American Indian and Alaska Native	56,010	1.1%	4,363	0.8%	8,237	1.4%	4,717	0.9%
Asian	139,028	2.8%	29,077	5.1%	20,433	3.4%	14,037	2.6%
Native Hawaiian and Other Pacific Islander	6,623	0.1%	1,140	0.2%	607	0.1%	457	0.1%
Some other race	364,140	7.2%	39,049	6.8%	71,191	11.9%	22,425	4.2%
Two or more races	172,456	3.4%	24,357	4.3%	24,559	4.1%	14,546	2.7%
Hispanic or Latino (of any race)	1,038,687	20.7%	105,522	18.4%	190,965	31.8%	76,445	14.3%

Source: U.S. Bureau of the Census, Census 2010.

3.1.8 Weather and Climate

Weather and climate are important factors in aviation operations. Wind, temperature, precipitation and storms affect how aircraft operate and how air traffic is managed. While the Study Area usually experiences four well defined seasons, the climate is significantly influenced by the Rocky Mountains and is often characterized by rapidly changing weather.

Aircraft generally takeoff and land into the wind (known as a headwind) whenever possible. Headwinds reduce an aircraft's takeoff and landing distance, and increase climb rate. Aircraft can operate with considerable crosswinds (a wind blowing at the side of the aircraft), up to about 20 knots for a typical air carrier aircraft. Aircraft can operate with limited tailwinds (a wind blowing on the rear of the aircraft), up to 10 knots for a typical air carrier aircraft. Tailwinds increase takeoff and landing distance. Winds in excess of crosswind and tailwind limits force aircraft to use a different runway. Accordingly, wind speed and direction dictate the orientation of runways at an airport and the use of specific runway configurations. The general atmospheric flow in the Study Area is from west to east and winds are generally from the north and south at DEN and APA and from the north and west at BJC. The average wind speed at DEN is 8.9 mph, at APA is 7.3 mph and at BJC is 6.4 mph.[5] On average, the spring and summer months are windier than the other months. Strong winds are also frequently associated with severe thunderstorms.

Temperature is an important factor in aircraft performance. High temperatures decrease the density of air, which increases aircraft takeoff distance and reduces climb performance. This generally results in

increased noise propagation in hot temperatures, as compared to colder temperatures. Temperatures at DEN, APA and BJC are somewhat moderated by the Rocky Mountains. The average temperature for all three airports is about 50-degrees Fahrenheit.

In general, precipitation is associated with storm events and reduced visibility. These factors can result in increased airport delays. Snowfall and precipitation amounts depend greatly upon location within the Study Area relative to the lee side of the mountains. On average, 60 inches of snow and 15 inches of liquid precipitation fall each year at DEN.[6]

As discussed in the previous Chapters, the Proposed Action is the implementation of new RNAV procedures, inclusive of RNP and OPD, for RNAV-capable aircraft flying into and out of DEN, APA and BJC. Section 3.2 identifies the impact categories that are not expected to have an impact due to the Proposed Action and Section 3.3 provides baseline conditions for the natural and social environment to be evaluated for potential impacts from the Proposed Action.

3.2 Non-Issue Impact Categories

Table 3.6 provides the impact categories in FAA Order 1050.1E that are not anticipated to be impacted by the Proposed Action. A brief description of the categories and the rationale for dismissing the impact category is discussed in the table below.

Table 3.6

Non-Issue Impact Categories

Category	Description	Reason for Dismissal
Coastal Resources	Federal activities involving or affecting coastal resources are governed by the Coastal Barriers Resources Act, the Coastal Zone Management Act (CZMA) and E.O. 13089, Coral Reef Protection. The CZMA of 1972 ensures effective management, beneficial use, protection and development of the coastal zone. Coastal Zone Management Programs, prepared by states according to guidelines issued by the National Oceanic and Atmospheric Administration, are designed to address issues affecting coastal areas.	The project area is not located in a coastal zone, is not within a coastal barrier and is not included in a Coastal Zone Management Program. Therefore there would be no impacts with respect to coastal resources or coastal barriers and no further analysis is required.
Construction Impacts	NEPA documents must include a general description of the type and nature of any construction, and measures to be taken to minimize potential adverse effects. Local, State, Tribal or Federal ordinances and regulations address the impacts of construction activities, including construction noise, dust and noise from	The implementation of new RNAV procedures does not involve any construction activity/ground-based impacts; therefore, there would be no construction impacts associated with the Proposed Action and no further analysis is required.

Table 3.6
Non-Issue Impact Categories

Category	Description	Reason for Dismissal
	heavy equipment traffic, disposal of construction debris, and air and water pollution.	
Farmlands	The Farmland Protection Policy Acts (FPPA) of 1980 and 1995 require identification of the effects of Federal programs on the conversion of farmland to non-agricultural uses.	The Proposed Action does not claim farmland, as it does not involve the development of any land. Therefore, no farmland soils will be impacted and the agricultural economy of the area will not be affected and no further analysis is required.
Floodplains	Executive Order No. 11988 was enacted in order to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of floodplains, including the avoidance of direct and indirect support of floodplain development wherever there is a practical alternative.	The Proposed Action would not result in the construction of facilities. Therefore, it would not encroach upon areas designated as a 100-year flood event area as described by the Federal Emergency Management Agency (FEMA) and no further analysis is required.
Hazardous Materials, Pollution Prevention, and Solid Waste	FAA actions to fund, approve or conduct an activity may require consideration of hazardous material, pollution prevention and solid waste impacts in NEPA documentation. Laws governing the handling and disposal of hazardous materials, chemicals, substances and wastes are the Resource Conservation and Recovery Act (RCRA) (as amended by the Federal Facilities Compliance Act of 1992) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). RCRA governs the generation, treatment, storage and disposal of hazardous wastes. CERCLA provides for consultation with natural resources trustees and cleanup of any release of a hazardous substance (excluding petroleum) into the environment.	The Proposed Action would not result in any construction or development or any physical disturbances of the ground. Therefore the potential for impact in relation to hazardous materials, pollution prevention and solid waste is not anticipated and no further analysis is required.
Light Emissions and Visual Impacts	The FAA considers the extent to which any lighting associated with an action will create an annoyance among people or interfere with their normal activities.	Due to the altitude of the proposed RNAV procedures, the lights associated with aircraft operating on these routes would not be bright

Table 3.6
Non-Issue Impact Categories

Category	Description	Reason for Dismissal
		enough to be an annoyance to people or interfere with normal activities on the ground. Additionally, flight locations are in the same proximate location in the future as they are in the existing condition. Therefore, no further analysis is required.
Natural Resources and Energy Supply	Federal agencies should ensure that energy use, its conservation, and energy efficient alternatives are considered along with other pertinent factors in planning, detailed design, and in the decision making process leading to an action. The potential to change demands on stationary facilities, local energy supplies, and natural resources, other than fuel, is also considered. The CEQ has also indicated that greenhouse gas emissions should be considered in NEPA analysis.	The Proposed Action would not result in the construction of facilities that would potentially impact known sources of minerals or energy. Therefore, it is anticipated that the Proposed Action would not result in the depletion of local supplies of energy and/or natural resources and no further analysis is required. Any increase in fuel burn will be discussed in Section 4.10, *Climate* of the Environmental Consequences.
Secondary (Induced) Impacts	When potential for major development proposals involve the potential for induced or secondary impacts on surrounding communities, the EA shall describe in general terms such factors. This includes any shifts in patterns of population movement and growth, the demand for public services, and changes in business and economic activity within the confines of the Study Area.	Induced impacts are normally not significant except where there are also significant impacts in other categories, especially noise, land use, or direct social impacts. Impacts are not anticipated for any of these categories, therefore there would be no significant secondary impacts due to the proposed project.
Water Quality	The Federal Water Pollution Control Act, as amended by the Clean Water Act (CWA) of 1977, establishes water quality standards for restoring and maintaining the integrity of the nation's waters. Section 402 of the CWA established the National Pollutant Discharge Elimination System (NPDES) to limit pollutant discharges into streams, rivers, and bays and is the key regulatory element in the enforcement of the CWA.	The Proposed Action would not require construction of facilities, and therefore does not impact water resources and no further analysis is required.
Wetlands	Section 404 of the CWA, as amended,	The Proposed Action would not result

Table 3.6
Non-Issue Impact Categories

Category	Description	Reason for Dismissal
	regulates the discharges of dredged or fill materials into navigable waters of the United States through the Section 404 Permit program.	in the construction of facilities and would therefore not encroach upon areas designated navigable waters. Therefore no further analysis is required.
Wild and Scenic Rivers	The Wild and Scenic Rivers Act of 1968 (PL.90-542) was instituted to protect and preserve in free-flowing condition, river segments which with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. The Wild and Scenic Rivers Act limits development within 1,000 feet of segments of a river designated as Wild or Scenic.	One designated Wild and Scenic River, the Cache la Poudre River, penetrates the Study Area within Rocky Mountain National Park. Existing aircraft noise exposure is <29 DNL at all 23 points modeled along the river, and maximum change in noise exposure with any of the alternatives is +2 DNL. (See Appendix D). These noise levels reflect the high altitude that aircraft are using as they traverse the section of the River within the Study Area. Also, the Proposed Action will not result in any ground-based impacts. No further analysis is required.

Source: HNTB Analysis, 2012.

3.3 Affected Environmental Resource Categories

Noise and other resource categories related to noise exposure are discussed in this section, along with existing air quality and wildlife potentially found in the Study Area.

3.3.1 Noise

Aircraft noise is often the most noticeable environmental effect associated with aviation. This section includes a brief overview of the noise analysis methodology used for this EA as well as a discussion of the existing aircraft noise exposure levels in the Study Area.

3.3.1.1 Noise Modeling Methodology

The FAA has developed specific guidance and requirements for the assessment of aircraft noise in order to comply with NEPA. This guidance, specified in FAA Order 1050.1E, requires that aircraft noise be analyzed in terms of the yearly Day-Night Average Sound Level (DNL) metric. To this end, DNL noise levels are calculated for the average annual daily operations for the years of interest. The Proposed Action covers a widespread area and involves high-altitude route changes. The noise analysis is conducted for the entire Study Area up to an altitude of 18,000' AGL and includes aircraft operations at DEN, APA and BJC. For this study, noise modeling

was conducted for 2010 (base year) as described in this chapter. Forecast conditions in 2012 (first year of implementation) and 2017 (five years beyond implementation) for the No Action Alternative and Proposed Action Alternatives are described in Chapter 4, *Environmental Consequences*.

Noise Metric

The DNL metric is the sound level from aircraft operations for a 24-hour period, which includes all of the time-varying aircraft sound energy within the period. Since there is a greater annoyance caused by noise events at night, a 10 decibel (dB) weighting is added to the DNL for night-time noise events. The weighting, in essence, equates one night-time flight to 10 daytime flights. Night-time noise events, as defined by the FAA, are those that occur between 10:00 P.M. and 6:59 A.M. This extra night-time event weighting helps to account for the annoyance of noise during time periods when people are trying to sleep and ambient noise levels are lower. Additional details relating to the physics of sound, the effect of noise on people and the DNL metric is available in **Appendix B**, ***Noise and its Effect on People Technical Report***.

Noise Models

Two noise models were used for the analysis of noise in this EA: the Integrated Noise Model (INM) and the Noise Integrated Routing System (NIRS). The INM is the FAA's approved model for assessing noise at civilian airports. The INM has been used for environmental review of aviation noise impacts since 1978 and is used for 14 CFR Part 150 studies and NEPA environmental assessments and environmental impact statements. The NIRS model was developed by the FAA specifically to assess noise effects associated with regional airspace projects. The NIRS model was initially developed in 1995 by the FAA's Office of Environment and Energy in cooperation with FAA Air Traffic for assessing the noise impacts of regional airspace design projects covering large geographic areas. NIRS was validated by the FAA Office of Environment and Energy against INM in 1997. The NIRS model has been used to assess noise impact for regional airspace redesign in multiple environmental documents by the FAA. NIRS shares common features with INM, including noise computational algorithms and an aircraft reference database. Both models are average-value models which are designed to estimate the long term average changes in operating conditions.

Although not a regional airspace redesign because of the expanse of the area to be studied within this EA (i.e. the study goes beyond the immediate vicinity of the individual airports included in the Proposed Action), the extensive number of new air traffic procedures, and the capabilities within the NIRS model to adjust aircraft flight profiles to accurately represent procedural changes, it was decided to use the model to analyze operations into and out of DEN. For the noise analysis at the satellite airports (APA and BJC) it was determined that the INM would be used. This determination was made based on the satellite airports having fewer proposed air traffic procedures and fewer RNAV-capable aircraft that would potentially use the proposed procedures. However, the flight segment generator within NIRS was used to

generate RNAV procedure flight segments for input into the INM so as to replicate air traffic procedures as INM does not have this type of capability.

Detailed information on aircraft operations within the Study Area was assembled for input into INM and NIRS. This includes specific fleet mix information such as aircraft type, arrival and departure times, and origin/destination airport. The operational forecasting used in the noise modeling is discussed in **Appendix C, *Flight Activity Forecast Development Technical Report*** and annual operations by airport and year of analysis are summarized in **Table 3.7**.

Table 3.7
Existing and Forecast Annual Operations by Airport

Airport	2010	2012	2017
DEN	618,310	643,094	731,460
APA	271,781	287,125	298,405
BJC	117,694	119,597	133,384

Source: HNTB analysis, 2011.

While the fleet mix defines the number and type of aircraft operations, runway use and flight track location/usage provide information on where and how aircraft travel in the Study Area. Modeled flight tracks were developed from a 365-day sample of radar data, which included over 680,000 actual flight tracks. The radar data provided information on flight route geometry and headings, aircraft usage by type and time of day, and flight profiles (i.e., altitudes).

Weather conditions (e.g., temperature and humidity) that affect the propagation of noise through the air and terrain data are also incorporated into the NIRS and INM modeling. Additional details on NIRS and INM and development of the noise modeling are available in **Appendix D, *Noise Modeling Technical Report*.**

Noise exposure from aircraft operations was calculated at more than 68,000 locations throughout the approximate 6,905 square miles. The locations consist of (1) population centroids (i.e., center of census block); (2) noise sensitive locations such as historic sites, schools and parks; and (3) evenly spaced grids over National and state parks and wilderness areas.

Census blocks are the smallest geographic unit for which the U.S. Census Bureau tabulates data. Census blocks are generally bounded by streets, legal boundaries and other features. The number of people exposed to noise is estimated as the number residing in the census block. For this analysis, the census block counts represent the maximum potential population within the census block that could be exposed to the modeled DNL levels. The actual number of people impacted can be less than the total population represented by a single census block because noise levels will vary throughout the census block. A total of over 65,600 census blocks (748 census tracts) in the Study Area were analyzed.

3.3.1.2 Existing Aircraft Noise Exposure at Population Centroids

Figure 3-18 shows the existing (2010) noise exposure levels at population centroids from 45 DNL up to 75 DNL for the entire Study Area. The color of each population centroid is thematically based as defined in **Table 3.8**. In general, the majority of the Study Area is exposed to aircraft noise levels less than 45 DNL. As would be expected, the areas closer to the airports are exposed to the highest noise exposure levels. As shown in **Table 3.9**, the majority (i.e., 88%) of people residing within the Study Area are exposed to less than 45 DNL. Approximately 422 people (i.e., 0.01%) experience noise exposure levels of 65 DNL or more. The 2010 existing condition noise analysis is intended to provide a frame of reference when considering the future condition noise analyses presented in Chapter 4, *Environmental Consequences*. In addition, the 2010 noise analysis is the foundation upon which the noise modeling for the future conditions (i.e., 2012, first year of implementation and 2017, five years beyond implementation) is developed.

Table 3.8

Color Coding for DNL Ranges

DNL Range (dB)	Color
Less than 45	Magenta
45 to less than 50	Dark Blue
50 to less than 55	Light Blue
55 to less than 60	Green
60 to less than 65	Yellow
65 to less than 70	Orange
70 to less than 75	Baby Pink
75 or Greater than	Red

Source: HNTB analysis, 2011.

Table 3.9

2010 Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Population	Percentage of Total
Less than 45	2,598,603	87.83%
45 to less than 50	262,170	8.86%
50 to less than 55	71,048	2.40%
55 to less than 60	23,252	0.79%
60 to less than 65	3,309	0.11%
65 to less than 70	422	0.01%
70 to less than 75	0	
Greater than or equal to 75	0	
Total	**2,958,804**	**100%**

Source: HNTB analysis, 2011

3.3.2 Section 4(f) and 6(f) of the DOT Act

49 U.S.C. Section 303(c), commonly referred to as Section 4(f) of the Department of Transportation (DOT) Act, states that the "…Secretary of Transportation will not approve a project that requires the use of any publicly-owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land from a historic site of national, state, or local significance as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land…and [unless] the project includes all possible planning to minimize harm resulting from the use." The term "use" encompasses both direct and indirect impacts to Section 4(f) properties. Direct use is the physical taking of the 4(f) property. Indirect adverse impacts such as noise that compromise the use of Section 4(f) properties for their intended purpose are considered a "constructive use."

Privately owned parks, recreation areas and wildlife refuges are not subject to Section 4(f). The determination of use must consider the entire property and not simply the portion of the property being used for the proposed project.

FAA has established guidelines for aircraft noise and land use compatibility under 14 CFR Part 150. Part 150 is limited, however, in its ability to assess the impact of noise in areas where quiet and serenity are expected. Special consideration is given to parks and natural areas where a quiet setting is a generally recognized purpose and attribute. In these areas the FAA official "must consult all appropriate Federal, State, and local officials having jurisdiction over the affected Section 4(f) resources when determining whether project-related noise impacts would substantially impair the resource."[7]

Since there is the potential for the Proposed Action to "use" 4(f) properties, this section describes the parks and natural areas located within the Study Area. Natural areas, as defined for the purpose of this document, include wildlife refuges, forests, wildlife management areas and other places that are considered recreationally and environmentally significant. The Study Area has numerous city, county, state and federally maintained parks as well as other natural areas. National Natural Resource Areas are depicted in **Figure 3-19** and correlated with a reference number in **Table 3.10**.

Many Section 4(f) properties are also subject to the Section 6(f) of the Land and Water Conservation Fund (LWCF) Act.[8] Section 6(f) states that no public outdoor recreation areas acquired or developed with any LWCF assistance can be converted to non-recreation uses without the approval of the Secretary of the Interior. The Secretary of the Interior may only approve conversions if they are in accordance with the comprehensive statewide outdoor recreation plan and if the converted areas will be replaced with other recreation lands of reasonably equivalent usefulness and location. In Colorado, LWCF state matching grants are administered by Colorado State Parks. Since 1965, nearly 1,000 grants totaling more than $58 million have funded local government and state park outdoors investments statewide.[9] **Appendix E, *Section 6(f) Resources*,** provides a list of

Section 6(f) properties by County in the Study Area.

The following subsections address National Park Service (NPS) lands, the National Forest System, State Parks and Forests, and other areas of state significance.

Table 3.10

National Parks, National Forests, National Wildlife Refuges and National Wilderness Areas within Study Area

Name	Type	County
Rocky Mountain National Park	National Park	Boulder, Grand, Larimer, Gilpin, Clear Creek
Arapaho National Forest	National Forest	Grand, Clear Creek
Pike National Forest	National Forest	Clear Creek, Teller, Park, Jefferson, Douglas, El Paso
Roosevelt National Forest	National Forest	Larimer, Boulder, Gilpin, Jefferson
San Isabel National Forest	National Forest	Park
Rocky Flats National Wildlife Refuge	National Wildlife Refuge	Jefferson, Boulder, Broomfield
Rocky Mountain Arsenal National Wildlife Refuge	National Wildlife Refuge	Adams , Denver
Two Ponds National Wildlife Refuge	National Wildlife Refuge	Jefferson
Lost Creek Wilderness	National Wilderness Area	Jefferson, Park
Indian Peaks Wilderness	National Wilderness Area	Boulder, Grand
James Peak Wilderness	National Wilderness Area	Clear Creek, Gilpin
Mount Evans Wilderness	National Wilderness Area	Clear Creek, Park

Source: US Department of the Interior, National Park Service.

3.3.2.1 National Park Service Lands

National Parks are intended to "conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations."[10] The first national park was Yellowstone National Park, created in 1872. Today, the national park system includes nearly 400 units including seashores, monuments and preserves among others.[11] Rocky Mountain National Park is the only National Park within the Study Area.

Rocky Mountain National Park

Rocky Mountain National Park (RMNP or the Park) is located in the northwest section of the Study Area. RMNP was established in 1915 as land "dedicated and set apart as a public park for the benefit and enjoyment

of the people of the United States…with regulations being primarily aimed at the freest use of the said park for recreation purposes by the public and for the preservation of the natural conditions and scenic beauties thereof."[12] RMNP consists of 265,769 acres of land in north-central Colorado.[13] Within RMNP, 2.9 percent is developed, 2.1 percent is backcountry, 93.5 percent is recommended wilderness, 0.4 percent is potential wilderness and 1.1 percent is designated wilderness. The Backcountry/Wilderness Management Plan manages all non-developed areas, defining RMNP's wilderness management policies and vision.

Backcountry/ Wilderness Areas

Almost the entirety of RMNP is considered backcountry or wilderness area (with the exception of 2.9 percent developed land). As defined by the National Wilderness Act of 1964, a wilderness is "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."[14] The Park has a great variation of land types, with approximately 60% forest, 13% alpine tundra, 18% exposed rock and 9% mixture of habitats. RMNP is separated into two vegetation zones by the Continental Divide which bisects the Park from north to south. The Park has a diversity of flora and fauna, including 69 endangered, threatened or rare species. RMNP also includes many historic structures, lands and trails.[15]

In addition to the diverse natural and cultural features, equally protected resources of RMNP's environment include the natural quiet, solitude, natural light and scenery of the Park. While the Park does not prohibit the use of wilderness and backcountry areas by humans, there are many limitations in place to protect the land and perpetuation of natural processes on it. Limitations include restrictions on day and overnight use, and the issuance of permits to access certain areas.

Park Zones

The Park can be divided into zones based on park use, including the scenic viewing or drive-through zone, the day-use zone and the primitive or backcountry zone. The drive-through zone allows visitors or cross-country travelers to access the Park by two major east-west highways and to take advantage of the scenic views. The day-use zone includes normally used areas such as roads, picnic sites, shorter trails and cross country skiing. The primitive zone provides more isolation, with longer trails, and overnight tent camping.[16] **Figure 3-20** illustrates the road system, hiking trails, wilderness areas, as well as generalized land cover within the Park.

3.3.2.2 National Forest System

The United States Department of Agriculture (USDA) Forest Service is responsible for managing the lands and resources of the National Forest System, which includes almost 193 million acres of land in 42 states, the Virgin Islands and Puerto Rico. The system is composed of 155 national forests, 20 national grasslands and various other lands under the jurisdiction of the Secretary of Agriculture. Section 4(f) applies to only those areas in a National Forest that are historic sites or designated by statute or management plans as a park, recreation area, or wildlife and waterfowl refuge.[17]

There are 11 national forests that total over 14.5 million acres in the State of Colorado and four of these national forests are within the Study Area: Arapaho National Forest, Roosevelt National Forest, Pike National Forest and San Isabel National Forest as illustrated in Figure 3-19. The Arapaho and Roosevelt National Forests and Pawnee National Grassland (ARP) are managed jointly by the United States Forest Service office in Fort Collins, Colorado. Pike National Forest and San Isabel National Forest and Comanche National Grasslands (PSICC) are jointly managed and headquartered in Pueblo, Colorado. Combined, the complete area is nearly 3 million acres.

3.3.2.3 National Wildlife Refuge System

The United States Department of the Interior Fish and Wildlife Service (FWS) is responsible for the administration of the National Wildlife Refuge System which now comprises more than 540 units and encompasses over 95 million acres of valuable wildlife habitat.[18] Wildlife refuge areas are a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Three National Wildlife Refuges are located within the Study Area: Rocky Flats National Wildlife Refuge, Rocky Mountain Arsenal National Wildlife Refuge and Two Ponds National Wildlife Refuge as illustrated in Figure 3-19.

3.3.2.4 National Wilderness Areas

The National Wilderness Preservation System (NWPS) was created by the Wilderness Act of 1964. Currently the NWPS includes 757 areas in 44 states and Puerto Rico. The United States Forest Service, the NPS, the Bureau of Land Management (BLM) and the FWS all manage Wilderness Areas. The intent of National Wilderness Areas is to preserve some of the country's last remaining wild places and to protect their natural processes and values from development.[19]

Four National Wilderness Areas exist within the Study Area: Lost Creek, Indian Peaks, James Peak and Mount Evans wilderness areas. Table 3.10 and Figure 3-19 illustrate the National Wilderness Area locations, along with the counties in which they are located. Like the wilderness areas of RMNP, these wilderness areas include certain areas that regard a quiet setting as an environmental resource of the land which must be protected.

3.3.2.5 State Parks, Forests and Other Area of Significance

Within the Study Area, there are nine state parks totaling over 36,500 acres of land and over 830 local and municipal parks, totaling approximately 65,000 acres. There are 21 State Wildlife Areas and no state-designated forests in the Study Area.[20] **Table 3.11** provides a list and **Figure 3-21** illustrates the State parks, forests and other areas (e.g. fairgrounds and Wildlife Management Areas) of state significance identified in the Study Area. Local and municipal parks located within the Study Area are also considered in the assessment of Section 4(f) impacts discussed in Chapter

4, *Environmental Consequences*. (Appendix G provides a list of the local parks in the Study Area.)

Table 3.11

State Parks, Forests and Areas of Significance within Study Area

Name	County	Acreage (approx.)	Figure 3-21 ID #.
State Parks			
Barr Lake	Adams County	2,890	1
Castlewood Canyon	Douglas County	2,300	2
Chatfield	Douglas and Jefferson Counties	5,940	3
Cherry Creek	Arapahoe County	4,410	4
Eldorado Canyon	Boulder County	1,335	5
Golden Gate Canyon	Gilpin and Jefferson Counties	11,920	6
Roxborough	Douglas County	3,295	7
St. Vrain	Weld County	655	8
Staunton	Park and Jefferson Counties	3,835	9
State Wildlife Areas			
Georgetown SWA	Clear Creek County	670	1
Mount Evans SWA	Clear Creek County	3,398	2
Lone Tree Reservoir SWA	Larimer County	476	3
Denver Headquarters SAA	Adams County	15	4
Lon Hagler SWA	Larimer County	280	5
Webster SWA	Weld County	794	6
Banner Lakes SWA	Weld County	934	7
Big Thompson Ponds SWA	Larimer County	56	8
Simpson Ponds SWA	Larimer County	66	9
Bergen Peak SWA	Clear Creek County	1,107	10
Sawhill Ponds	Boulder County	212	11
Whitehorse SWA	Adams County	401	12
Boedecker Reservoir SWA	Larimer County	403	13
Sharptail Ridge SWA	Douglas County	699	14
Columbine SWA	Douglas County	153	15
Twin Sisters SWA	Larimer County	621	16
Lowell Ponds SWA	Adams County	43	17
Sheets Lake SWA	Adams County	5	18
Ward Road Pond SWA	Jefferson County	26	19
Ralston Creek SWA	Gilpin County	2,321	20
Four Mile SWA	Douglas County	361	21
State Trust Lands			
Bald Mountain	Boulder County	240	1
Bergen Peak SWA	Clear Creek County	840	2
Blue Mountain	Jefferson County	640	3
Castlewood East Canyon	Douglas County	500	4
Four Mile Section	Douglas County	360	5

Table 3.11

State Parks, Forests and Areas of Significance within Study Area

Name	County	Acreage (approx.)	Figure 3-21 ID #.
Green Ranch Section 16	Gilpin County	640	6
Heil Ranch	Boulder County	560	7
Kiowa Creek	Elbert County	640	8
Lake Gulch Section 16	Douglas County	640	9
Lowry Range	Arapahoe County	21,570	10
Pinewood Reservation/Rattlesnake Park	Larimer County	640	11
Rockett/ Roxborough South	Douglas County	450	12
Rocky Flats Section 16	Jefferson County	105	13
Twin Sisters SWA	Larimer County	640	14
Upper Elk Falls	Park County	540	15

Source: Colorado Department of Natural Resources, Colorado State Parks.

3.3.3 Historical, Architectural, Archaeological, and Cultural Resources

A number of federal laws and regulations address protection of the Country's cultural resources. The statute specifically devoted to cultural resource issues is the National Historic Preservation Act of 1966 (16 USC 470), as amended, which contains two provisions that are pertinent to changes in aircraft routing.

Section 106 of the Act requires federal agencies to consider the effect of federally funded or licensed projects on properties and districts listed, or eligible for listing, in the National Register of Historic Places (NRHP).[21] National Historic Landmarks, a designation bestowed on a limited number of particularly significant cultural resources, are afforded special protection under Section 110 of the National Historic Preservation Act.[22] NRHP has established standards by which individual resources (both archaeological and architectural) are evaluated to determine their eligibility for listing. Resources may include buildings, sites, objects, and structures and are placed on the NRHP in reference to their: (1) association with events that have made a significant contribution to the broad patterns of American history; (2) association with the lives of persons significant in our past; (3) architectural or archaeological significance; and/or (4) ability to yield information important in prehistory or history.[23]

A broader range of cultural resources are protected under Section 4(f) of the Department of Transportation Act of 1966 which requires projects funded by the DOT to avoid "any significant historic site" unless there is no "feasible or prudent" alternative. This provision generally applies to resources listed, or eligible for listing, in the NRHP.

Although implementation of the Proposed Action does not require the physical taking of any cultural resource, the Proposed Action may result in an indirect impact to cultural resources. Indirect adverse impacts such as noise may be considered a "constructive use" or taking of the property. Therefore, cultural resources in the Study Area have been identified as shown in **Figure 3-22.** There are 677 listed historic resources in the Study Area, including places designated on the NRHP and/or designated as historic by the State of Colorado. Noise analysis was conducted at over 700 locations. A comprehensive list of historic resource sites and their designation status (national, state, or both) is included in **Appendix F, *Listing of Historic Resources***.

Native American Lands

Potential impacts to Tribal lands must also be assessed when evaluating impacts to cultural resources. The Study Area does not include any Native American Lands, Indian Reservations or State Designated American Indian Statistical Areas.

There are two federally recognized Indian tribes in Colorado, the Southern Ute and Ute Mountain tribes.[24] Both of the Indian Reservations are in the southwest corner of the State of Colorado, and do not fall within the Study Area boundary for this EA.[25]

3.3.4 Air Quality

This section describes the existing air quality conditions within the Study Area, as related to national air quality standards.

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for ambient (i.e., outdoor) concentrations of the following criteria pollutants: Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Ozone (ground-level O_3), Sulfur Dioxide (SO_2), Lead (Pb), particulate matter with a diameter of 10 microns or less (PM_{10}) and particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$). Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation and buildings.

States must identify geographic areas that do not meet the NAAQS for each criteria pollutant. These areas are then identified as non-attainment areas for the applicable criteria pollutant(s). Non-attainment areas for O_3 and PM_{10} are further classified based on the severity of the non-attainment (i.e., submarginal, marginal, moderate, serious, severe 17, severe 15, and extreme for O_3 non-attainment areas, or moderate and serious for PM_{10} for non-attainment areas, and lastly attainment or non-attainment for $PM_{2.5}$). States must develop a State Implementation Plan (SIP) for non-attainment areas that includes a variety of emission control measures that the state deems necessary to produce attainment of the applicable standard(s) in the future. If a SIP already exists, it must be revised if an area becomes non-attainment for a criteria pollutant.

An area previously designated non-attainment pursuant to the Clean Air Act (CAA) Amendments of 1990 and subsequently re-designated as attainment, is termed a maintenance area. A maintenance area must have a maintenance plan in a revision to a SIP to ensure attainment of the air quality standards is maintained.

Within the Study Area one criteria pollutant is in non-attainment and two criteria pollutants are in maintenance status. A description of the status of these three criteria pollutants follow.

3.3.4.1 Carbon Monoxide (CO)

CO is a colorless, odorless and poisonous gas produced by incompletely burned carbon in fuels. The majority of CO emissions are from transportation sources, with the largest from highway motor vehicles. CO molecules survive in the atmosphere for a period of approximately one month, but eventually react with oxygen to form carbon dioxide. CO levels found in ambient air may reduce the oxygen carrying capacity of the blood. Health threats are most serious for those with angina or peripheral vascular disease. Exposure to elevated CO levels can cause impairment of visual perception, manual dexterity, learning ability, and decreased performance of complex tasks. There are no areas within the Study Area designated non-attainment for CO; however, there are 10 counties in the Study Area designated as maintenance areas for CO as shown in **Table 3.12** and **Figure 3-23**.

Table 3.12

CO Maintenance Areas in the Study Area

Pollutant	County	Classification Standard
CO	Adams (Denver Metro Area)	Maintenance – Serious
	Arapahoe (Denver Metro Area)	Maintenance – Serious
	Boulder (Longmont)	Maintenance - Moderate
	Boulder (Denver Metro Area)	Maintenance – Serious
	Broomfield	Maintenance – Serious
	Denver	Maintenance – Serious
	Douglas (Denver Metro Area)	Maintenance - Serious
	El Paso	Maintenance - Moderate
	Jefferson (Denver Metro Area)	Maintenance - Serious
	Larimer	Maintenance - Moderate
	Teller	Maintenance - Moderate
	Weld (Longmont)	Maintenance - Moderate

Source: US EPA Office of Air Quality Planning & Standards, Green Book, available online at: http://www.epa.gov/airquality/greenbk/anayo_co.html (accessed February 17, 2012).

3.3.4.2 Ozone

Ozone is a colorless gas composed of three atoms of oxygen, one more than the oxygen molecule that people need to breathe. The additional oxygen atom makes ozone extremely reactive and irritating to tissue in the respiratory system. Ozone exists naturally in the Earth's upper atmosphere (i.e., the stratosphere) where it shields the Earth from the sun's ultraviolet rays. However, ozone found close to the Earth's surface, called ground-level O_3, is an air pollutant.

Ozone is formed by a complex series of chemical reactions between VOCs and NO_x in the presence of sunlight during hot, stagnant summer days. The primary manmade sources of VOCs and NO_x are industrial and automobile emissions. Other sources of VOCs include aircraft, airport ground support equipment, lawn and garden equipment, and consumer products such as paints, insecticides, and cleaners. Ozone concentrations can reach unhealthy levels when the weather is hot and sunny with little or no wind. High ozone levels usually occur between 1 p.m. and 7 p.m. from May through September. High concentrations of ozone may cause inflammation and irritation of the respiratory tract, particularly during heavy physical activity. Not only are there negative health effects for humans, but there is clear evidence that ozone harms vegetation and forests.

The regulations for ozone are in terms of an 8-hour standard, i.e. the amount of ozone measured over an eight hour period.

Nine of the counties in the Study Area are classified by the EPA as being in non-attainment for the 8-hour ozone standards. The counties are listed in **Table 3.13** and shown on **Figure 3-24.** The non-attainment areas in the Study Area are all classified as "Former Subpart 1" (as opposed to Severe, Serious, Moderate, etc.) until reclassification of the areas is finalized. Proposed reclassifications were published in January 2009.

Table 3.13
8-Hour Ozone Non-Attainment Areas in the Study Area

Pollutant	County	Classification Standard
8-hour Ozone	Adams	Former Subpart 1
	Arapahoe	Former Subpart 1
	Boulder	Former Subpart 1
	Broomfield	Former Subpart 1
	Denver	Former Subpart 1
	Douglas	Former Subpart 1
	Jefferson	Former Subpart 1
	Larimer	Former Subpart 1
	Weld	Former Subpart 1

Note: On June 8, 2007, the US Court of Appeals vacated the Subpart 1 portion of the Phase 1 Rule. The Subpart 1 areas in the Greenbook are listed as "Former Subpart 1" until reclassification of the areas is finalized. Proposed reclassifications were published in January 16, 2009 (74 FR 2936).

Source: US EPA Office of Air Quality Planning & Standards, Green Book, available online at: http://www.epa.gov/airquality/greenbk/anayo_co.html (accessed April 20, 2011). Status as of February 17, 2012

3.3.4.3 Particulate Matter (PM)

Air pollutants considered as particulate matter include dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activities, fires, and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as SO_2 and VOCs are also considered particulate matter. Based on studies of human populations exposed to high concentrations of particles and laboratory studies of animals and humans, there are major effects to human health from particulate matter. These include effects on breathing and respiratory symptoms, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogens, and premature death. Particulate matter also soils and damages materials and is a major cause of visibility impairment.

Since July 1, 1987, the EPA has used the indicator PM_{10} which includes only those particles with aerodynamic diameter smaller than 10 micrometers. These smaller particles are likely responsible for most of the adverse health effects of particulate matter because of their ability to reach the thoracic, or lower, regions of the respiratory tract.

The PM spectrum includes both coarse and fine particles. While the main distinction between coarse and fine particles is the process by which they are produced, EPA and epidemiologists who study the health effects of particulate pollution identify coarse and fine particles through rough approximations of those particles' diameters. Coarse particles, which become airborne usually from the crushing and grinding of solids, generally have diameters between 2.5 and 10 micrometers and are identified by the indicator $PM_{10-2.5}$. Fine particles, indicated by $PM_{2.5}$, come mainly from combustion of gases and have diameters of 2.5 micrometers or less.

The EPA has developed $PM_{2.5}$ air quality standards. However, the proposed

rulemaking to: (1) amend the conformity regulations to specifically include $PM_{2.5}$ as a criteria pollutant subject to transportation conformity, and (2) to outline the specific conformity requirements that would apply in newly designated $PM_{2.5}$ non-attainment areas, is still being negotiated.

Figure 3-25 and **Table 3.14** show the PM maintenance areas within the Study Area. Under the current standards, no counties in the Study Area are designated as non-attainment for PM_{10}. Seven counties are designated as maintenance areas for PM_{10}. No counties are designated as non-attainment or maintenance for $PM_{2.5}$.

Table 3.14

Particulate Matter Maintenance Areas in the Study Area

Pollutant	County	Classification Standard
PM_{10}	Adams	Maintenance - Moderate
	Arapahoe	Maintenance - Moderate
	Boulder	Maintenance - Moderate
	Broomfield	Maintenance - Moderate
	Denver	Maintenance - Moderate
	Douglas	Maintenance - Moderate
	Jefferson	Maintenance - Moderate
$PM_{2.5}$	None	

Source:
US EPA Office of Air Quality Planning & Standards, Green Book, available online at:
http://www.epa.gov/airquality/greenbk/anayo_co.html (accessed April 20, 2011). Status as of February 17, 2012.

3.3.5 Climate

Research has shown there is a direct correlation between fuel combustion and greenhouse gas (GHG) emissions. In terms of U.S. contributions, the General Accounting Office (GAO) reports that "domestic aviation contributes about 3 percent of total carbon dioxide emissions, according to EPA data," compared with other industrial sources including the remainder of the transportation sector (20 percent) and power generation (41 percent).[26] The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly 3 percent of all anthropogenic GHG emissions globally.[27] Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global climate.[28]

The scientific community is continuing efforts to better understand the impact of aviation emissions on the global atmosphere. The FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., NASA, NOAA, EPA, and DOE), has developed the Aviation Climate Change Research Initiative (ACCRI) in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. FAA also funds the Partnership for AiR Transportation Noise & Emissions Reduction (PARTNER) Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric

composition. Similar research topics are being examined at the international level by ICAO.

GHG emissions are commensurate with fuel consumption. Current aircraft fuel burn was calculated for DEN only, as the fuel consumption for RNAV-capable aircraft and existing operations for those aircraft overwhelmingly represent the fuel consumption of the three airports considered in this EA. The analysis was completed for aircraft operations within 30 NM of DEN as a means to provide a Study Area comparison. The 2010 fuel burn for DEN within 30 NM is calculated to be 608,679 kg. Carbon dioxide (CO_2) emissions associated with the Study Area in 2010 are 1,920,382 kg.

3.3.6 Threatened and Endangered Species and Migratory Birds

Section 7 of the Endangered Species Act of 1973 (ESA), as amended, (16 U.S.C. § 1531 et seq.) provides protection to any wildlife, which includes endangered plants or animals. In compliance with Section 7(c) of the ESA, federal agencies are required to ensure development/improvements will not jeopardize the continued existence of threatened or endangered species, or result in the destruction of adverse modification of the critical habitat of such species. Endangered species are defined as those in danger of extinction throughout all or a significant portion of its range. Threatened species are defined as any species that are likely to become an endangered species, within the foreseeable future, throughout all or a significant portion of its range.

This section describes the affected environment as related to threatened and endangered species and migratory bird patterns. Migratory bird patterns are considered as avian species in the Study Area may be impacted by changes to aircraft routing.

3.3.6.1 Threatened, Endangered, Proposed, and Candidate Species

The FWS provides recommendations for threatened and endangered species under the authority ESA, as amended. The FWS provided a list of threatened, endangered, candidate, and proposed species by county in June 2010 in response to scoping. This list was based on the best available information, including scientific and technical literature. **Table 3.15** illustrates the list provided from FWS, supplemented with information from the FWS Endangered Species Program website (http://www.fws.gov/endangered/). This list is used as a basis for determining federally listed, proposed, or candidate species potentially present in the Study Area.

There are 28 species in the counties in the Study Area that are listed by the FWS as threatened, endangered, proposed, or candidate species. The number of species within the Study Area listed in each of the listing categories is discussed below.

As shown in Table 3.15, there are 12 species listed as endangered in counties within the Study Area, including various birds, fishes, flowering plants, insects and mammals. Endangered species are species "that are in danger of extinction throughout all or a significant portion of its range."[29] The Colorado pikeminnow and Black-footed ferret are listed as both endangered and *Experimental, nonessential.* Experimental, nonessential populations of endangered species are treated as threatened species on public land, for consultation purposes, and as species proposed for listing on private land.

There is one proposed species listed in the Study Area counties: the Mountain Plover, found in seven of the counties. Proposed species is any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the ESA. [30] There are five Candidate species listed in the Study Area counties, including birds, fishes and mammals. Candidate species are species "under consideration for official listing for which there is sufficient information to support the listing. [31]

Additionally, there are also two Recovery species listed in the counties in the Study Area: the Bald eagle and the American peregrine falcon. Recovery is the ultimate goal of the endangered species program and is the process by which the decline of an endangered or threatened species is reversed and threats to its survival are reduced. The goal of this process is to restore the species to the point where it is a secure, self-sustaining part of its ecosystem and to the point that protections under the ESA are no longer needed.[32]

Table 3.15

Threatened, Endangered, Candidate, and Proposed Species by County

Group	Species	Scientific Name	Federal Status	Counties
Birds	Least tern (interior population) ▲	*Sternula antillarum*	Endangered	Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Elbert, El Paso, Gilpin, Jefferson, Larimer, Morgan, Park, Teller, Weld
Birds	Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Adams, Arapahoe, Boulder, Clear Creek, Douglas, El Paso, Gilpin, Jefferson, Larimer, Park, Teller, Weld
Birds	Mountain Plover	*Charadrius montanus*	Proposed	Adams, Arapahoe, El Paso, Larimer, Morgan, Park, Weld
Birds	Piping plover ▲	*Charadrius melodus*	Threatened	Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, El Paso, Elbert, Gilpin, Jefferson, Larimer, Morgan, Park, Teller, Weld
Birds	Whooping crane ▲	*Grus americana*	Endangered	Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, El Paso, Elbert, Gilpin, Jefferson, Larimer, Morgan, Park, Teller, Weld
Birds	Greater Sage-grouse	*Centrocercus urophasianus*	Candidate	Grand, Larimer, Park
Birds	Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	Grand
Fishes	Pallid sturgeon ▲	*Scaphirhynchus albus*	Endangered	Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, El Paso, Gilpin, Jefferson, Larimer, Morgan, Park, Teller, Weld
Fishes	Greenback cutthroat trout	*Oncorhynchus clarki stomias*	Threatened	Boulder, Clear Creek, Douglas, El Paso, Grand #, Larimer, Park
Fishes	Arkansas darter	*Etheostoma cragini*	Candidate	El Paso, Elbert
Fishes	Bonytail*	*Gila elegans*	Endangered	Grand
Fishes	Colorado pikeminnow*	*Ptychocheilus lucius*	Endangered/Experimental Population, Non-essential	Grand
Fishes	Humpback chub*	*Gila cypha*	Endangered	Grand
Fishes	Razorback sucker*	*Xyrauchen texanus*	Endangered	Grand
Flowering Plants	Ute ladies'-tresses orchid	*Spiranthes diluvialis*	Threatened	Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Morgan, Weld
Flowering Plants	Western prairie fringed orchid ▲	*Platanthera praeclara*	Threatened	Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, El Paso, Gilpin, Jefferson, Larimer, Morgan, Park, Teller, Weld
Flowering Plants	Colorado butterfly plant	*Gaura neomexicana spp. coloradensis*	Threatened	Boulder, Broomfield, Douglas, Jefferson, Larimer, Weld
Flowering Plants	Osterhout milkvetch	*Astragalus osterhoutii*	Endangered	Grand

Table 3.15

Threatened, Endangered, Candidate, and Proposed Species by County

Group	Species	Scientific Name	Federal Status	Counties
Flowering Plants	Penland beardtongue	*Penstemon penlandii*	Endangered	Grand
Flowering Plants	North Park phacelia	*Phacelia formosula*	Endangered	Larimer
Flowering Plants	Penland alpine fen mustard	*Eutrema penlandii*	Threatened	Park
Insects	Pawnee montane skipper	*Hesperia leonardus montana*	Threatened	Douglas, El Paso, Jefferson, Park, Teller
Insects	Uncompahgre fritillary butterfly	*Boloria acrocnema*	Endangered	Grand, Park
Mammals	North American wolverine	*Gulo gulo luscus*	Candidate	Boulder, Clear Creek, El Paso, Gilpin, Grand, Jefferson, Larimer, Park, Teller, Weld
Mammals	Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Threatened	Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Elbert, Jefferson, Larimer , Morgan, Teller, Weld
Mammals	Canada lynx	*Lynx canadensis*	Threatened	Boulder, Clear Creek, Gilpin, Grand, Jefferson, Larimer, Park
Mammals	Gunnison's prairie dog	*Cynomys gunnisoni*	Candidate	Douglas, El Paso, Jefferson, Park, Teller
Mammals	Black-footed ferret **§**	*Mustela nigripes*	Endangered/Experimental Population, Non-essential	Adams, Arapahoe, Boulder, Broomfield, Douglas, Larimer, Morgan
Birds	Bald eagle	*Haliaeetus leucocephalus*	Recovery	Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Elbert, Jefferson, Larimer, Morgan, Park, Teller, Weld
Birds	American peregrine falcon	*Falco peregrinus anatum*	Recovery	Adams, Arapahoe, Boulder, Clear Creek, Denver, Douglas, El Paso, Elbert, Gilpin, Jefferson, Larimer, Morgan, Park, Teller, Weld

Notes:

***** Water depletions in the Upper Colorado River and San Juan River Basins, may affect the species and/or critical habitat in downstream reaches in other states.

▲ Water depletions in the North Platte, South Platte and Laramie River Basins may affect the species and/or critical habitat associated with the Platte River in Nebraska.

§ This applies only to white-tailed or Gunnison's prairie dog habitats. All black-tailed prairie dog habitats within Colorado have been block-cleared from the requirements of ferret surveys.

Source: U.S. Department of Interior Fish & Wildlife Service Ecological Services Colorado Field Offices: http://www.fws.gov/Mountain-Prairie/EndSpp/CountyLists/Colorado.pdf; and FWS Species Reports, http://www.fws.gov/endangered/, accessed 10/24/11.

3.3.6.2 Migratory Birds

Migratory birds are protected by the Migratory Bird Treaty Act (MBTA). The FWS is the Federal agency responsible for the management of migratory birds as they spend time in habitats of the United States. The MBTA protects migratory birds, nests, and eggs from possession, sale, purchase, barter, transport, import, export, and take. Under the MBTA, it is unlawful unless permitted by regulations to pursue, hunt, take, capture, kill, or attempt to pursue, take, capture, or kill any migratory birds by any means or in any manner. The MBTA applies to 1,007 species of migratory birds identified in 50 C.F.R. § 10.13. The MBTA does not require intent to be proven, there is no incidental take statement, "take" is defined in 50 C.F.R. § 10.12, and the ESA does not absolve individuals or companies from liability under the MBTA. Unless permitted by the FWS, the MBTA prohibits any intentional or unintentional activity that results in the take of migratory birds. Although the MBTA does not protect the habitats of migratory birds, activities that affect habitats and result in the take of migratory birds do violate the MBTA. There are several species of birds that are of concern, are endangered or threatened, in recovery, or are proposed candidate species within the counties included in the Study Area. These birds, along with their status, are listed in Table 3.15. Since changes in where aircraft fly may occur in areas that are traditionally used as migration routes, the description of the affected environment includes a discussion of migratory routes in the Study Area. This is followed by a discussion of the specific areas and stopovers, which provide nesting, feeding, and resting habitat for all types of migratory fowl. Finally, Bird Conservation Regions (BCRs) within the Study Area are described. BCRs are ecologically distinct regions with similar bird communities, habitats, and resource management issues. The FWS often use BCRs when considering conservation efforts and issues.

Migration Routes

Migration routes may be defined as the various lanes birds travel from their breeding ground to their winter quarters. The actual routes followed by a given migratory bird species differ by variables such as distance traveled, time of starting, flight speed, geographic position and latitude of the breeding, and wintering grounds.

Birds migrate along four main routes or flyways in North America: the Atlantic, the Central, the Mississippi, and the Pacific flyways as illustrated in **Figure 3-26**. These flyways are not specific lines the birds follow but broad areas through which the birds migrate. The most frequently traveled migration routes conform very closely to major topographical features that lie in the general north-south movement of migratory bird flyways. Therefore, the lanes of heavier concentration in the Study Area follow principal river valleys and mountain ranges.

The Central Flyway is the only North American flyway to cross near or through the State of Colorado and is the only flyway that could potentially interact with the Study Area. It encompasses all of the vast region between the valley of the Mississippi River and the Rocky Mountains. The majority of the birds that use the Central Flyway make direct north and south journeys from

breeding grounds in the North to winter quarters in the South.[33]

The flyway boundaries have been recognized as an oversimplification of an extremely complex situation involving crisscrossing of migration routes that vary from species to species. The routes are not sharply defined, and are most applicable to birds migrating in family groups, such as geese, swans and cranes.[34]

Bird Conservation Regions

The FWS has deemed Bird Conservation Regions (BCRs) as the smallest and ecologically most relevant unit by which to describe the migratory bird affected environment for the Study Area. BCRs have been endorsed by the North American Bird Conservation Initiative (NABCI) as the basic ecological units within which all bird conservation efforts will be planned and evaluated.[35] NABCI is an endeavor to increase the effectiveness of bird conservation at the continental level and currently includes the United States, Canada, and Mexico. Its goal is to deliver "the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships."[36] NABCI has recognized 35 BCRs that cover the contiguous 48 States, Alaska, and Hawaii. These BCRs are numbered 1 to 5, 9 to 37, and 67.[37] Portions of BCR's 16 (Southern Rockies/Colorado Plateau) and 18 (Shortgrass Prairie) are located within the Study Area as shown in **Figure 3-27.**

The bird species potentially found within each BCR within the Study Area are summarized in **Table 3.16**. This table also indicates which of these species are included on the nation and/or regional lists of Birds of Conservation Concern. The 1988 amendment to the Fish and Wildlife Conservation Act mandates the FWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." *Birds of Conservation Concern 2002* (BCC 2002) is the most recent effort to carry out this mandate. The overall goal of this report was to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities of the FWS and draw attention to species in need of conservation action.

The following is a description of the habitat and predominant migratory birds associated with each of the BCR's within the Study Area.

Bird Conservation Region 16 (Southern Rockies/Colorado Plateau)

This topographically complex region includes the Wasatch and Uinta Mountains to the west and the Southern Rocky Mountains to the east, separated by the rugged tableland of the Colorado Plateau. Various coniferous forest types (often lodgepole pine) interspersed with aspen dominate higher elevations. These are replaced by piñon-juniper woodlands on the lower plateaus. Important birds also segregate into elevational bands, with Brown-capped Rosy-Finch and White-tailed Ptarmigan in alpine tundra, Williamson's Sapsucker in conifers, Virginia's Warbler and Lewis' Woodpecker in montane shrub sites, and most of the world's breeding Gray Vireos in piñon-juniper.

High arid plains and dry upland short-grass prairies provide critical breeding areas for Mountain Plover. San Luis Valley wetlands and surrounding uplands support one of the highest densities of nesting waterfowl in North America and provide migration habitat for Sandhill Cranes and other wetland species.[38]

Bird Conservation Region 18 (Shortgrass Prairie)

The Shortgrass Prairie lies in the rainshadow of the Rocky Mountains, where arid conditions greatly limit the stature and diversity of vegetation. Some of the continent's highest priority birds breed in this area, including the Mountain Plover, McCown's Longspur, Long-billed Curlew, Ferruginous Hawk, Burrowing Owl, and Lesser Prairie-Chicken. Reasons for the precarious status of these birds are poorly understood but could involve a reduction in the diversity of grazing pressure as bison and prairie dogs have largely been replaced by cattle. For migrants, it is possible that conditions on wintering grounds could also be having a negative impact. Barr Lake State Park, within BCR 18, is host to more than 350 species of migratory and resident birds. Many bald eagles winter at the lake and the southwest side of the lake is home to over 200 nests.[39]

Numerous rivers, such as the Platte, drain out of the Rocky Mountains through this region toward the Mississippi Valley. These rivers created broad, braided, and treeless wetlands that are heavily used by migrating waterfowl, shorebirds, and cranes. Hydrological simplification has resulted in the invasion of trees and shrubs that support breeding eastern riparian birds, but otherwise greatly reduce the value of the areas as wetlands. The Playa Lakes area in the southern portion of this region consists of numerous shallow wetlands that support many wintering ducks, migrant shorebirds, and some important breeding species, such as the Snowy Plover.[40]

Table 3.16

Potential Species and Birds of Conservation Concern by Bird Conservation Region

Species	BCR 16	BCR 18
American Golden-Plover		X
Bell's Vireo		X
Bendire's Thrasher	X	
Black Swift	X	
Black-throated Gray Warbler	X	
Buff-breasted Sandpiper		X
Borrowing Owl	X	X
Cassin's Sparrow		X
Chestnut-collared Longspur	X	X
Crissal Thrasher	X	
Ferruginous Hawk	X	X
Flammulated Owl	X	
Golden Eagle	X	
Grace's Warbler	X	
Gray Vireo	X	

Table 3.16

Potential Species and Birds of Conservation Concern by Bird Conservation Region

Species	BCR 16	BCR 18
Gunnison Sage-Grouse	X	
Lark Bunting		X
Lesser Prairie-Chicken		X
Lewis's Woodpecker	X	X
Long-billed Curlew		X
Marbled Godwit	X	
McCown's Longspur		X
Mountain Plover	X	X
Northern Harrier	X	X
Peregrine Falcon	X	X
Pinyon Jay	X	
Prairie Falcon	X	X
Sage Sparrow	X	
Short-eared Owl	X	
Snowy Plover	X	X
Solitary Sandpiper	X	X
Sprague's Pipit	X	X
Swainson's Hawk	X	
Virginia's Warbler	X	
Williamson's Sapsucker	X	
Wilson's Phalarope	X	
Yellow-billed Cuckoo	X	

SPECIES FROM THE *BIRDS OF CONSERVATION CONCERN 2002*

Sources: U.S. Fish and Wildlife Service. 2002. Birds of conservation concern 2002. Division of Migratory Bird Management, Arlington, Virginia. (Online version available at http://www.fws.gov/pacific/migratorybirds/BCC2002.pdf.

3.3.6.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) prohibits individuals and companies from knowingly, or with wanton disregard for the consequences of the Act, taking any bald or golden eagles or their body parts, nests, chicks, or eggs, which includes collection, molestation, disturbance, or killing. The BGEPA affords eagles additional protections beyond those provided by the MBTA by making it unlawful to "disturb" eagles. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle or causes either a decrease in its productivity or nest abandonment due to interference with breeding, feeding, or sheltering. A permitting process provides limited exceptions to the BGEPA's prohibitions and the Service has issued regulations concerning the permit procedures in 50 C.F.R. § 22. Bald eagles are found within the Study Area.

3.4 Summary

There are eight impact categories with the potential for impact due to the Proposed Action, the implementation of new RNAV procedures, inclusive of RNP and OPD, for DEN, APA and BJC in order to improve the safety and efficiency of the Denver Complex Airspace. These include the following categories, in accordance with FAA Order 1050.1E:

- Noise;
- Compatible Land Use;
- Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks;
- Department of Transportation Act: Section 4(f) and 6(f) Resources;
- Historic, Architectural, Archaeological, and Cultural Resources;
- Air Quality;
- Climate; and
- Threatened and Endangered Species and Migratory Birds.

The Proposed Action does not include construction of any physical infrastructure. Therefore, there are no anticipated impacts to the following environmental impact categories due to the Proposed Action:

- Coastal Resources;
- Construction Impacts;
- Farmlands;
- Floodplains;
- Hazardous Materials, Pollution Prevention, and Solid Waste;
- Light Emissions and Visual Impacts;
- Natural Resources and Energy Supply;
- Secondary (Induced) Impacts;
- Water Quality;
- Wetlands; and
- Wild and Scenic Rivers.

Due to the fact that there are no anticipated impacts to these categories, no detailed description of the affected environment associated with the above impact categories is provided; however, Table 3.6 provides a brief discussion of these categories and the reasons for dismissal.

Endnotes

[1] Letter from Aaron J. Barnett, Air Traffic Manager, Denver TRACON/Denver District, June 28, 2011.

[2] Denver TRACON/Denver District, 2011.

[3] Department of Transportation Order 5610.2, "Environmental Justice in Minority and Low-Income Populations," April 15, 1997, see Appendix, pg 18380.

[4] Ibid.

[5] Weather Underground, www.wunderground.com

[6] Denver Airport Climate and Weather, denver-den.airports-guides.com/den_climate.html

[7] U.S. Department of Transportation Federal Aviation Administration (FAA), Order 1050.1E, CHG 1: *Environmental Impacts: Policies and Procedures*, March 20, 2006, see Appendix A, pg A20. http://www.faa.gov/documentLibrary/media/order/energy_orders/1050-1E.pdf, accessed May 19, 2011.

[8] 16 USC 460.

[9] LWCF Project Lists, Colorado State Parks, http://www.parks.state.co.us/Trails/LWCF/ProjectLists/Pages/LWCF%20Projects%20List.aspx, accessed 9/8/11.

[10] 16 USC Section 1.

[11] 2006 NPS Management Policies, National, Park Service, 2006, p.8, <http://www.nps.gov/policy/MP2006.pdf>.

[12] RMNP Master Plan. Introduction. http://www.nps.gov/romo/parkmgmt/upload/final_master_plan.pdf

[13] RMNP. Backcountry/Wilderness Management Plan and Environmental Assessment. Introduction. http://www.nps.gov/romo/parkmgmt/wilderness_backcountry_plan.htm

[14] RMNP Master Plan. http://www.nps.gov/romo/parkmgmt/upload/final_master_plan.pdf

[15] RMNP. Backcountry/Wilderness Management Plan and Environmental Assessment. http://www.nps.gov/romo/parkmgmt/wilderness_backcountry_plan.htm

[16] RMNP Master Plan. http://www.nps.gov/romo/parkmgmt/upload/final_master_plan.pdf

[17] US Forest Service, *Land Areas Report (LAR) – as of September 30, 2011*, http://www.fs.fed.us/land/staff/lar/LAR2011/LAR_Table_01.pdf, Accessed 4/4/12.

[18] National Wildlife Refuge System Fact Sheet – 2007, U.S. Fish & Wildlife Service.

[19] National Wilderness Areas, Wilderness.net, www.wilderness.net, last updated 4/20/11, accessed 9/8/11.

[20] http://wildlife.state.co.us/LandWater/StateWildlifeAreas/Pages/swa.aspx

[21] Regulations related to the Section 106 process are outlined in 36 CFR Part 800 "Protection of Historic Properties."

[22] 16 USC 470, promulgated under 36 CFR Part 800.10.

[23] National Register of Historic Places, 36 CFR Part 60.

[24] Native American Tribes of Colorado. < http://www.native-languages.org/colorado.htm>

[25] National Park Service, *Indian Reservations in the Continental United States*, http://www.nps.gov/nagpra/DOCUMENTS/ResMAP.HTM, accessed 10/10/11, and Map of Native American Reservations Located on the Colorado Plateau. < http://www.fgdc.gov/grants/2005CAP/projects/05HQAG0140_map/image_view_fullscreen>

[26] *Aviation and Climate Change,* GAO Report to Congressional Committees, (2009). http://www.gao.gov/new.items/d09554.pdf

[27] Alan McIrose, "European ATM and Climate Adaptation: A Scoping Study," in *ICAO Environmental Report.* (2010).

[28] As explained by the U.S. EPA, "greenhouse gases, once emitted, become well mixed in the atmosphere, meaning U.S. emissions can affect not only the U.S. population and environment but other regions of the world as well; likewise, emissions in other countries can affect the United States." Climate Change Division, Office of Atmospheric Programs, U.S. EPA, *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3* (2009), available at http://epa.gov/climatechange/endangerment.html.

[29] U.S. Fish & Wildlife Service, *Glossary,* http://www.fws.gov/midwest/endangered/glossary/index.html, last updated 10/12/11. (Accessed 10/25/11).

[30] U.S. Fish & Wildlife Service, *Glossary,* http://www.fws.gov/midwest/endangered/glossary/index.html, last updated 10/12/11. (Accessed 10/25/11).

[31] U.S. Fish & Wildlife Service, *Glossary,* http://www.fws.gov/midwest/endangered/glossary/index.html, last updated 10/12/11. (Accessed 10/25/11).

[32] U.S. Fish & Wildlife Service, *Recovery*, http://www.fws.gov/cno/es/recovery.html, last updated 8/8/11. (Accessed 10/25/11).

[33] North American Migration Flyways, http://www.birdnature.com/flyways.html, Accessed 10/25/11.

[34] USGS, *Migration of Birds: Routes of Migration*, Last modified 8/3/2006. Accessed 10/25/11.

[35] U.S. NABCI Committee, North American Bird Conservation Initiative, *Bringing It All Together*, September 2000

[36] Ibid.

[37] U.S. NABCI Committee, North American Bird Conservation Initiative, *Bird Conservation Regions Map*, September 2000

[38] U.S. NABCI Committee, North American Bird Conservation Initiative, *Bird Conservation Region Descriptions, A Supplement to the North American Bird Conservation Initiative Bird Conservation Regions Map,* September 2000

[39] Colorado Department of Natural Resources. Colorado State Parks. Barr Lake State Park. http://www.parks.state.co.us/parks/barrlake/Pages/BarrLakeHome.aspx

[40] Ibid.

CHAPTER 4:
ENVIRONMENTAL CONSEQUENCES

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Chapter Four: ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences associated with the No Action Alternative and the Proposed Action Alternatives in accordance with FAA Order 1050.1E.

The potential impacts associated with the Proposed Action Alternatives are determined by comparing the projected future condition due to the Proposed Action Alternatives with the corresponding future conditions due to the No Action Alternative. The years of analysis are 2012 (initial year of phased implementation) and 2017 (five years beyond initial implementation).

4.1 Noise

This section describes the noise analysis methodology and compares existing and forecast aircraft noise exposure levels in the Denver Complex Airspace for the No Action and Proposed Action Alternatives. The airports considered for analysis in the Denver Complex Airspace include DEN, APA and BJC.

4.1.1 Noise Modeling Methodology

The noise modeling methodology described in Section 3.3.1 and detailed in Appendix D, *Noise Modeling Technical Report*, is also used for the 2012 and 2017 noise analysis. The noise modeling methodology is consistent with noise modeling of aircraft operations as required by the FAA, inclusive of requirements considered for an airspace modification.

As discussed in Appendix D, detailed information on aircraft operations within the Study Area was assembled for input into the noise models. This includes average annual daily flight schedules, flight tracks, and runway use for the future years. For a given year, the No Action and Proposed Action Alternatives have the same flight schedule. Average daily flight schedules were developed for 2012 and 2017, as discussed in Appendix C, *Flight Activity Forecast Development Technical Report*. The flight schedules are used to supply arrival and departure times, aircraft types, and origin/destination information. Aircraft type information is used for estimating performance and noise characteristics for each flight while the origin/designation data are used to predict aircraft weight at departure.

Projections of future runway and routing (i.e., flight track) use were developed to model noise exposure with the Proposed Action Alternatives. Modeled flight tracks (i.e., the path and direction the aircraft fly) are based on radar data collected during the existing 2010 condition analysis and through collaboration with ATC. Flight tracks for the No Action Alternative are the same as used in the existing condition analysis. For the Proposed Action Alternatives, RNAV STAR and SID procedures were developed from the alternative tracks created by the Denver RNAV Workgroup using the Terminal Area Route Generation Evaluation Traffic and Simulation (TARGETS) program.

The TARGETS model provides a series of capabilities for the design, analysis and assessment of airspace procedures (e.g., information pertaining to the route structure, waypoint location, and altitude and speed restrictions). The data export features of TARGETS includes the output of route structures, generic flyability routes for categories of aircraft, and specific databases of waypoints associated with each procedure. Data from the TARGETS model was directly input into a GIS for further post-processing and ultimately into each of the noise models used in this analysis.

4.1.2 Noise Impact Criteria

Change in noise exposure for each point in the Study Area is evaluated based on FAA guidance to determine the degree of change in noise exposure. The FAA established 65 DNL as the threshold above which aircraft noise is considered to be not compatible in residential areas. The FAA also determined that a significant impact occurs if a proposed action would result in an increase of 1.5 DNL or more in any noise-sensitive area within the 65 DNL exposure level. [1, 2, 3]

In 1992, the Federal Interagency Committee on Noise (FICON) recommended that in cases where increases of 1.5 DNL or more occur at noise-sensitive locations at or above 65 DNL, further evaluation should be completed to assess whether or not noise increases of 3 DNL or more occur at noise-sensitive locations between 60 and 65 DNL. The FAA adopted FICON's recommendation into FAA Order 1050.1E for consideration in airspace actions, such as changes to air traffic routes.

The FAA issued a noise screening procedure in 1990 for determining whether certain airspace actions above 3,000 feet AGL might increase DNL by five decibels or more. The procedure serves as a response to FAA experience that increases in noise of 5 dB or more, at cumulative levels below DNL 65 dB, could be disturbing to people and become a source of public concern. The FAA determined that 45 DNL is the minimum level at which noise needed to be considered because "even distant ambient noise sources and natural sounds such as wind in trees can easily exceed this [45 DNL] value."[4]

For the purpose of this noise analysis, increases of 1.5 DNL above 65 DNL are considered significant. Increases of 3 DNL between 60 and 65 DNL are to receive consideration when evaluating the environmental impacts of a proposed project. Increases of 5 DNL or greater at levels between 45 DNL to 60 DNL are to be disclosed. The increase in noise at these levels is enough to be noticeable and potentially disturbing to some people, but the cumulative noise level is not high enough to constitute a "significant impact." The FAA scoring criteria are used to compare DNL changes at the population locations in the Study Area. For each alternative, the population in the Study Area is divided into three categories: (1) those receiving an increase in noise exposure relative to the No Action Alternative; (2) those receiving a decrease relative to the No Action Alternative; and (3) those having no change relative to the No Action Alternative. The rules defining the increase, decrease and no change categories and the sources for each rule are presented in **Table 4.1**. Additionally, in accordance with Order 1050.1E, special consideration will be given to the evaluation of the significance of noise impacts on noise sensitive areas

within national parks, national wildlife refuges and historic sites. See Sections 4.7 and 4.6 respectively, in this document. For example, the DNL 65 dB threshold does not adequately address the effects of noise on visitors to areas within a national park where other noise is low and a quiet setting is the recognized intention of the area.[5]

Table 4.1

Criteria for Determining Impact of Increases in Aircraft Noise

DNL Noise Exposure with Proposed Action	Minimum Increase in DNL with Proposed Action	Level of Impact
65 DNL or higher	1.5 DNL[1]	Exceeds Threshold of Significance
60 to 65 DNL	3.0 DNL[2]	For Consideration When Evaluating Air Traffic Actions
45 to 60 DNL	5.0 DNL[3]	Information Disclosed

Source:
(1) FAA Order 1050.1E, Appendix A, Paragraph 14.3, Title CFR Part 150, Sec. 150.21(2)(d); and FICON, *Federal Agency Review of Selected Airport Noise Issues*, August 1992.
(2) FAA Order 1050.1E, Appendix A, Paragraph 14.4c and 14.5e; and FICON, *Federal Agency Review of Selected Airport Noise Issues*, August 1992.
(3) FAA Order 1050.1E, Appendix A, 14.5e.

4.1.3 Aircraft Noise Impact Analysis

Based upon the noise methodology described in Section 4.1.1 and the noise impact criteria described in Section 4.1.2, a noise analysis was conducted to evaluate noise exposure levels using the applicable thresholds of significance, for each of the Proposed Action Alternatives as compared to the No Action Alternative.

4.1.4 No Action Alternative

Noise exposure was calculated for population centroids with a population greater than zero for the No Action Alternative in 2012 and 2017. **Table 4.2** depicts the overall population exposed to various noise levels in 2012. **Figure 4-1** depicts 2012 noise exposure greater than 45 DNL. In 2012, most of the Study Area is expected to experience noise levels below 45 DNL, with exceptions of areas near DEN, APA and BJC. As expected, noise exposure from DEN includes the largest area; however, the relative density of population around DEN is less than that surrounding APA and BJC.

Table 4.3 depicts estimated population impacts in 2017. **Figure 4-2** depicts 2017 noise exposure greater than 45 DNL at population centroids. Overall, approximately 84% of the Study Area population would be exposed to noise levels less than 45 DNL, 15% would be exposed to levels between 45 and 55 DNL, and less than 1% would be exposed to noise levels above 55 DNL.

Table 4.2

2012 No Action Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,545,251	86.0%
45 to less than 50	320,763	10.8%
50 to less than 55	68,896	2.3%
55 to less than 60	20,850	0.7%
60 to less than 65	2,622	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

Table 4.3

2017 No Action Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,479,394	83.8%
45 to less than 50	374,759	12.7%
50 to less than 55	79,716	2.7%
55 to less than 60	21,891	0.7%
60 to less than 65	2,622	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

4.1.5 Proposed Action Alternatives

The following sections present the noise results for each of the Proposed Action Alternatives. Because of the timing of initial implementation and the complexities of integrating RNAV SIDs for APA and BJC with proposed DEN RNAV STARs and SIDs, only Alternative 1 could realistically be implemented in 2012. For this reason, only Alternative 1 is examined for noise impact in 2012. By 2017 other alternatives could reasonably be implemented for the Denver Complex Airspace and thus all alternatives are reviewed for this timeframe. See Chapter 2, Alternatives, and Appendix D for the modeling assumptions associated with the Proposed Action Alternatives.

4.1.6 Alternative 1

Figure 4-3 depicts noise exposure greater than 45 DNL at population centroids due to the implementation of Alternative 1 in 2012. Most of the Study Area remains exposed to noise levels less than 45 DNL (approximately 86%), while 13% would be exposed to levels between 45 and 55 DNL, and less than 1% would be exposed to noise levels above 55 DNL. The areas of highest noise exposure are located in the immediate vicinity of DEN, APA and BJC. Some areas representing levels of 45 DNL or higher are evident to the west of DEN, APA and BJC, as terrain associated with the Rocky Mountains reduces the distance between the source (aircraft) and receivers (populated areas). A comparison of the 2012 No Action Alternative and 2012 Alternative 1 noise exposure for populated centroids, shown in **Figure 4-4**, indicates there are no significant impacts (increases of 1.5 DNL in areas that would experience DNL noise levels of 65 or above). The color coding used on these figures to identify the change in noise exposure level is defined in **Table 4.4**.

Table 4.4

Graphical Color Coding for Change in Noise Exposure Levels

Color	DNL Noise Exposure with Proposed Action	Minimum Change in DNL with Proposed Action
Noise Increase		
Yellow	45 to 60 DNL	>=5.0+ DNL Increase
Orange	60 to 65 DNL	>=3.0+ DNL Increase
Red	65 DNL or higher	>=1.5+ DNL Increase
Noise Decrease		
Purple	45 to 60 DNL	>=5.0+ DNL Decrease
Blue	60 to 65 DNL	>=3.0+ DNL Decrease
Dark Green	65 DNL or higher	>=1.5+ DNL Decrease

Source: NIRS User Guide.

There are various areas of decrease in noise exposure in areas east and west of DEN in areas of 45-60 DNL, which is attributable to the location of the RNAV STAR arrivals to DEN. To the west of DEN, APA and BJC, an area of reportable increase exists along two RNAV SID departure paths, as a result of the consolidation of air traffic along these routes. **Table 4.5** depicts the population exposed to various levels of noise under Alternative 1 in 2012.

Table 4.6 presents the changes in the population exposed to various levels of noise exposure relative to the 2012 No Action Alternative.

In 2017, implementation of Alternative 1 (and all remaining Proposed Action Alternatives) would include a higher overall use of RNAV/RNP procedures (95%), as well as increases in overall operations as compared to 2012.

Figure 4-5 depicts noise exposure greater than 45 DNL at population centroid due to the implementation of Alternative 1 in 2017.

Table 4.5

2012 Alternative 1 Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,544,362	86.0%
45 to less than 50	321,957	10.9%
50 to less than 55	68,474	2.3%
55 to less than 60	20,905	0.7%
60 to less than 65	2,684	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

Table 4.6

Change in Noise Exposure Between 2012 No Action Alternative and Alternative 1

DNL Range (dB)	Estimated Change in Population
Less than 45	-889
45 to less than 50	1,194
50 to less than 55	-422
55 to less than 60	55
60 to less than 65	62
65 to less than 70	0
70 to less than 75	0
Greater than or equal to 75	0

Source: HNTB Analysis, 2012.

A majority of the Study Area population (approximately 81%) remains exposed to noise levels less than 45 DNL, and approximately 559,238 people would be exposed to noise levels of 45 DNL or above. Approximately 18% of the Study Area population would be exposed to levels between 45 and 55 DNL, and less than 1% would be exposed to levels above 55 DNL.

Similar to Alternative 1 in 2012, the areas of highest noise exposure are located in the immediate vicinity of DEN, APA and BJC, and some areas representing levels of 45 DNL or higher are evident to the west of these airports. A comparison of the 2017 No Action Alternative and Alternative 1 noise exposure in 2017 for populated centroids, shown in **Figure 4-6**, indicates there are no significant impacts (increases of 1.5 DNL in areas that would experience DNL noise levels of 65 or above) due to Alternative 1 in 2017.

Areas of reportable decrease in noise exposure east and west of DEN in areas of 45-60 DNL exist, and an area of reportable increase (between 45 and 60 DNL) exists along two RNAV SID departure paths, as a result of the consolidation of air traffic along these routes. **Table 4.7** depicts the population exposed to various levels of noise under Alternative 1 in 2017.

Table 4.8 presents the changes in the population exposed to various levels of noise exposure relative to the 2017 No Action Alternative. There would be no change in noise exposure to populations above 65 DNL, 62 people would be newly exposed to the 60 to 65 DNL, and 353 people would be newly exposed to the 55 to 60 DNL. There would be 3,812 people expected to experience relief from noise levels between 50 and 55 DNL. An estimated 83,225 people would be newly exposed to noise levels between 45 and 50 DNL.

Table 4.7
2017 Alternative 1 Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,399,566	81.1%
45 to less than 50	457,984	15.5%
50 to less than 55	75,904	2.6%
55 to less than 60	22,244	0.8%
60 to less than 65	2,684	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

Table 4.8
Change in Noise Exposure Between 2017 No Action Alternative and Alternative 1

DNL Range (dB)	Estimated Change in Population
Less than 45	-79,828
45 to less than 50	83,225
50 to less than 55	-3,812
55 to less than 60	353
60 to less than 65	62
65 to less than 70	0
70 to less than 75	0
Greater than or equal to 75	0

Source: HNTB Analysis, 2012.

4.1.7 Alternative 2

Figure 4-7 and **Table 4.9** present noise exposure as a result of the implementation of Alternative 2 in 2017, which introduces RNAV SIDs at APA and BJC. Approximately 81% of the Study Area population would be exposed to noise levels less than 45 DNL, while a total of 560,523 persons would be exposed to noise levels above 45 DNL, an increase of less than 3% relative to the 2017 No Action. Approximately 18% of the Study Area population would be exposed to levels between 45 and 55 DNL, less than 1% would be exposed to levels above 55 DNL, and there would be no change in the number of persons experiencing noise levels of 65 DNL or above.

Noise exposure patterns remain consistent with Alternative 1 in 2017, with the highest levels of noise exposure close to DEN, APA, and BJC and some areas exposed to levels of 45 DNL or higher evident to the west of these airports.

A comparison of the 2017 No Action Alternative and the 2017 Alternative 2 noise exposure for populated centroids is shown in **Figure 4-8**, while **Table 4.10** presents the changes in the population exposed to various levels of noise exposure. Applying the FAA impact thresholds, there are no significant impacts (increases of 1.5 DNL in areas that would experience DNL noise levels of 65 or above).

Various areas of reportable decrease in noise exposure are evident in areas east and west of DEN in areas of 45-60 DNL, attributable to the location of RNAV STAR arrivals to DEN. To the west of DEN, APA and BJC, an area of reportable increase exists along two RNAV SID departure paths, as a result of the consolidation of air traffic along these routes. An area immediately south of APA would experience reportable increases in noise exposure with the implementation of the APA RNAV SID associated with Alternative 2.

Under Alternative 2, there would be no change in noise exposure to populations above 65 DNL and 428 people would be newly exposed to noise between the 60 to 65 DNL. There would be 655 people expected to experience relief from noise levels between 55 and 60 DNL, and an estimated 87,304 people would be newly exposed to noise levels between 45 and 50 DNL.

Table 4.9

2017 Alternative 2 Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,398,281	81.1%
45 to less than 50	462,063	15.6%
50 to less than 55	73,752	2.5%
55 to less than 60	21,236	0.7%
60 to less than 65	3,050	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

Table 4.10

Change in Noise Exposure Between 2017 No Action Alternative and Alternative 2

DNL Range (dB)	Estimated Change in Population
Less than 45	-81,113
45 to less than 50	87,304
50 to less than 55	-5,964
55 to less than 60	-655
60 to less than 65	428
65 to less than 70	0
70 to less than 75	0
Greater than or equal to 75	0

Source: HNTB Analysis, 2012.

4.1.8 Alternative 3

Overall, Alternative 3 represents the most mature and complete RNAV utilization for APA and BJC, with arrival aircraft to APA and BJC using a dedicated set of procedures at higher altitudes. **Figure 4-9** and **Table 4.11** present noise exposure as a result of the implementation of Alternative 3 in 2017.

With Alternative 3, approximately 82% of the Study Area population would be exposed to noise levels less than 45 DNL, while a total of 548,097 estimated persons (almost 18% of the Study Area population) would be exposed to noise levels above 45 DNL. Less than 1% of the estimated population would be exposed to noise levels above 55 DNL, and relative to the 2017 No Action Alternative, there would be no change in the number of persons

experiencing noise levels of 65 DNL or above.

Noise exposure patterns remain consistent with Alternative 1 in 2017, with the highest levels of noise exposure close to DEN, APA and BJC and some areas exposed to levels of 45 DNL or higher evident to the west. As evident in Figure 4-9, there are no significant impacts associated with Alternative 3.

Figure 4-10 depicts the distribution of changes in DNL as compared to the No Action Alternative. There are areas of reportable increase and reportable decrease located in the Study Area. To the west of DEN, APA and BJC, two areas of reportable increase are evident, which result from the implementation of RNAV SIDs from DEN, and the consolidation of flight traffic on those defined routes. To the south of APA, an area of reportable increase exists as a result of the implementation of the LOOOP RNAV SID, which concentrates RNAV-capable jet departures from Runway 17L to the south. **Table 4.12** presents the changes in the population exposed to various levels of noise exposure relative to the 2017 No Action Alternative.

Under Alternative 3, there would be no change in noise exposure to populations above 65 DNL, while 62 people would be newly exposed to noise between the 60 to 65 DNL. An estimated 462 people would be expected to experience relief from noise levels between 55 and 60 DNL, 7,225 people would be removed from the 50 to 55 DNL, and an estimated 76,312 people would be newly exposed to noise levels between 45 and 50 DNL.

Table 4.11

2017 Alternative 3 Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,410,707	81.5%
45 to less than 50	451,071	15.2%
50 to less than 55	72,491	2.5%
55 to less than 60	21,429	0.7%
60 to less than 65	2,684	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

Table 4.12

Change in Noise Exposure Between 2017 No Action Alternative and Alternative 3

DNL Range (dB)	Estimated Change in Population
Less than 45	-68,687
45 to less than 50	76,312
50 to less than 55	-7,225
55 to less than 60	-462
60 to less than 65	62
65 to less than 70	0
70 to less than 75	0
Greater than or equal to 75	0

Source: HNTB Analysis, 2012.

4.1.9 Alternative 4

Figure 4-11 and **Table 4.13** present noise exposure as a result of the implementation of Alternative 4 in 2017. Under this alternative, approximately 81% of the Study Area population would be exposed to noise levels less than 45 DNL, 18% of the Study Area population would be exposed to levels between 45 and 55 DNL, and less than 1% would be exposed to levels above 55 DNL. A total of 561,248 estimated persons would be exposed to noise levels above 45 DNL, an increase of less than 3%. Overall, less than 1% of the estimated population would be exposed to noise levels above 55 DNL, and relative to the 2017 No Action Alternative, there would be no change in the number of persons experiencing noise levels of 65 DNL or above.

Noise exposure patterns are evident in Figure 4-11, with some areas exposed to levels of 45 DNL or higher to the west of DEN, APA and BJC, due to the implementation of RNAV SIDs to the west from DEN. Near APA, some additional persons would experience levels of 45 DNL or higher due to RNAV SIDs in use at APA under this alternative.

A comparison of the 2017 No Action Alternative and the Alternative 4 noise exposure for populated centroids is shown in **Figure 4-12**. **Table 4.14** presents the changes in the population exposed to various levels of noise exposure relative to the 2017 No Action Alternative.

Applying the FAA impact thresholds, there are no significant impacts (increases of 1.5 DNL in areas that would experience DNL noise levels of 65 or above). There are various areas of reportable decrease in noise exposure in areas east and west of DEN in areas of 45-60 DNL, attributable to the location of RNAV STAR arrivals to DEN. To the west of DEN, APA and BJC, an area of reportable increase exists along two RNAV SID departure paths, as a result of the consolidation of air traffic along these routes. An area immediately south of APA would experience reportable increases in noise exposure with the implementation of the RNAV SIDs associated with Alternative 4.

No changes in noise exposure to populations above 65 DNL would occur

under Alternative 4. An estimated 427 people would be newly exposed to noise between the 60 to 65 DNL, while 562 people would be expected to experience relief from noise levels between 55 and 60 DNL. An estimated 87,581 people would be newly exposed to noise levels between 45 and 50 DNL.

4.1.10 Summary of Noise Exposure at Population Centroids

Table 4.15 presents a comparison of noise exposure at population centroids for the 2012 No Action Alternative and Alternative 1. **Table 4.16** presents noise exposure for the 2017 No Action and each of the 2017 Proposed Action Alternatives analyzed.

Table 4.13

2017 Alternative 4 Maximum Population Exposed to Aircraft Noise

DNL Range (dB)	Estimated Population	Percentage of Total
Less than 45	2,397,556	81.0%
45 to less than 50	462,340	15.6%
50 to less than 55	74,108	2.5%
55 to less than 60	21,329	0.7%
60 to less than 65	3,049	0.1%
65 to less than 70	422	0%
70 to less than 75	0	0%
Greater than or equal to 75	0	0%
Total	2,958,804	100%

Source: HNTB Analysis, 2012.
Note: Totals may not equal 100% due to rounding.

Table 4.14

Change in Noise Exposure Between 2017 No Action Alternative and Alternative 4

DNL Range (dB)	Estimated Change in Population
Less than 45	-81,838
45 to less than 50	87,581
50 to less than 55	-5,608
55 to less than 60	-562
60 to less than 65	427
65 to less than 70	0
70 to less than 75	0
Greater than or equal to 75	0

Source: HNTB Analysis, 2012.

Overall, none of the alternatives would result in a significant impact, and the implementation of any of the Proposed Action Alternatives would result in reportable change in some DNL ranges. The 45 to 50 DNL range includes the largest increase in population exposed to reportable noise change. Alternative 3 has the lowest increase in persons exposed to the 45 to 50 DNL range while also the largest decrease in persons exposed to the 50 to 55 DNL range.

Table 4.15

2012 Comparison of Noise Impact Above 45 DNL

DNL Range (dB)	2012 No Action Estimated Population	2012 Proposed Action Estimated Population	Estimated Change in Population
45 to less than 50	320,763	321,957	-1,194
50 to less than 55	68,896	68,474	422
55 to less than 60	20,850	20,905	-55
60 to less than 65	2,622	2,684	-62
65 to less than 70	422	422	0
70 to less than 75	0	0	0
Greater than or equal to 75	0	0	0
Total greater than 45	**413,553**	**414,442**	**-889**

Source: HNTB Analysis, 2012.

4.2 Compatible Land Use

Compatibility of land uses in airport study areas is usually determined by the extent of the airport's noise impacts. Existing land use in the Study Area is discussed in Chapter 3, *Affected Environment, Section 3.1.6.* Because the Proposed Action Alternatives are not expected to have significant noise impacts (as measured by noise exposure in populated centroids), it can be concluded that there will be no impacts to compatible land use. Additionally, existing non-compatible land uses currently exposed to noise levels greater than or equal to 65 DNL will not experience significant increases in noise levels as a result of any of the Proposed Action Alternatives, as discussed in Section 4.1 of this chapter.

Table 4.16

2017 Comparison of Noise Impact Above 45 DNL

DNL Range (dB)	2017 No Action Estimated Population	2017 Alt 1 Estimated Population	2017 Alt 1 - Compared to 2017 No Action	2017 Alt 2 Estimated Population	2017 Alt 2 - Compared to 2017 No Action	2017 Alt 3 Estimated Population	2017 Alt 3 - Compared to 2017 No Action	2017 Alt 4 Estimated Population	2017 Alt 4 - Compared to 2017 No Action
45 to less than 50	374,759	457,984	83,225	462,063	87,304	451,071	76,312	462,340	87,581
50 to less than 55	79,716	75,904	-3,812	73,752	-5,964	72,491	-7,225	74,108	-5,608
55 to less than 60	21,891	22,244	353	21,236	-655	21,429	-462	21,329	-562
60 to less than 65	2,622	2,684	62	3,050	428	2,684	62	3,049	427
65 to less than 70	422	422	0	422	0	422	0	422	0
70 to less than 75	0	0	0	0	0	0	0	0	0
Greater than or equal to 75	0	0	0	0	0	0	0	0	0
Total greater than 45 DNL	**479,410**	**559,238**	**79,828**	**560,523**	**81,113**	**548,097**	**68,687**	**561,248**	**81,838**

Source: HNTB Analysis, 2012.

4.3 Socioeconomic Impacts and Environmental Justice

According to FAA Order 1050.1E, the proposed route changes with the Proposed Action Alternatives should be evaluated for their potential to result in the relocation of residences and businesses as well as the potential to alter surface transportation patterns, divide established communities, disrupt orderly, planned development, or to create an appreciable change in employment.

Neither the No Action nor the Proposed Action Alternatives involve any construction of physical facilities or change in noise exposure levels in excess of the applicable thresholds of significance. There would be no acquisition of real estate, no relocation of residents or community businesses, no disruption of local traffic patterns, no loss in community tax base, and no changes to the fabric of the community. Accordingly, there would be no socioeconomic impacts.

In addition, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Population*, requires Federal agencies to identify and address disproportionately high and adverse human health and environmental impacts on low-income and minority populations in the communities potentially impacted by the Proposed Action.

There are no adverse human health or environmental effects associated with the Proposed Action Alternatives (including the noise, air quality, water quality, hazardous materials, and cultural resource categories), which would exceed applicable thresholds of significance. There are no impacts from the Proposed Action Alternatives which would affect low income or minority populations at a disproportionately higher level than it would other population segments. Accordingly, there would be no significant environmental justice impacts.

4.4 Children's Environmental Health and Safety Risks

FAA is required to identify and assess environmental health and safety risks that the agency has reason to believe could disproportionately affect children. In proportion to their size, children breathe more air, drink more water and eat more food than adults. This puts them at greater risk of exposure to pollutants. Children's bodies are also less able to metabolize, detoxify and expunge these pollutants. There are no impacts associated with the Proposed Action Alternatives (including the noise, air quality, water quality, hazardous materials, and cultural resource categories) which would exceed applicable thresholds of significance. The Proposed Action Alternatives would not affect products or substances that a child is likely to come into contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately affect children. Accordingly, there would be no significant impacts related to children's environmental health and safety risks.

4.5 Secondary or Induced Impacts

The Proposed Action Alternatives and No Action Alternative were evaluated for their potential to impose induced or secondary effects on the surrounding communities as a result of the proposed implementation of new RNAV and RNP routes. This includes any shifts in patterns of population

movement and growth, the demand for public services, and changes in business and economic activity within the confines of the Study Area. The proposed routes and procedures were designed by the FAA to improve the safety and efficiency of the Denver Complex Airspace in response to inadequacies and inefficiencies. While the procedures were designed with the intent to increase airspace efficiency for existing air traffic, the proposed routes and procedures would not induce additional demand or create additional air traffic.

Secondary impacts would normally not be a significant impact except where there is also a significant impact to noise, compatible land use, and social impacts. As discussed in this chapter, there are no impacts associated with the Proposed Action Alternatives in excess of the applicable thresholds of significance for these impact categories. Moreover, the Proposed Action Alternatives do not involve development, and would not be expected to result in shifts in population and growth, increased demand for public services, or changes in business and economic activity. Therefore, there would be no potential for secondary or induced impacts.

4.6 Historical, Architectural, Archaeological, and Cultural Resources

Archaeological and historic architectural resources that will be affected by federally funded and licensed undertakings come under the protection of the National Historic Preservation Act. Section 106 of this Act requires Federal agencies to consider the effects of such undertakings on properties listed, or eligible for listing, on the National Register of Historic Places.

An adverse effect is considered to be one that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. If a determination of adverse impact is made, the consultation procedures of the Advisory Council on Historic Preservation must be followed.[6]

Primary impacts include the removal or alteration of historic resources. There would be no ground disturbance as a result of the Proposed Action Alternatives. Therefore, there would be no direct impacts on properties listed on or eligible to be listed on the National Register of Historic Places.

Secondary or indirect impacts include changes in noise, vehicular traffic, light emissions, or other changes that could interfere substantially with the use or character of the resource. Indirect impacts include noise impacts that would diminish the integrity of the property's setting.

To assess the potential indirect effects on historic resources, an area of potential effect (APE) was defined. The Proposed Action APE, which is the same as the NEPA Study Area described in Section 1.2 of this document, encompasses approximately 6,900 square miles. Seven hundred and seventy-six data points were analyzed for 677 listed historic resources, including places designated as historic by the State of Colorado.

The magnitude of the change in aircraft noise exposure level between the No Action Alternative and the Proposed Action Alternatives was the primary basis for determining the effect of the undertaking on historic resources. The criteria for determining the level of impact of increases in aircraft noise when comparing the

Proposed Action Alternatives to the No Action Alternative are:

- DNL 1.5 dB in areas exposed aircraft noise of DNL 65 and higher,
- DNL 3.0 dB in areas exposed to aircraft noise from DNL 60 to 65, or
- DNL 5.0 dB in areas exposed to aircraft noise from DNL 45 to 60.

As indicated in **Table F.2 (Appendix F)**, no historic properties would experience a 1.5 DNL increase in areas of noise exposure of 65 DNL or higher in 2012 or 2017. In addition, none of the historic resources in proximity to reportable changes for population centroids between 45-60 DNL include a quiet setting as a generally recognized feature or attribute of the resource's significance. Thus there are no adverse effects to historic properties resulting from implementation of the Proposed Action. Consultation with History Colorado, the State Historic Preservation Office, occurred during the project. The State Historic Preservation Officer indicated concurrence with both the definition of the APE and the finding of no adverse effect, under Section 106 (see Appendix H).

4.7 Department of Transportation Act Section 4(f), and Land and Water Conservation Fund Act Section 6(f)

Section 303(c), Title 49 USC, commonly referred to as Section 4(f) of the DOT Act,[7] states that the "…Secretary of Transportation will not approve a project that requires the use of any publicly-owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land from a historic site of national, state, or local significance as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land…and [unless] the project includes all possible planning to minimize harm resulting from the use."[8] Section 4601, Title 16 USC, The Land and Water Conservation Fund (LWCF) Act, commonly referred to as Section 6(f) states that no public outdoor recreation areas acquired with LWCF assistance can be converted to non-recreation uses without the approval of the Secretary of the Interior. The potential impacts to both Section 4(f) and Section 6(f) were analyzed as described in Historic, Architectural, Archaeological and Cultural Resources are discussed in Section 4.6.

4.7.1 Section 4(f): Parks, Wildlife Refuges, Wilderness Areas

Section 4(f) resources within the Study Area are described in Chapter 3, *Affected Environment, Section 3.3.2*. In regard to Section 4(f) properties the term use encompasses both direct and indirect impacts. *Direct use* is the physical taking of the Section 4(f) properties. The Proposed Action Alternatives do not include any land-based impacts as there is no physical disturbance or land acquisition. Therefore, the Proposed Action Alternatives do not result in a direct use of any Section 4(f) property.

Adverse *indirect impacts* including noise may constitute a "constructive use" of a Section 4(f) property. In determining whether there is a "constructive use" the FAA must determine if the impacts would substantially impair the property. A Section 4(f) property is determined to be substantially impaired when the activities, features, or attributes of the site that

contribute to its significance or enjoyment are substantially diminished.

Noise exposure levels were calculated for grid points at 0.25 NM intervals throughout the larger Section 4(f) properties. For Section 4(f) properties that were not covered by the grid interval (i.e., smaller parks and monuments), noise exposure was calculated as a single point located in the center of the park.

As discussed in *Chapter 3, Affected Environment*, four National Wilderness Areas were included in the Study Area: Indian Peaks Wilderness Area, James Peak Wilderness Area, Lost Creek Wilderness Area and Mount Evans National Wildlife Area.

Indian Peaks Wilderness Area would experience noise levels ranging from 40 DNL or less under the 2012 No Action Alternative, to 43 DNL or less under the 2012 Alternative 1. Under the 2017 No Action Alternative, noise levels are projected to be a maximum of 41 DNL, while maximum levels of 43 DNL are projected in all of the 2017 Proposed Action Alternatives. James Peak Wilderness Area would be anticipated to experience maximum levels of 38 DNL with the 2012 No Action Alternative, potentially increasing to 46 under Alternative 1 in 2012. In 2017, the 2017 No Action Alternative maximum level is projected to be 38 DNL, increasing to a maximum of 47 DNL under any of the 2017 Proposed Action Alternatives. Lost Creek Wilderness Area would, under the 2012 No Action Alternative, experience maximum DNL levels of 25 DNL from aircraft noise, while the highest noise levels projected under the Alternative 1 in 2012 would be 26 DNL. In 2017, the maximum level of 25 DNL under the 2017 No Action Alternative would increase under any of the 2017 Proposed Action Alternatives to a maximum of 27 DNL. Mt. Evans National Wildlife Area would experience noise levels of 43 DNL or less under the 2012 No Action Alternative, 50 DNL or less under Alternative 1 in 2012, 44 DNL under the 2017 No Action Alternative, and 50 DNL or less under any of the 2017 Proposed Action Alternatives.

The National Wildlife Refuges analyzed include Rocky Flats, Rocky Mountain Arsenal, and Two Ponds National Wildlife Refuge. At Rocky Flats, no noise levels are projected to exceed 52 DNL under any Alternative in either 2012 or 2017, and changes in noise exposure would be anticipated to be less than 2 dB. At Rocky Mountain Arsenal, noise levels in the 2012 No Action Alternative or Alternative 1 in 2012 remain at 55 DNL or below. In 2017, the No Action Alternative would have a maximum noise level of 56 DNL, while the Proposed Action Alternatives would potentially reduce the maximum noise levels from 56 DNL to 55 DNL. Noise levels at Two Ponds National Wildlife Refuge remain at or below 41 DNL in the 2012 No Action Alternative, 39 DNL in Alternative 1 in 2012, 42 DNL in the 2017 No Action Alternative, and 39 DNL under any of the 2017 Proposed Action Alternatives.

Rocky Mountain National Park would experience noise levels of 32 DNL or less under the 2012 No Action Alternative and Alternative 1 in 2012. Under the 2017 No Action Alternative and any of the 2017 Proposed Action Alternatives, noise levels would not be anticipated to exceed 33 DNL, with changes in values ranging from 2 to 3 DNL. Appendix D, Section D.5 further describes the noise environment at RMNP.

Noise levels in state parks, spread geographically throughout the Study Area, range from DNL values of 26 to 55 under the 2012 No Action, 24 to 55 DNL in Alternative 1 in 2012, 26 to 55 DNL in the 2017 No Action, and 23 to 55 DNL in the 2017 Proposed Action Alternatives. Over 775 local parks were identified in the Study Area, all of which have DNL values of 56 or lower. ***Appendix G, Noise Exposure at Local Parks,*** Table G.1 provides the calculated noise values for each alternative at the local parks. Noise exposure was calculated at over 800 locations because multiple points were measures at some of the parks.

Figure 4-13 depicts noise exposure greater than 45 DNL at parks, forests, wildlife refuges and wilderness areas in the Study Area for the No Action Alternative in 2012. **Figure 4-14** depicts noise exposure for parks, forests, wildlife refuges and wilderness areas above 45 DNL for the 2017 No Action Condition.

Figures 4-15, 4-16, **4-17**, **4-18**, and **4-19** depict noise exposure for parks, forests, wildlife refuges and wilderness areas above 45 DNL for Alternative 1 in 2012, and all alternatives in 2017. Under Alternative 1, there are no parks, forests, wildlife refuges and wilderness areas that would experience a change in noise exposure level in excess of the applicable threshold of significance (i.e., a 1.5 DNL change resulting in a noise exposure level greater than or equal to 65 DNL). In 2012, Alternative 1 would result in reportable increases on portions of four different resources: Asel Park, Eldorado Canyon State Park, James Peak Wilderness Area, and the Mt. Evans Wilderness Area. **Table 4.17** depicts the reportable increases in noise associated with Alternative 1 in 2012.

The overall increase in the number of operations in 2017, coupled with an increase in the use of the RNAV procedures results in additional reportable increases in 2017. Mathews-Winters Park and Golden Gate Canyon State Park both would experience reportable increases in noise exposure, in addition to Asel Park, Eldorado Canyon State Park, James Peak Wilderness Area, and the Mt. Evans Wilderness Area. **Table 4.18** depicts the reportable increases in noise associated with all Alternatives in 2017.

Table 4.17

Section 4(f) Resources Experiencing Reportable Increases in Alternative 1 – 2012

Latitude	Longitude	Description	Section 4(f) Type	2012 No Action DNL (dB)	2012 Alternative 1 DNL (dB)
39.8969	-105.3253	Asel Park	Park (local)	39	46
39.90308	-105.3112	Eldorado Canyon	Park (state)	39	46-47
39.86727	-105.67243	James Peak Wilderness Area	National Wilderness Area	35-36	45-46
39.55971	-105.60368	Mt Evans Wilderness Area	National Wilderness Area	40-42	45-50

Source: HNTB Analysis, 2012.

Table 4.18

Section 4(f) Resources Experiencing Reportable Increases in All 2017 Alternatives

Latitude	Longitude	Description	Section 4(f) Type	2017 No Action DNL (dB)	2017 All Alternatives DNL (dB)
39.8969	-105.3253	Asel Park	Park (local)	40	47
39.90308	-105.3112	Eldorado Canyon	Park (state)	39-40	47-48
39.88137	-105.45231	Golden Gate Canyon	Park (state)	38-39	45
39.86365	-105.67966	James Peak Wilderness Area	National Wilderness Area	35-36	45-47
39.70015	-105.21818	Matthews-Winters Park	Park (local)	42	47
39.55971	-105.60368	Mt Evans Wilderness Area	National Wilderness Area	40-42	45-50

Source: HNTB Analysis, 2012.

There are no Section 4(f) properties that would experience a 1.5 DNL change resulting in a noise exposure level greater than or equal to 65 DNL. Although the Proposed Action Alternatives would cause reportable increases in noise within some of the resources studied none of these resources would be substantially impaired by the Proposed Action Alternatives. None of the areas that receive reportable noise are located in areas for which a quiet setting is a recognized feature of the park or wilderness area. Eldorado Canyon State Park is a highly used recreational area included activities such as boating, camping, horseback riding, picnicking and hunting. Golden Gate Canyon State Park is also highly used due to its proximity to Denver with similar activities to the Eldorado Canyon State Park with the exception that hunting is not allowed. The James Peak Wilderness Area is meant to be used as a recreational area and the use of snow mobiles are approved in times of adequate snow cover as well as use of other motorized and non-motorized mechanical devices.[9] The area of reportable noise change occurs over Ute Trail located in the west most portion of the James Peak Wilderness Area. The trail is lightly used and is not vegetated. The Mt Evans Wilderness Area includes a scenic drive that is featured as the highest paved road in North America and the reportable noise changes within this Wilderness occur near Interstate 70 over barren land with no trail access. Matthews-Winters Park is located near major roadways and offers easy access for biking, horseback riding and hiking as primary activities for this park. Asel Open Space Park is still being developed and the uses have not been formally determined. No activities, features, or attributes of the resource sites that contribute to their significance or enjoyment would be substantially diminished by the Proposed Action Alternatives; therefore no further analysis is required.

4.7.2 Section 6(f)

Section 6(f) properties within the Study Area are described in Section 3.3.2. NPS has determined that conversion of 6(f) parkland occurs under four conditions: 1) property interests are conveyed for non-public outdoor recreation uses; 2) non-recreation uses are made of the project area, or a portion of it; 3) non-eligible indoor facilities are developed within the project area without approval; and 4) public outdoor recreation use of the property is terminated. Because the Proposed Action would not convey 6(f) property and would not include the construction of indoor facilities, there would be a 6(f) impact only if the new procedures included in the Proposed Action Alternatives would result in the constructive use of a park such that it would cause a permanent and substantial use of the 6(f) property.

There are no Section 6(f) properties that would experience a 1.5 DNL change resulting in a noise exposure level greater than or equal to 65 DNL. As with 4(f) resources, the Proposed Action Alternatives would cause reportable increases in noise. There will be no constructive use of a 6(f) property.

4.8 Fish, Wildlife, and Plants

This resource category includes consideration of impacts to fish, wildlife, and plants, including migratory birds.

4.8.1 Species other than Migratory Birds

Potential impacts to fish, wildlife, and plants were evaluated in accordance with FAA Order 1050.1E. A significant impact would occur if the proposed action would jeopardize the continued existence of federally listed threatened or endangered species or result in the destruction or adverse modification of critical habitat for any species.

Impacts were also considered in accordance with Executive Order 13112, "Invasive Species." Impacts considered are those that could prevent the introduction, provide for the control, and minimize the economic, ecological, and human health impacts that are caused by invasive species.

The Proposed Action Alternatives involves ATC routing changes for airborne aircraft only and do not involve any ground-based impacts. Thus, it will not destroy or modify critical habitat for any species. Additionally, no species that meets the definition of an invasive species will be introduced in the project area due to the Proposed Action Alternatives. Therefore, there are no significant impacts to fish, non-avian wildlife, and plants which would exceed the threshold of significance defined in FAA Order 1050.1E, Appendix A, Section 8.

4.8.2 Migratory Birds

The following sections discuss migratory bird flyways, strike factors, and impact assessment.

Migratory bird patterns are discussed in Section 3.3.6.2. The Central Flyway, shown on Figure 3-26 of the *Affected Environment*, is pertinent to the Study Area.

The actual routes followed by many migratory birds vary by distance traveled, time of starting, flight speed, geographic position and latitude of the breeding, and wintering grounds. The most frequently

traveled migration routes conform very closely to major topographical features that lie in the general north-south movement of migratory bird flyways. Therefore, the lanes of heavier concentration in the Study Area follow principal river valleys and mountain ranges.

The Central Flyway is the only North American flyway to cross near or through the State of Colorado and is the only flyway that could potentially interact with the Study Area. It encompasses the vast region between the valley of the Mississippi River and the Rocky Mountains and is home to a large percentage of North America's ducks and geese. The majority of the birds that use the Central Flyway make direct north and south journeys from breeding grounds in the North to winter quarters in the South.[10]

The FAA National Wildlife Strike Database contains records of reported wildlife strikes since 1990. The database includes over 121,000 (Civil and USAF) wildlife strikes between 1990 and 2010. In 2010 there were a total of 177 reported wildlife strikes in the State of Colorado, with 149 of those occurring combined at DEN (141), APA (five) and BJC (three). There were fewer strikes reported in Colorado in 2010 than in 2000, when 225 strikes were reported (185 at DEN, two at APA). Migratory birds do not generally fly at altitudes greater than 10,000 feet and the majority (92 percent) of the bird strikes to commercial aircraft occur at or below 3,500 feet AGL and occur during the approach and landing roll.[11]

Any changes to flight paths/patterns due to the Proposed Action would occur above 3,500 feet AGL, at a higher altitude than where the majority of bird strikes occur. Additionally, the Proposed Action will not change the arrival and departure flows at DEN, APA and BJC so the approaches and departures are not expected to differ from those today. Therefore, based on the available information from the FAA National Wildlife Strike Database, it is concluded that the impacts to bird patterns resulting from the Proposed Action Alternatives would be minimal.

4.9 Air Quality

The CAA requires that all Federal actions conform to an applicable SIP. FAA actions are subject to the General Conformity Rule. General Conformity refers to the requirements under Section 176(c) for the CAA for federal agencies (other than FHWA and FTA) to show that their actions conform to the purpose of the applicable SIP. The EPA established criteria and procedures for Federal agencies to use in demonstrating conformity with an applicable SIP (40 CFR 93.150 *et seq.*).

On July 30, 2007, the FAA issued a presumed to conform list of actions under General Conformity [FR 41565]. In the aforementioned notice, the FAA summarized documentation and analysis which demonstrated that certain actions will not exceed the applicable *de minimis* emissions levels for nonattainment and maintenance areas as specified under 40 CFR 93.153(b). The FAA includes air traffic control activities and adopting approach, departure and enroute procedures for air operations in their list of presumed to conform actions thereby indicating that these types of actions will not exceed *de minimis* emissions levels.

The Proposed Action includes airspace and air traffic actions (e.g., changes in routes, flight patterns, and arrival and departure

procedures) above the mixing height (generally 3,000' AGL) that are needed to enhance safety and increase the efficient use of airspace by reducing congestion, balancing controller workload and improving coordination between controllers handling existing air traffic. The FAA's presumed to conform list is therefore applicable to the Proposed Action. Additionally, the Proposed Action is not regionally significant. Specifically, the total number of aircraft operations would not differ between the No Action Alternative and the Proposed Action Alternatives and it is estimated that fuel burn (see Section 4.10) will be reduced due to the Proposed Action thus producing less air pollutant emissions.

In terms of air quality impacts related to vehicle emissions, neither the No Action Alternative nor the Proposed Action Alternatives would induce changes to vehicular traffic. Aircraft operations and vehicular traffic would grow with or without the proposed ATC routing changes. In addition, the implementation of the Proposed Action would not significantly alter the distribution of vehicular traffic among the airports because the ATC routing changes would not likely change airline service trends and/or air passenger preferences on use of an airport. Air passengers traditionally select an airport based on the ticket cost, airport location, and service to a desired destination.

Since the Proposed Action is presumed to conform and would have a negligible effect on vehicle traffic no further analysis is required.

4.10 Climate

Although there are no federal standards for aviation-related GHG emissions, it is well-established that GHG emissions can affect climate.[12] The CEQ has indicated that climate should be considered in NEPA analyses. As noted by CEQ, however, "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions; as such direct linkage is difficult to isolate and to understand."[13]

GHG emissions are commensurate with fuel consumption. NIRS version 7.0b2 was used to determine estimated values for fuel burn, CO_2, and difference for the 2012 and 2017 No Action and Proposed Action Alternatives. The analysis only considered traffic associated with DEN since increases or decreases in fuel burn is most directly related to commercial aircraft operations.

It was necessary to adjust the overall length of noise model flight tracks to ensure that a similar geographic area was considered. The RNAV STAR and SID flight tracks extend well into ARTCC airspace, while the noise model flight tracks associated with conventional flight tracks at DEN extend slightly past 30 nautical miles from DEN. All noise model flight tracks were truncated at approximately 30 nautical miles from DEN, and general assumptions pertaining to flight altitudes were made.

As explained in *Section 3.3.5, Climate*, of this document, the 2010 fuel burn for DEN within 30 NM is calculated to be 608,679 kg. Carbon dioxide (CO_2) emissions associated with the Study Area in the Existing Condition (2010) are 1,920,382 kg.

Alternative 1 in 2012 will decrease aircraft fuel burn from 663,617 kg (2012 No Action Alternative) to 616,309 kg. The equivalent amount of CO_2 emissions for the 2012

Alternative 1 is 1,944,453 kg, less than the 2,093,713 kg for the 2012 No Action Alternative. Based on these data, GHG emissions associated with Alternative 1 would represent a decrease of 7.13 percent in 2012.

Implementation of the Proposed Action for DEN in 2017 will decrease aircraft fuel burn from 783,628 kg (2017 No Action Alternative) to 725,798 kg. The equivalent amount of CO_2 emissions for the Proposed Action at DEN in 2017, is 2,289,892 kg, less than the 2,472,348 kg for the 2017 No Action Alternative. Based on these data, GHG emissions associated with the Proposed Action at DEN in 2017 would represent a decrease of 7.38 percent.

Table 4.19 displays the total fuel burn and CO_2 emissions (in kilograms) for the No Action Alternative and the Proposed Action at DEN Alternative for both 2012 and 2017, along with the percentage difference between the two scenarios.

Table 4.19

Fuel Burn Analysis

2012 Proposed Action for DEN		
Fuel Burn Impact	**Fuel (kg)**	**CO_2 (kg)**
No Action	663,617	2,093,713
Alternative 1	616,309	1,944,453
% Difference (Alt. minus No Action)/ No Action	-7.13%	-7.13%
2017 Proposed Action for DEN		
Fuel Burn Impact	**Fuel (kg)**	**CO_2 (kg)**
No Action	783,628	2,472,348
Alternatives 1-4	725,798	2,289,892
% Difference (Alt. minus No Action)/ No Action	-7.38%	-7.38%

Source: HNTB Analysis, 2012.

4.11 Cumulative Impacts and Connected Actions

Airport development activities, including airport improvements and airspace redesigns, often create the potential for cumulative impacts. This analysis of cumulative impacts defines cumulative impacts, identifies potential impact categories, and presents the potential cumulative impacts of these categories.

4.11.1 Definition of Cumulative Impacts

The concept of cumulative impacts addresses the potential for individually minor but collectively significant impacts to occur over time. CEQ Regulations, Section 1508.7, defines "Cumulative Impact" as the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of the agency (Federal or non-federal) undertaking such actions. CEQ Regulations, Section 1508.25, defines the types of actions that should be considered in assessing cumulative impacts. These actions include the following:

(1) Connected actions, which are defined as:

- Actions that automatically trigger other actions which may require an Environmental Impact Statement;
- Actions that cannot or would not proceed unless other actions are taken previously or simultaneously; and/or
- Actions that are interdependent parts of a larger action and depend upon that action for their justification.

(2) Cumulative actions that, when considered with other proposed actions, would have cumulatively significant impacts; and

(3) Similar actions that have similarities such as timing or location with other reasonably foreseeable or proposed projects that provide a basis for evaluating their environmental impacts in the same NEPA document.

4.12 Projects for Consideration of Cumulative Impacts

Multiple airport improvements are scheduled for DEN, APA and BJC (e.g. runway/taxiway rehabilitations, construction of new taxiways, etc.) within a five-year planning timeframe. Five years corresponds with the typical capital improvement (CIP) planning horizon and was therefore applied as the timeline for including projects to be considered for cumulative impacts. The projects listed in **Table 4.20** are the capital improvements currently included in the FAA's CIP for APA, BJC and DEN. The only project that has the potential to have cumulative impacts when combined with the Proposed Action considered in this EA is the addition of another runway at DEN. With the implementation of another runway at DEN airspace changes and procedures will necessarily be required. The location and orientation of the runway, along with the procedures that will be used to and from this runway have yet to be determined. The ultimate location of a new runway has the potential to direct aircraft over new areas, depending on where the runway is located. It is expected that the addition of another runway at DEN would cumulatively change noise exposure in the Study Area, however the type and magnitude of change cannot be analyzed until additional planning is complete.

Additionally, BJC will soon host helicopter "Long Line" training operations. Long line helicopter operations are training operations for pilots operating helicopters with a long line (sling load) attached to it, for the purposes of aerial firefighting, aerial construction, heli-skiing, heli-seismic, aerial harvesting, ferrying external loads, etc. Operations associated with long line training have been evaluated separate from the Proposed Action under this analysis, and the results have been compared and included in this EA. Noise results were calculated for each of the population centroids and Section 4(f) resources, and comparisons with the No Action and Proposed Action Alternatives were made. With the cumulative noise from the proposed Long Line operations, no significant impacts were found. The remaining projects projected for the foreseeable future will not cause changes to the Denver Complex Airspace, are unrelated to the Proposed Action and are not expected to have cumulative impacts.

Table 4.20

Projects to be Considered for Cumulative Impacts

Airport	Improvement	Timing
Past Actions		
DEN	Implementation of Runway 16L/34R	2002
Future Foreseeable Actions		
APA	Construct Taxiway D (D1-D3)	2013
	Rehabilitation of Runway 10/28	2014
	Extend Taxiway C	2015
	Rehabilitate Taxiway A	2016
BJC	Long Line Helicopter Training Operations	2012
	Land Acquisition for Improving RSA for Runway 11L/29R	2012
	Relocate Localizer for Improving RSA for Runway 11L/29R	2013
	Rehabilitate Runway 11L/29R	2014
	Construct Taxiway A-3	2015
	Rehabilitate Runway 11R/29L	2016
DEN	Rehabilitate Runway 16L/34R	2012
	Construct Taxiway F-7 (exit from Runway 16L)	2012
	Rehabilitate terminal taxiway/apron system and drainage	2013-2014
	Rehabilitate Runway 17R/35L	2013
	Rehabilitate Runway 16R/34L	2014
	Construct Taxiway D5 for high speed exit from Runway 16L	2014
	Construct 7th Runway	2015

Source: FAA CIP for APA, BJC, DEN, 2012.

4.13 Summary

The FAA's Proposed Action to implement new RNAV procedures, inclusive of RNP and OPD, in the Denver Complex Airspace are intended to improve the safety and efficiency of the Denver Complex Airspace. The procedures were developed by the Denver RNAV Workgroup which worked for over two years on the procedure development with significant attention to the avoidance of environmental impacts.

The following environmental impact categories were evaluated for potential impacts in accordance with FAA Order 1050.1E due to the Proposed Action:

- Noise
- Compatible Land Use
- Socioeconomic Impacts and Environmental Justice
- Children's Environmental Health and Safety Risks
- Secondary or Induced Impacts
- Historical, Architectural, Archaeological, and Cultural Resources
- Department of Transportation Act: Section 4(f) and 6(f) Resources
- Fish, Wildlife and Plants
- Air Quality
- Climate
- Cumulative Impacts and Connected Actions

The No Action and Proposed Action Alternatives were analyzed for potential impacts to the above referenced impact categories. No significant impacts are associated with any of the alternatives. Furthermore, the procedures would not result in any ground based impacts, as no construction is required for the RNAV procedure implementation.

Endnotes

[1] Federal Aviation Administration, Order 1050.1E, "Policies and Procedures for Considering Environmental Impacts."

[2] 14 C.F.R. Part 150, Section 150.21(a)(2)(d).

[3] Federal Interagency Committee on Noise (FICON), "Federal Agency Review of Selected Airport Noise Analysis Issues," August 2992, p.3-5.

[4] Federal Aviation Administration, "Final Environmental Impact Statement, Expanded East Coast Plan – Changes in Aircraft Flight Patterns Over the State of New Jersey,1995.

[5] FAA Order 1050.1E, Appendix A, Section 14.3.

[6] 36 CFR Part 800.

[7] Department of Transportation Act of 1966, § 4(f) [recodified at 49 USC 303 (c)].

[8] FAA Order 1050.1E, Appendix A, page A-19.

[9] James Peak Wilderness and Protection Act. 16 USC 539*l*.

[10] North American Migration Flyways, http://www.birdnature.com/flyways.html, Accessed 10/25/11.

[11] FAA, FAA Wildlife Strike Database, http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx, Accessed 4/3/12.

[12] See *Massachusetts v. E.P.A.,* 549 U.S. 497, 508-10, 521-23 (2007).

[13] *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions,* CEQ (2010). http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf.

CHAPTER 5:
PUBLIC AND AGENCY INVOLVEMENT SUMMARY

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Chapter Five: PUBLIC AND AGENCY INVOLVEMENT SUMMARY

Public and agency involvement is important to ensure that information is provided to the general public and public agencies. As described in 40 CFR 1501.7, public and agency involvement is required for an EIS but optional in the case of an EA. The FAA considers an open public process to be an important component of this project and therefore has involved the public and agencies with jurisdiction or special knowledge in the environmental review process.

The sections that follow provide a summary of FAA public and agency involvement completed for development of this EA.

5.1 Scoping

Scoping is the early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. Scoping is also used to eliminate from detailed study the issues that are not significant or have been evaluated by prior environmental review.

During the scoping period for this EA the public and other agencies were given the opportunity to assist in determining the scope of issues to be addressed. In addition to the scoping process, the FAA has held a number of meetings to educate, inform, as well as to discuss the proposed project and to receive feedback from concerned citizens and organizations.

5.1.1 Agency and Community Scoping

Potentially interested agencies and community organizations were sent agency scoping packages with information about the project and the upcoming scoping meetings, including discussion of the scoping process, background information, the EA process, purpose and need, project alternatives, study area, and anticipated environmental impacts in February 2011. Agency input on the potential for impact to the protected resources due to the Proposed Action was also requested in the packages. A sample scoping package is included in ***Appendix H***. The following agencies and communities were sent scoping packages:

- City of Greenwood Village
- City of Arvada
- City of Federal Heights
- City of Thornton
- City of Northglenn
- City of Westminister
- Adams County
- City of Aurora
- City of Brighton
- City of Commerce City

- City and County of Broomfield
- City of Denver
- Town of Bennett
- Weld County
- Arapahoe County
- Jefferson County
- USEPA - Region 8
- State Historic Preservation Office
- Colorado Water Quality Control Division
- USDA Wildlife Services – Western Region
- U.S. Fish and Wildlife Service
- Colorado Division of Wildlife
- Colorado NRCS State Office
- Colorado State Parks
- National Park Service

An Agency Scoping Meeting was held from 1:30 – 3:00 p.m. on March 9, 2011 in the Mt. Evans Conference Room at Rocky Mountain Metropolitan Airport. Twenty-one (21) agency representatives were at the meeting. **Table 5.1** provides a list of agencies and community organizations in attendance at the Agency Scoping Meeting.

A PowerPoint presentation was provided to the group with project background, the elements of the EA, the Proposed Action and Purpose Need, and the preliminary study area. Attendees were provided the opportunity to ask the FAA and project team questions during and following the presentation. The project boards displayed at the Public Scoping Meetings were also exhibited at the Agency Scoping Meeting.

Table 5.1
Agency Scoping Meeting Attendees

Agency/Organization	
Adams County	City of Greenwood Village
Arapahoe County	City of Northglenn
City/County of Broomfield	City of Thornton
City of Aurora	National Park Service
Town of Castle Rock	U.S. Department of Agriculture/Wildlife Services
City of Commerce City	U.S. Forest Service
City of Denver	Weld County

5.1.2 Public Scoping

Public Scoping Meetings were held at three different locations on March 8th, 9th, and 10th, 2011, with each meeting location in proximity to one of the three airports included in the Proposed Action. The Public Scoping Meetings were advertised through the following newspapers, websites, and emails:

- *The Denver Post*
- Denver International Airport Website
- Rocky Mountain Metropolitan Airport Website
- Centennial Airport Website
- *The Aurora Sentinel*
- Greenwood Village Website
- Emails to elected officials and city managers

The scoping meetings were held in an open house format and also included a 30-minute PowerPoint presentation. Eight (8) poster-

size project boards were displayed at each of the meetings to provide relevant project and process information. Handouts were provided to the public with project information, frequently asked questions and information about the EA process (See *Appendix H*). Attendees were encouraged to circulate among the display boards where FAA, airport, and contractor staff were available to answer questions and discuss the Proposed Action with the public. Approximately 80 people total from the general public attended the scoping meetings on March 8th, 9th, and 10th.

5.1.3 Scoping Comments

Agencies and the public were invited to comment on the Proposed Action using several methods during the scoping process. During the public meetings, self-addressed comment cards were made available for written comments that could be either left at the meeting or sent in via mail. Attendees also had the option to submit scoping comments via email. It was requested that comments be submitted by April 10th, 2011, in order to allow the FAA time to identify issues early in the EA process and to maintain the project timeline.

A total of 26 written comments were received during the scoping period. The majority of the comments received were provided via email (17), three public comment forms were submitted at scoping meetings, and six comments were received via postal mail.

Of the comments received, the majority were from the public. Other categories of commenters include local jurisdictions (cities, towns, and counties); elected officials, commissioners, city council members and airport roundtable representatives; airport staff; neighborhood associations; and agencies. **Table 5.2** summarizes the comments received (See *Appendix H*). A scoping report was developed to describe the scoping process; the scoping report was posted on DEN, APA and BJC websites for public review.

Table 5.2

Agency and Public Scoping Comments

Respondent	Comment
Government/Agency Responses	
State Historic Preservation Office	Coordinate the NEPA studies with the studies required under Section 106 and 110 of the National Historic Preservation Act so SHPO will be able to fully complete their reviews under both Section 106 and NEPA.
U.S. Fish and Wildlife Service, Colorado Field Office	The Service provided recommendations for threatened and endangered species, protective measures for migratory birds, bald and golden eagle, and wilderness areas and National Wildlife Refuges.
USDA Forest Service – Arapaho and Roosevelt National Forests and Pawnee National Grassland	Concern for the noise generation from the Rocky Mountain Metropolitan Airport over wilderness areas which are managed to protect and perpetuate the feeling of solitude experienced by visitors to these areas.

Table 5.2

Agency and Public Scoping Comments

Rocky Mountain National Park	Aircraft noise impinges on visitor enjoyment and preservation of wilderness in the park. The Park requests the consideration of an alternative flight path over the park to place the path more in line with Trail Ridge Road, and invite the FAA to use the park for noise-monitoring.
Front Range Airport	Consider the inclusion of Buckley AFB and Front Range Airport in the study area as both airports have jet aircraft operations.
City of Aurora	Keep the City of Aurora informed of meetings and changes in the EA, include supplemental noise metrics into the noise model analysis, and evaluate additional raptor species in the EA (American Peregrine Falcon and the Ferruginous Hawk).
Arapahoe County	The County supports the RNAV effort and its benefits (noise reduction) to citizens within its district.
Douglas County	County supports the RNAV/RNP flight procedures, and requests the Draft EA be developed in a manner to facilitate community understanding of the proposal.
Town of Castle Rock	Requests examination of potential impacts of RNAV/RNP to Castle Rock residents from flights at Centennial Airport.
Greenwood Village Council	Council is optimistic about the EA process and hopes the project will result in lower noise levels in their neighborhoods.
Greenwood Village elected official	Supports the proposed changes and development of RNAV routes and procedures.
City of Castle Pines	Supports the proposed changes.
Arapahoe County Commission	Supports the proposed changes.
Adams County	Request the EA to identify how the noise contours will change and how concentrated flight paths will impact the County. Suggest additional modeling completed for indoor noise impacts, inclusion of Front Range Airport in the EA, and analysis of migratory species.
Aircraft Owners and Pilots Association	Supports the proposed changes.
Centennial Airport Community Noise Roundtable	Representing citizens in unincorporated Arapahoe County, they strongly support the proposed airspace redesign.
Public Responses	
Stonegate Village Owners (Parker, CO)	Request for copy of public meeting presentation and to be added to the mailing list regarding updates on the impact for flight patterns that could affect their community

Table 5.2

Agency and Public Scoping Comments

Sapphire Point Citizens	Address the air traffic noise issues over Sapphire Point and support of Centennial Airport shifting their routes to avoid flight paths over neighborhoods.
Castle Rock Resident	Supports the proposed changes but requests attention given to the area of Douglas County that is about 800 feet higher than Centennial Airport.
Resident of Sapphire Point	Complaints of air traffic noise in neighborhood from Centennial Airport and hopes it can be directed away from residential areas.
Resident of Sapphire Point	Request that Sapphire Point be included in the EA and for the new routes to avoid residential areas.
Public Meeting Comment Form	Concern for commercial flight paths intersecting the Buckley AFB fighter paths over populated areas.
Public Meeting Comment Form	Supports the project.
Public Meeting Comment Form	Interest in protecting Brighton and Barr Lake Area from negative impacts due to concentration of flight paths.
Public Meeting Comment Form	Does not believe the project will improve efficiency. Provides ideas on how to fix the system with speed control, timing, and organization.
Public Meeting Comment Form	Assumes the focused flight paths will be over open spaces and not residential areas and suggests addressing helicopters as well.

5.2 Additional Coordination

In addition to the scoping process described in Section 5.1, the FAA met with the NPS, Colorado State Parks representatives, the Centennial Noise Round Table, and staff from DEN Planning and Noise Office on many occasions to discuss the project. Throughout the development of the RNAV and RNP procedures, the FAA met frequently with agencies, airport sponsors, cities and counties, as well as interested citizen groups to disseminate information on the procedure development and to better understand potential concerns regarding the proposed procedures.

Specifically, the FAA met with the Cherry Creek State Park Manager, the High Plains District Manager and the Manager of Supervisors in the High Plains District. The meetings were initiated to provide the agency with an understanding of the benefits of implementing PBN procedures. The FAA also met with representatives of the NPS to discuss procedures that directly overfly RMNP.

Additionally, prior to issuance of the Draft EA, the FAA met with interested agencies on March 15, 2012, as a follow-up to the agency scoping meeting held in March 2011. The follow-up meeting described the

noise modeling input and illustrated typical graphics that are used within environmental documentation for air traffic actions.

5.3 Public Meetings for Review of the Draft EA

Following the publication of the Draft EA, a series of public meetings were held to provide the public with an opportunity to view the findings and provide comment. Three meetings were held over the course of three days (June 26th through June 28th, 2012). The first meeting was held on June 26th, from 5:30 – 8:00 p.m. in the Mt. Evans Conference Room at Rocky Mountain Metropolitan Airport, followed by June 27th, 2012 at the Denver Marriott South at Park Meadows, near APA. The final meeting was held at the Crowne Plaza Denver International Airport on June 28th, 2012, from 5:30 – 8:00 p.m.

The public meetings were held in an open house format, and attendees were provided the opportunity to ask the FAA and project team questions before and following the presentation. The PowerPoint presentation included a brief overview of the EA process, a summary of the scoping effort, the project background, the purpose and need, a description of the Proposed Action Alternatives, and findings of the environmental analysis. Fourteen (14) poster-size display boards were displayed to provide relevant project information and the results of the noise analysis (See *Appendix H*). Handouts were provided with information about the Draft EA and instructions on how to submit comments. Following the presentation, attendees were encouraged to circulate among the display boards where FAA, airport, and contractor staff were available to answer questions and discuss the Proposed Action Alternatives with the public. Approximately 30 people attended the Draft EA public meetings over the course of the three days.

5.4 Comments on the Draft EA

Following the series of public meetings, a total of 29 written comments were received. A majority of comments were provided via email (13) and postal mail (13), and three were submitted at the public meetings. Of the comments received, the majority were from the public. Other categories of commenters include local jurisdictions (cities, towns, and counties); elected officials, commissioners, city council members and airport roundtable representatives; neighborhood associations; airport staff; and agencies. **Table 5.3** summarizes the comments received and responses. The comments are provided in the order of receipt with agency comments provided first followed by public comments.

In response to additional coordination following the publication of the Draft EA, a series of figures were prepared for inclusion in the Final EA. **Figures 5-1 through 5-4** depict the Proposed Action Alternatives and noise exposure changes, overlaid with the proposed RNAV STARs and SIDs. **Figures 5-6 through 5-11** depict various areas of noise exposure change within the Study Area, designed to provide the reader with additional information regarding the location of the Proposed Action Alternatives and resulting noise exposure.

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
Government/Agency Responses			
4	Tribal Response Form (Eastern Sheshone Tribe)	Does not require additional consultation on the proposed project.	Comment noted.
6	Town of Castle Rock	Asks that the impacts of the proposed action to Castle Rock residents be minimized, and that consideration be given to Castle Rock's unique topographic conditions, which exacerbate noise issues. Requests these routes continue to be assessed into the future, and adjustments made accordingly to limit the impacts.	Comment noted. The Proposed Action – Preferred Alternative does not result in any significant impact as defined in Table 4.1 (Page 4-3), including areas in Castle Rock. However, areas of increase and decrease at levels disclosed by the FAA are included. See Figures 5-1 through 5-11 for additional information. The FAA has no immediate plans to measure noise impacts once the procedures have been implemented; however, any future noise studies undertaken by Centennial Airport should include all aircraft activity. The FAA has no immediate plans to change the procedures as designed. Any future changes to the procedures may require separate analysis under NEPA.
7	City of Westminster, Department of Community Development	Has no comment, as long as it is true that above the existing 45 DNL level, there are no increases in noise exposure near Rocky Mountain Metropolitan Airport.	Figures 5-1 through 5-4 depict changes in 2017 noise exposure and proposed RNAV flight tracks for each of the Proposed Action Alternatives. The figures indicate no increases above levels reported by the FAA (5 dB) in the immediate vicinity of BJC.
8	History Colorado, the Colorado Historical Society	Concurs that there will be no adverse effect.	Comment noted. The letter represents the State Historic Preservation Officer's written concurrence with both the definition of the Area of Potential Effects (APE) and the finding of no adverse effect, under Section 106.
9	City of Aurora	Supports the project, but has concerns that the public will not easily be able to locate the RNAV/RNP procedure flight paths and their relation to specific areas of the city. Also suggests using projected 2017 population data to evaluate environmental consequences for the year 2017.	The Final EA includes additional graphics that provide the RNAV/RNP tracks as well as conventional modeled tracks for ease of comparison. See Figures 5-1 through 5-4 and 5-9 through 5-11. The FAA used current census data for population centroid analysis and did not project population for future years of analysis.

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
10	City of Greenwood Village	Supports Alternative 3 as it will enhance safety, the environment, efficiency, capacity and access as a result of Performance Based Navigation.	Comment noted. Alternative 2 is the FAA's Proposed Action – Preferred Alternative. Alternative 2 provides the safest and most efficient RNAV system that can be integrated into the Denver Complex Airspace while considering environmental concerns expressed during the EA process.
11	United States Department of the Interior, National Park Service	Appreciates the FAA's consideration of the revised alignment of the northwest RNAV STAR flight path more in line with Trail Ridge Road. NPS indicates that the project includes all possible planning to minimize harm resulting from the use if, and only if, (a) Alternatives 1, 2, or 4 are selected inclusive of RNP and OPD, (b) aircraft are sequenced west of RMNP, (c) aircraft follow the STAR on a narrow flight path directly to TOMSN, and (d) to the maximum extent possible, aircraft are not vectored off the STAR prior to arrival at TOMSN.	The FAA has selected Alternative 2 as the preferred alternative for the project. Also, Figures 5-1 through 5-4 depict changes in 2017 noise exposure and proposed RNAV flight tracks for each alternative. For the percentages of aircraft that will use the RNAV STAR procedures that overfly RMNP, aircraft are modeled to converge west of the park boundary and fly a common route over the park. As modeled, aircraft that use the RNAV STAR would not be vectored off of the procedure over the park. However, as indicated in Appendix D, some aircraft will fly conventional procedures as shown under the existing conditions and No Action Alternative.

Table 5.3

Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
12A/B	City of Thornton	Interprets significant increases in noise within the City of Thornton from Draft EA. Suggests three (3) possible modifications to DIA departure paths, and requests that these be formally considered as part of the EA.	Changes in noise exposure are below 50 DNL and are not considered significant; however, the FAA disclosed this level of change for informational purposes. Table 4-1 (Page 4-3) provides the criteria for significance for changes in noise exposure. Figures 5-1 through 5-11 depict change in noise exposure, proposed RNAV STAR and SID flight tracks, and conventional flight tracks at scales that improve the presentation of the results. The modifications as suggested by the commenter are included in Appendix H, as part of comment letter 12A. The location that is projected to experienced increases in noise exposure corresponds to the location at which DEN arrival and DEN departure aircraft become clear from one another. From this "conflict clear" zone, westbound and northbound departing aircraft climb out of 10,000' MSL and either continue west or begin a turn to the north. The suggested revisions to departure flight tracks would result in increased noise (as DEN departures would be required to be held at an altitude of 7,000' MSL to avoid mixing with DEN arrivals), ATC separation conflicts with DEN arriving aircraft, and an overall derogation of safety (by moving arrivals and departures into close proximity). The location of the waypoints and flight paths are specific to each proposed alternative. Multiple revisions were vetted as part of the design process. The resulting procedures were developed to satisfy the needs of ATC and the airlines while incorporating consideration of potential environmental impacts. The FAA is recommending Alternative 2 as it provides for utilization of RNAV technology immediately upon departure to avoid conflicting with DEN arrivals and departures. The FAA does not intend to implement all four alternatives. The preferred alternative is Alternative 2. The FAA has no immediate plans to change the procedures as designed. Any future changes to the procedures may require separate analysis under NEPA.

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
13	Douglas County	Notes that Alternatives 2, 3 and 4 result in an increase in the population exposed to 45-50 DNL within the County. States that these alternatives also result in an increase in noise exposure greater than or equal to 5.0 DNL near Surrey Ridge neighborhood. Warns that individual noise events may impact some residents' enjoyment of their homes and properties beyond what a 45-50 DNL noise level may suggest. Requests further consideration of mitigation of noise in the Surrey Ridge area.	Changes in noise exposure are below 50 DNL and are not considered significant as defined in Table 4.1 (Page 4-3); however, the FAA disclosed this level of change for informational purposes. Figures 5-1 through 5-11 depict change in noise exposure, proposed RNAV STAR and SID flight tracks, and conventional flight tracks at scales that improve the presentation of the results. Mitigation is not required as a result of the level of changes in noise exposure anticipated under the Proposed Action Alternatives.
14	Centennial Airport	States that increased altitudes for arrivals and departures would be essential to providing a positive impact on communities surrounding the airport. Suggests routing departure tracks from Centennial over open space bluffs approximately a half mile to the north of the existing flight track path. Believes that implementation of the RNAV/RNP procedures should occur sooner. Questions the validity of the forecast used to predict traffic and RNAV use levels in 2017. Expresses concern that the consultant did not sufficiently keep individuals informed who had provided email addresses.	Noise exposure changes over the bluffs near Centennial are not a significant noise impact, as defined in Table 4-1 (Page 4-3). The location of the waypoints and flight paths are specific to each proposed alternative. Multiple revisions were vetted as part of the design process. The resulting procedures were developed to satisfy the needs of ATC and the airlines while incorporating consideration of potential environmental impacts. To the south of APA, aircraft that would use the RNAV SID procedures would take advantage of an unrestricted climb to 10,000' MSL, versus conventional departures that climb to 8,000' AGL and must be integrated with DEN operations. The FAA intends to implement the procedures as quickly and safely as possible. The forecast methodology is presented in Appendix C, and the assumptions used in the development of the forecast were approved by the FAA. Centennial Airport noise staff were invited to all meetings throughout the EA process. The commentor was contacted throughout the EA along with the other members of the public that had requested to be informed of the Draft EA availability.

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
14A	Centennial Airport	Following a meeting with the FAA on July 20, 2012, the Arapahoe County Public Airport Authority provided an additional comment letter to the FAA on July 25, 2012 amending their comment letter of July 10, 2012. This comment letter included conditional support of the proposed action but stipulated a request to review the LOOOP SID in Alternative 2 as well as modifications to the accompanying waypoints.	Noise exposure changes over the bluffs near Centennial were evaluated based on FAA guidance to determine the degree of change in noise exposure. The noise analysis did not result in significant noise impacts as per FAA Order 1050.1E and shown in Table 4-1 (Page 4-3). The location of the waypoints and flight paths are specific to each proposed alternative. Multiple revisions were vetted as part of the design process. The resulting procedures were developed to satisfy the needs of ATC and the airlines while incorporating consideration of potential environmental impacts. The FAA is recommending Alternative 2 as it provides for utilization of RNAV technology immediately upon departure to avoid conflicting with DEN arrivals and departures. The FAA does not intend to implement all four alternatives. The preferred alternative is Alternative 2. The FAA made no commitment during meetings with Centennial Airport representatives to move waypoints under the preferred action. Any future changes to the procedures may require separate analysis under NEPA.
15	Denver International Airport	Suggests adjusting scale of maps to match. Urges including E-470 freeway on all maps. Inquires about including RNAV/RNP utilization and benefit beyond 2017. Suggests creating additional exhibit in Chapter 2, Alternatives, that shows a simpler schematic view of the airspace for ease of understanding by non-technical readers. States that the Proposed Action alternatives increase the population exposed to greater than 45 DNL by 5,000 people, and suggests showing where this occurs.	The scale of the figures is generally consistent, although the extent of the Study Area shown in each figure may vary due to the size of the legend and the intent of the figure. Maps that depict noise exposure change show increases in the number of persons exposed to higher noise levels. The scope of this EA is to evaluate and disclose the environmental impacts, if any, of the Proposed Action Alternatives based on the year of implementation and a period five-years following implementation. In order to assist the reader in understanding how the Denver Terminal Complex airspace is structured, Figure 2-1, which depicts the Denver Terminal Airspace Arrival and Departure gates, has been added. E-470 will be included on all relevant maps. Figures 5-1 through 5-11 depict change in noise exposure, proposed RNAV STAR and SID flight tracks, and conventional flight tracks at scales that improve the presentation of the results.

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
19	State of Colorado, Department of Transportation	The Colorado Division of Aeronautics supports the findings in the Draft EA and supports implementation of the proposed PBN flight routes and procedures in the vicinity of the Denver International Airport. However, if any specific comments are received from any of the three airports or surrounding communities we would expect further review to occur.	Comment noted. Comments received from APA and DEN, and a number of municipalities and members of the public as part of the NEPA process are reproduced and responded to in this Final EA.
25	Surrey Ridge Homeowner's Association	Expresses concern that Surrey Ridge and Surrey Ridge Estates are the only communities in Douglas County to have noise increases by a measurable factor. Indicates that these communities are populated and are not open space. Conveys that residents of the area have been tolerant of increases in airport noise in the past, but do not appreciate further increases in noise. Suggests moving procedures to on top of or east of Interstate 25. Emphasizes the need for unrestricted climbs and optimized profile descents as part of the implementation of the RNAV/RNP procedures.	The EA does not reference changes associated with the proposed RNAV SID departure procedures from APA as being located in open space. Noise exposure changes that may occur near Centennial Airport are not considered a significant impact and, according to FAA guidance, are presented for informational purposes only (see Table 4-1, Page 4-3). See Figures 5-1 through 5-4 and 5-9 through 5-11 for additional details pertaining to the location of conventional and proposed RNAV flight tracks. The location of the waypoints and flight paths are specific to each proposed alternative. Multiple revisions were vetted as part of the design process. The resulting procedures were developed to satisfy the needs of ATC and the airlines while incorporating consideration of potential environmental impacts. The APA RWY17L/R RNAV SID begins east of I-25 as the runway is located east of I-25. The location of the turn to the west is based on ATC separation requirements, RNAV design criteria requirements, and noise mitigation over the communities south of APA. The current SID design follows I-25 until it reaches the west turn point, which if located further south, would conflict with ATC separation requirements. Specifically, the route would conflict with APA arrivals and DEN arrivals and departures. The only ATC remedy would be to hold the departure aircraft down to an altitude of 8,000' MSL, creating additional noise exposure. If it was located further north, it would interfere with the aircraft traffic pattern at APA and violate RNAV design criteria. The FAA has no immediate plans to change the procedures as designed. Any future changes to the procedures may require

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
			separate analysis under NEPA. To the south of APA, aircraft that would use the RNAV SID procedures would take advantage of an unrestricted climb to 10,000' MSL, versus conventional departures that climb to 8,000' AGL and must be integrated with DEN operations.
28	City and County of Broomfield	Expresses concern that all of the flight tracks immediately turn over the core of Broomfield. Inquires as to whether these can be dispersed or redirected to the south east or to less populated areas to the south west.	Figures 2-6 and 2-7 depict conventional arrivals and departures for BJC, while Figures 2-11, 2-13, 2-15, 2-17, and 2-19 depict proposed RNAV STAR and SID flight tracks. The Proposed Action Alternative flight tracks generally follow existing flight tracks. For the proposed RNAV SIDs (Alternatives 2, 3, and 4), in order for aircraft to climb faster, aircraft are routed from either runway to the northeast prior to turning to their destination fix in order to avoid air traffic conflicts.

Table 5.3

Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
29	Adams County	Expresses concern that Adams County was not made aware of the comment deadline and requests extension of public comment period. Expresses additional concern regarding noise over residential areas and the continued and expanded operations at Front Range Airport. Specifically requests what measures were used to mitigate noise per the court-approved noise mitigation plan and whether there were other routes that could be considered that would have less impact on Adams County. Requested clarification on population centroids used in FAA noise modeling.	The FAA provided appropriate notice regarding availability of the Draft EA and the public comment period in the Denver Post on June 8, 2012, the study airport websites on June 11, 2012, and CDs were sent to Agencies on June 8, 2012. A subsequent public notice was published in the Denver Post on June 12, 2012. The FAA is not extending the public comment period as requested. Pre-proposal consultations were held with DIA and affected Counties. Additionally, scoping meetings were held to identify potential alternatives that might accomplish the purpose and need of the proposed action. (refer to Chapter 5 Public & Agency Involvement Summary). Noise concerns were an element of consideration through the design process. Multiple revisions were vetted as part of the design process. The resulting procedures were developed to satisfy the needs of ATC and the airlines while incorporating consideration of potential environmental impacts (refer to Chapter 2). The FAA was not a party to the District court mitigation plan. Air traffic approach & departure procedure design is not constrained by Space Port launch operations since all air traffic operations would be restricted during any future Space Port activities should they be developed at Front Range Airport. Refer to Section 3.3.1.1 Noise Modeling Methodology for an explanation of the concept of population centroids and size. NOTE: Although received outside of the comment period, this letter was included because the Final EA was still in production.

Table 5.3

Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
Public Responses			
1	Public Meeting Comment Form	Supports the project.	Comment noted.
2	Public Meeting Comment Form	Supports the proposed changes for Alternative 3 for both departures and arrivals, saying that it will be the most efficient and impact the fewest number of people of the proposed alternatives.	Comment noted. Alternative 2 is the FAA's Proposed Action – Preferred Alternative. Alternative 2 provides the safest and most efficient RNAV system that can be integrated into the Denver Complex Airspace while considering environmental concerns expressed during the EA process.
3	Public Meeting Comment Form	Requests showing noise reductions around Centennial Airport as a result of the proposed action, if they exist.	See Figures 5-1 through 5-4 and 5-9 through 5-11 for additional details pertaining to the location of conventional and proposed RNAV flight tracks and noise exposure changes. Both increases and decreases exist at lower levels of change (less than 5 dB) however these do not meet FAA criteria for disclosure for informational purposes and are not shown.
5	Public Letter	Expresses appreciation for Denver Airport.	Comment noted.
16, 17, 18, 20, 21, 22, 23, 26, 27	Public Letters, Castle Rock Residents	Expresses concern that not sufficient time or detail has been given to fully absorb the information. Communicates that the proposed departure procedure over the Castle Rock neighborhood is populated and not open space. Asserts that long time residents have been living in Castle Rock for as long as Centennial Airport has been in operation and have tolerated the noise increases at the airport without complaint. Inquires whether or not the area on top of or east Interstate 25 were considered for the RNAV/RNP procedures and requests that the procedures be redesigned accordingly. Requests clarity on the altitude profiles of aircraft using RNAV/RNP, as compared to current operations. Requests further consideration of mitigation of noise in the Surrey Ridge area. Requests the date of next meeting. Expresses concern that additional noise may affect home values in the area. Emphasizes the need for unrestricted climbs	The FAA provided appropriate notice regarding availability of the Draft EA and the public comment period in the Denver Post on June 8, 2012, the study airport websites on June 11, 2012 and a subsequent public notice was published in the Denver Post on June 12, 2012. The comment period was open until July 10th, 2012 allowing 33 days to receive comments. The EA does not reference changes associated with the proposed RNAV SID departure procedures from APA as being open space. Noise exposure changes that may occur near Centennial Airport are not considered a significant impact, as defined in Table 4-1 (Page 4-3), and according to FAA guidance, are presented for informational purposes only. See Figures 5-1 through 5-4 and 5-9 through 5-11 for additional details pertaining to the location of conventional and proposed RNAV flight tracks. The location of the RNAV SID to the west of APA minimizes the interaction between DEN and APA operations, and allows aircraft to climb quicker than under current conditions. To the south of APA, aircraft that would use the RNAV SID procedures would take advantage of an unrestricted climb to 10,000'

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
		and optimized profile descents as part of the implementation of the RNAV/RNP procedures. There will be a significant increase in low-altitude air traffic. Would like to know if this is indeed correct.	MSL, versus conventional departures that climb to 8,000' AGL and must be integrated with DEN operations. Mitigation is not required as a result of the level of changes in noise exposure anticipated under the Proposed Action – Preferred Alternative. No additional meetings are scheduled as part of the EA process. The property value impacts of aviation noise have been studied on multiple occasions with publication of study results beginning in the mid-1970s, to-date there is still no definitive answer. For individuals who might work at (or near) the airport or who use the airport for travel, the benefits of proximity can be reflected in residential property values. Because it is possible for an airport to have both negative and positive effects on property values, the net effect can be negative or positive. Separation of aviation noise from other noise emitters has always been at issue for determining a specific property value impact due to aviation noise. Some studies have found that impact due to aviation noise is negligible while others have found the impact to be upwards of 10 percent. A 2003 study by J. Nelson, Department of Economics, Pennsylvania State University entitled Meta-Analysis of Airport Noise and Hedonic Property Values: Problems and Prospects found that the “cumulative noise discount in the U. S. is about 0.5% to 0.6% per decibel at noise exposure levels of 75 dB or less”. For this study 20 hedonic property value studies are analyzed, covering 33 estimates of the noise discount for 23 airports in Canada and the United States. Nelson, Jon P: Aircraft Noise and the Market for Residential Housing: 50/78/24, Sept. 1978 (Available from NTIS as PB 297 681). Specifically, at DNL above 65 dB, the effect is about 1% per additional dB; at DNL between 60 and 65 dB, the effect is about 0.5% per additional dB; below 55 dB DNL, no effect has been measured. Nelson, Jon P., “Hedonic Property Value Studies of Transportation Noise: Aircraft and Road Traffic”, Proceedings of the International Symposium on Hedonic Methods in Real Estate, Geneva, Switzerland, June 2007. Aircraft using the RNAV STAR and SID

Table 5.3
Agency and Public Meeting Comments and Responses

Comment No.	Respondent	Comment	Response
			procedures are not anticipated to fly at lower altitudes versus the No Action Alternative.
24	Public Letter	States that airplane and helicopter traffic have already increased dramatically over the 120th and Holly routes. Indicates that aircraft fly very low and there is more night traffic after 11:30 p.m.	Any increases in air traffic activity are not associated with the Proposed Action. Table 3.7 (Page 3-15) provides annual average day forecast operations for each airport. Appendix C provides additional detail regarding the forecast methodology, and Appendix D provides information pertaining to forecast operations, including the fleet mix, runway use, flight track use, and other noise modeling parameters.

Source: HNTB, 2012.

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CHAPTER 6:
LIST OF PREPARERS

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Chapter 6: LIST OF PREPARERS

6.1 List of Preparers

This chapter identifies the individuals assisting in the preparation and independent review of this Environmental Assessment (EA) along with each preparer's responsibilities.

Table 6.1 includes FAA staff who are responsible for the preparation of the EA and/or who were involved in its review. Supporting the FAA in this effort are individuals from HNTB.

Table 6.1

List of Preparers

Name	Project Role	Education/ Registration	Experience (Years)	EA Project Responsibility
Federal Aviation Administration				
Augustin Moses, P.E.	Environmental Coordination	M.S. Environmental Engineering/ PE	39	COTR
Ted Goodlin	NextGen Implementation Specialist	FAA ATCT TRACON, TMU Staff	36	Procedures Design Coordinator
Chris Laschinger	NextGen Implementation Specialist	FAA ATCT TRACON, Staff	25	Procedures Design Coordinator
HNTB Corporation				
Kim Hughes, P.E.	Project Manager	B.S. Civil Engineering/ P.E.	26	Overall Document Development
Pat Kennon	Sr. Aviation Economist	B.S. Urban Planning M.S. Economics	30	Forecast and Fleet Mix Development
Kent Miller	GIS Analyst		15	GIS Analysis
Yue Xu	Aviation Economist	M.S./ Ph.D Civil Engineering	4	Noise/Track Analysis
Caroline Pinegar, A.I.C.P.	Environmental Planner	B.A. Historic Preservation, M.C.R.P. Masters in City and Regional Planning / A.I.C.P.	9	Purpose and Need, Affected Environment, Environmental Consequences Documentation

Table 6.1

List of Preparers

Name	Project Role	Education/ Registration	Experience (Years)	EA Project Responsibility
Royce Bassarab	Environmental Planner	B.A. Urban and Regional Planning	12	Noise Analysis and Documentation, Alternatives Documentation
Alan McDonald, E.I.T.	Jr. Environmental Planner	B.S./M.S. Civil Engineering/E.I.T.	2	Noise Analysis
Jillian Daniels	Jr. Environmental Planner	B.S. Aviation Management	3	Noise Analysis
Ryan Carey, E.I.T.	Jr. Environmental Planner	B.S. Civil Engineering/ E.I.T.	1	Document Development

CHAPTER 7:
LIST OF ACRONYMS, ABBREVIATIONS, AND GLOSSARY OF TERMS

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Chapter Seven: LIST OF ACRONYMS, ABBREVIATIONS, AND GLOSSARY OF TERMS

7.1 List of Acronyms and Abbreviations

AAD	Average Annual Day
ACCRI	Aviation Climate Change Research Initiative
AFE	Above Field Elevation
AGL	Above Ground Level
ANOMS	Airport Noise and Operations Monitoring System
APA	Centennial Airport
APA ATCT	Centennial Airport Traffic Control Tower (Centennial Tower)
ARP	Arapaho and Roosevelt National Forests and Pawnee National Grassland
ARTCC	Air Route Traffic Control Center
ATADS	Air Traffic Activity System (FAA)
ATC	Air Traffic Control
ATCSCC	Air Traffic Control Systems Command Center
ATCT	Airport Traffic Control Tower
ATNS	Air Traffic Noise Screening
BCC 2002	*Birds of Conservation Concern 2002*
BCR	Bird Conservation Region
BGEPA	Bald and Golden Eagle Protection Act
BJC	Rocky Mountain Metropolitan Airport
BJC ATCT	Rocky Mountain Metropolitan Airport ATCT (Metro Tower)
BKF	Buckley Air Force Base Airport

BLM	Bureau of Land Management
CAA	Clean Air Act
CAASD	Center for Advanced Aviation System Development
CCD	City and County of Denver
Center	Air Route Traffic Control Center
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CO	Carbon Monoxide
COS	Colorado Springs Airport
cps	Cycles per Second
CTAS	Center/TRACON Automation System
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
D01 TRACON	Denver Terminal Radar Approach Control
dB	Decibel
dBA	A-Weighted Decibel
dBC	C-Weighted Decibel
DEN	Denver International Airport
DEN ATCT	DEN Airport Traffic Control Tower (Denver Tower)
DME	Distance Measuring Equipment
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DOE	Department of Energy (United States)
DOT	Department of Transportation (United States)

DP	Departure Procedure
EA	Environmental Assessment
EAC	Early Action Compact (Areas)
EDMS	Emissions Dispersion Modeling System
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency (United States)
ESA	Endangered Species Act of 1973
ETMS	Enhanced Traffic Management System
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FICAN	Federal Interagency Committee on Aviation Noise
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
FR	Federal Register
FMS	Flight Management System
FNL	Fort Collins-Loveland Airport
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FR	Federal Register
FSG	Flight Segment Generator
FTG	Front Range Airport
FWS	Fish and Wildlife Service
GA	General Aviation
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System

GXY	Greeley-Weld County Airport
HITL	Human in the Loop
HUD	Housing and Urban Development
Hz	Hertz
IAP	Instrument Approach Procedure
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IGA	Intergovernmental Agreement
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INM	Integrated Noise Model
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Sound Level
LWCF	Land and Water Conservation Fund
MBTA	Migratory Bird Treaty Act
MOA	Military Operations Areas / Memorandum of Agreement
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NAR	National Airspace Redesign
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NATCA	National Air Traffic Controllers Association
NAVAID	Navigation Aid
NCAR	National Center for Atmospheric Research
NextGen	Next Generation Air Transportation System

NDB	Non-Directional Beacon
NEPA	National Environmental Policy Act
NIRS	Noise Integrated Routing System
NM	Nautical Miles
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOAA	National Oceanographic and Atmospheric Administration
NO_x	Nitrogen Oxides
NPIAS	National Plan of Integrated Airport Systems
NPS	National Park Service
NRHP	National Register of Historic Places
NSF	National Science Foundation
NWPS	National Wilderness Preservation System
O_3	Ozone
OPD	Optimized Profile Descent
PA	Physiographic Area
PARTNER	Partnership for AiR Transportation Noise and Emissions Reduction
Pb	Lead
PBN	Performance-Based Navigation
PDARS	Performance Data Analysis and Reporting System
$PM_{2.5}$	Particulate Matter less than 2.5 micrometers in diameter
PM_{10}	Particulate Matter less than 10 micrometers in diameter
PSICC	Pike and San Isabel National Forests Cimarron and Comanche National Grasslands
RCRA	Resource Conservation and Recovery Act
RMNP	Rocky Mountain National Park

RNAV	Area Navigation
RNP	Required Navigation Performance
RVFP	RNAV Visual Flight Procedure
SEL	Sound Exposure Level
SID	Standard Instrument Departures
SIP	State Implementation Plan
SM	Statute Miles
SO_2	Sulfur Dioxide
SPL	Sound Pressure Level
STAR	Standard Terminal Arrival Route
TA	Time-Above a Specified Level
TACAN	Tactical Air Navigation Equipment
TAF	Terminal Area Forecast
TARGETS	Terminal Area Route Generation, Evaluation and Traffic Simulation
TMS	Traffic Management Systems
TOD	Top of Descent
Tower	Airport Traffic Control Tower
TRACON	Terminal Radar Approach Control
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions

VOC	Volatile Organic Compound
VOR	VHF Omni-directional Range
VORTAC	VHF Omni-directional Range with Tactical Air Navigation
WAAS	Wide Area Augmentation System
ZDV ARTCC	Longmont Air Route Traffic Control Center

7.2 Glossary of Terms

A-Weighted Sound Level –The A-weighting scale discriminates against the lower frequencies below 1000 hertz according to a relationship approximating the auditory sensitivity of the human ear. The A-weighted sound level is approximately related to the relative "noisiness" or "annoyance" of many common sounds.

Acoustics – The science of sound, including the generation, transmission, and effects of sound waves, both audible and inaudible.

Air Carrier – An entity holding a Certificate of Public Convenience and Necessity issued by the Department of Transportation to conduct scheduled air services over specified routes and a limited amount of non-scheduled operations.

Air Pollutant – Any substance in air that could, in high enough concentration, harm humans, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of airborne matter capable of being airborne. They may be in gases, particulates, or in combinations thereof. Generally, they fall into two main groups: (1) those emitted directly from identifiable sources and (2) those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents, with or without photoactivation.

Air Route Traffic Control Center (ARTCC, Center) – An FAA facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the en-route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

Air Taxi – An air carrier certificated in accordance with Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

Air Traffic Clearance – An authorization by air traffic control for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace.

Air Traffic Control (ATC) – A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

Airport Traffic Control Tower (ATCT, Tower) – A facility that uses air/ground communications, visual signaling, and other

devices to provide ATC services to aircraft operating in the vicinity of an airport. Authorizes aircraft to land or take-off at the airport controlled by the tower regardless of flight plan or weather conditions.

Airspace – Navigable area used by aircraft for purposes of flight.

Airspace complexity – A function of the degree to which aircraft routes are intermingled, with more route crossings resulting in more complex airspace. Complexity is also related to the number of aircraft, types of aircraft, and duration of a flight in a particular volume of airspace.

Airway – A control area or portion of established in the form of a corridor, the center line of which is defined by radio navigational aids. The network of airways serving aircraft operations up to but not including 18,000 feet MSL are referred to as "Victor" airways. The network of airways serving aircraft operations at or above 18,000 feet MSL are referred to as "Jet" airways.

Altitude – Height above a reference point, usually expressed in feet. Reference points are typically sea level, the ground, or airfield elevation in which case MSL, AGL or AFE further describes the altitude, respectively.

Ambient Noise Level – The level of noise that is all-encompassing within a given environment for which a single source cannot be determined. It is usually a composite of sounds from many and varied sources near to and far from the receiver.

Area Navigation (RNAV) – A method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability.

Attainment Area – An area in which the Federal or state standards for ambient air quality are being achieved.

Block – Census blocks are small areas bounded on all sides by visible features such as streets, roads, streams, and railroad tracks, and by invisible boundaries such as city, town, township, and county limits; property lines; and short, imaginary extensions of streets and roads. Blocks are numbered uniquely within each census tract or block numbering area (BNA). A three-digit number identifies a block, sometimes with a single alphabetical suffix. The U.S. Bureau of Census designates census blocks.

Centroid – A point representing the geographic center of a U.S. Bureau of Census, census block.

Clearance – See Air Traffic Clearance.

Climb – The act or instance of increasing altitude.

Conformity – A determination that a project conforms with a State Implementation Plan (SIP) whose purpose is to eliminate or reduce the severity and number of violations of the National Ambient Air Quality Standards; and does not impede the scheduled attainment of such standards.

Controlled Airspace – Airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

Corner Post – An airspace structure wherein arriving aircraft are routed to one of

four arrival fixes located at the corners of the TRACON airspace, at approximately 90-degrees from one another. A straight track from the arrival fix to the major airport is used to route arriving aircraft; therefore, there are four primary arrival routes in a corner post system. Departing aircraft are routed via several departure routes that use the airspace between the arrival routes. This effectively segregates arriving and departing aircraft into different sections of airspace.

Criteria Pollutants – The 1970 amendments to the Clean Air Act required EPA to set National Ambient Air Quality Standards for certain pollutants known to be hazardous to human health. EPA has identified and set standards to protect human health and welfare for six pollutants: ozone, carbon monoxide, total suspended particulates, sulfur dioxide, lead, and nitrogen oxide. The term, "criteria pollutants" derives from the requirement that EPA must describe the characteristics and potential health and welfare effects of these pollutants. It is on the basis of these criteria that standards are set or revised.

***de minimis* Levels** – *de minimis* levels vary according to the type of pollutant and severity of the non-attainment area. These levels are consistent for all conformity determinations (unless the State chooses to set lower *de minimis* levels and apply the conformity requirements to non-federal as well as Federal entities). The calculation of total project emissions is made and the difference before the Proposed Action emissions and the No Action emissions are compared to these *de minimis* cutoffs. If the emissions for a pollutant are above *de minimis*, the project requires a conformity determination. All emissions from the project must be analyzed and found to conform, not only those above the *de minimis* levels.

Departure – The act of an aircraft taking off from an airport.

Departure Procedure (DP) – A preplanned IFR ATC departure procedure printed for pilot use in graphic and/or textual form. DP's provide transition from the terminal to the appropriate en route structure.

Descent – The process of decreasing altitude.

Distance Measuring Equipment (DME) – Equipment (airborne and ground) used to measure, in nautical miles, the slant-range distance of an aircraft from the DME navigational aid.

Day-Night Average Sound Level (DNL) – A measure of the annual average noise environment over a 24-hour day. It is the 24-hour, logarithmic- (or energy-) average, A-weighted sound pressure level with a 10-decibel penalty applied to the nighttime event levels that occur between 10 p.m. and 7 a.m.

Decibel (dB) – Commonly used to define the level produced by a sound source. The term used to identify 10 times the common logarithm of two like quantities proportional to power, such as sound power or sound pressure squared.

Delay – The primary measure of the operational efficiency of the airspace system. Delays in the airspace system are the result of congestion and severe weather.

Emissions – Pollution discharged into the atmosphere from stationary sources such

as smokestacks, surface areas of commercial or industrial facilities, residential chimneys, and from mobile sources such as motor vehicles, locomotives, or aircraft exhausts.

Energy-Averaged Sound Pressure Level – The logarithmic sum of the sound power of a series of sound pressure levels divided by the number of levels included in the sum.

En Route Airspace – A general term to describe the airspace controlled by an ARTCC.

Equivalent Sound Level (L_{eq}, LAEQ, LAEQD or LAEQN) – The level of a constant sound which, in the given situation and time period, has the same average sound energy as does a time-varying sound. Specifically, equivalent sound level is the energy-averaged sound pressure level of the individual A-weighted sound pressure levels occurring during the time interval. The time interval over which the measurement is taken (or for which the metric is computed) should always be specified. For example, if the time interval is the daytime period (7 a.m. to 10 p.m.) then the acronym LAEQD is used. Similarly, if the time interval is the nighttime period (10 p.m. to 7 a.m.) then the acronym LAEQN is used.

Family – According to the U.S. Census Bureau, a family consists of two or more people, one of whom is the householder, related by birth, marriage, or adoption and residing in the same housing unit.

Federal Aviation Administration (FAA) – The element of the United States government with primary responsibility for the safety of civil aviation. Among its major functions are the regulation of civil aviation to promote safety and fulfill the requirements of national defense and development and operation of a common system of air traffic control and navigation for both civil and military aircraft.

Federal Airway – See Airway.

Fix – A geographical position determined by reference to the surface, by reference to one or more NAVAIDs or area navigation (RNAV) (including GPS).

Flexibility – Generally defined as the ability of the system to respond to changes in user preferences.

Flight Track – The route used by an aircraft in flight.

Flight Track Utilization – The amount and type of aircraft that use a specific flight track, on either departure or arrival.

Frequency (acoustic) – The number of oscillations per second completed by a vibrating object.

Gates – A fix used by ATC to transfer control of aircraft from one facility's area of jurisdiction to another facility's area of jurisdiction. (i.e., ARTCC to TRACON). The gates and posts found in this document pertain specifically to this project in the Denver Complex Airspace. (e.g., The air traffic arriving to DEN is directed to the airport/runways via the four "Corner Posts" (Northwest, Northeast, Southeast, and the Southwest gate transitions).

General Aviation (GA) – All civil aviation except scheduled passenger and cargo airlines.

Global Positioning System (GPS) – A satellite-based radio positioning and

navigation system operated by the Department of Defense. The system provides highly accurate position and velocity information, and precise time, on a continuous global basis to an unlimited number of properly equipped users.

Handoff – An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

Heading – A compass bearing indicating the direction of travel.

Hertz (Hz) – The unit used to designate frequency; specifically, the number of cycles per second.

Household – A household includes all the persons who occupy a housing unit. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.

Hub – Airport that serves as a focus of an air carrier's route structure. Flights from many cities converge at the focal airport permitting passengers to connect to other points in the route structure.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Instrument Approach Procedure (IAP) – A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.

Instrument Flight Rules (IFR) – Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.

Instrument Meteorological Conditions (IMC) – Weather conditions expressed in terms of visibility, distance from clouds, and cloud ceilings during which all aircraft are required to operate using Instrument Flight Rules (IFR).

Integrated Noise Model (INM) – A computer program developed, updated and maintained by the Federal Aviation Administration to evaluate aircraft noise impacts.

In-Trail Separation – The distance between two aircraft on an identical route; one aircraft is following another.

Invasive Species – Invasive species are organisms (usually transported by humans) which successfully establish themselves in, and then overcome, otherwise intact, pre-existing native ecosystems.

Knots – Speed measured in nautical miles per hour.

Loudness – The attribute of an auditory sensation, in terms of which sounds may be ordered on a scale extending from soft to loud. Loudness depends primarily upon the sound pressure of the source, but it also depends upon the frequency and waveform of the source.

Mean Sea Level (MSL) – The height of the surface of the sea for all stages of the tide, used as a reference for elevations. Also called sea level datum.

National Airspace System (NAS) – The NAS is the common network of air

navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material.

National Ambient Air Quality Standards (NAAQS) – Standards for criteria pollutants established by United States Environmental Protection Agency that apply to outdoor air.

Natural Areas – Undeveloped areas of land such as parks, wildlife refuges/management areas, and nature preserves.

Nautical Mile (NM) – A measure of distance equal to 1 minute of arc on the earth's surface (approximately 6,076 feet).

Navigation Aids (NAVAIDs) – Any visual or electronic device airborne or on the surface which provides point to point guidance information or position data to aircraft in-flight.

Noise – Any sound that is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying.

Noise Abatement Procedure – Measures taken to reduce the off-airport impacts of aircraft noise. Procedures developed by airport operators in cooperation with the FAA, and local community officials, to mitigate aircraft noise near airports.

Noise Exposure – The cumulative acoustic stimulation reaching the ear of a person over a specified period of time (e.g., a work shift, a day, a working life, or a lifetime).

Noise Integrated Routing System (NIRS) – A computer program developed, updated, and maintained by the Federal Aviation Administration to evaluate aircraft noise impact for air traffic actions involving multiple airports over broad geographic areas.

Non-Attainment Area – Areas with levels that exceed one or more of the National Ambient Air Quality Standards for the criteria pollutants designated in the Clean Air Act.

Non-Directional Beacon (NDB) – A radio beacon transmitting non-directional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Land System (ILS) marker, it is normally called a Compass Locator.

Operation – Landing or take-off of an aircraft.

Operational efficiency – Refers to how well a particular design works. Operational efficiency criteria include: reduce delay, balance controller workload, meet system demands, improve user access to the system, expedite arrivals and departures, increase flexibility in routing, and maintain airport throughput.

Overflights – Aircraft whose flights originate or terminate outside the controlling facility's area that transit the airspace without landing.

Positive Control – The separation of all air traffic within designated airspace by air traffic control.

Post – Air traffic arrives into and departs out of the airports/runways via "posts," where the gate transitions occur. The gates and

posts found in this document pertain specifically to this project in the Denver Complex Airspace. (e.g., The air traffic arriving to DEN is directed to the airport/runways via the four "Corner Posts" (Northwest, Northeast, Southeast, and the Southwest gate transitions).

Radar (primary) – A device which, by measuring the time interval between transmission and reception of radio pulses, and correlating the angular orientation of the radiated antenna beam, or beams in azimuth and/or elevation, provides information on range, azimuth, and /or elevation of objects in the path of the transmitted pulses. Also known as Primary Radar.

Radar (secondary) – A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the interrogator site for processing and display at an ATC facility. Also known as a radar beacon.

Radial – A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

Receiver – The listener or measuring microphone that detects the sound transmitted by the source.

Required Navigation Performance (RNP) – RNP is RNAV with the addition of on-flight monitoring of the airplane's performance. The pilot receives an alert if the aircraft is not performing in accordance with the requirements for a specific procedure.

Satellite Navigation – See Global Positioning System.

Sector – A defined volume of airspace, including both lateral and vertical limits, in which a single air traffic controller is responsible for the safe movement of air traffic. A TRACON's or ARTCC's airspace is comprised of multiple sectors.

Scoping – The early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. Scoping is also used to eliminate from detailed study the issues that are not significant or have been covered by prior environmental review.

Separation – Spacing between aircraft. This spacing may be vertical, lateral, longitudinal and visual.

Sequencing – Procedure in which air traffic is merged into an orderly flow.

Sound Exposure Level (SEL) – A time-integrated metric (i.e., continuously summed over a time period) which quantifies the total energy in the A-weighted sound level measured during a transient noise event. The time period for this measurement is generally taken to be that between the moments when the A-weighted sound level is 10 dB below the maximum.

Sound Pressure Level – A measure, in decibels, of the magnitude of the sound. Specifically, the sound pressure level of a sound that, in decibels, is 10 times the logarithm to the base 10 of the ratio of the squared pressure of this sound to the squared reference pressure. The reference

pressure is usually taken to be 20 micropascals. (See also Energy-Averaged Sound Pressure Level.)

Source (acoustic) – The object that generates the sound.

Statute Mile (SM) – A measure of distance equal to 5,280 feet.

Sulfur Dioxide (SO_2) – Sulfur dioxide typically results from combustion processes, refining of petroleum, and other industrial processes.

Terminal Area – A general term used to describe airspace in which approach control services for airport traffic control service is provided.

Terminal Radar Approach Control (TRACON) – An FAA ATC facility which uses radar and two way radio communication to provide separation of air traffic within a specified geographic area in the vicinity of one or more large airports.

Topography – The configuration of a surface including its relief and the position of its natural and man-made features.

Tower – See Airport Traffic Control Tower.

Turboprop Aircraft – An aircraft whose main propulsive force is provided by a propeller driven by a gas turbine. Additional propulsive force may be provided by gas discharged from the turbine exhaust.

Vector – Heading instructions issued by ATC to provide navigational guidance by radar.

Visual Meteorological Conditions (VMC) – Weather conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.

Visual Flight Rules (VFR) – Rules that govern the procedures for conducting flight under visual conditions. The term 'VFR' is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

Voice communications – Includes both controller to controller, and controller to pilot communications. Controller–to-controller communications are required to transfer responsibility for a particular aircraft. Controller-to-pilot communications are required to provide instructions to pilots.Volatile Organic Compound (VOC) – Any organic compound that participates in atmospheric photochemical reactions except those designated by EPA as having negligible photochemical reactivity.

VOR (Very High Frequency Omni-directional Radio Range Station) – A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360° in azimuth, oriented from magnetic North. DME may be installed. Used as a basis for navigation in the National Airspace System.

VORTAC (Very High Frequency Omni-directional Range with Tactical Air Navigation) – A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site. The most common form of radio navigation currently in use.

Wake Turbulence – Phenomena resulting from the passage of an aircraft through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air.

Weighting – An additive (or subtractive) factor by which the sound pressure level at certain frequencies in an acoustic measurement is increased (or reduced) in order for that measurement to be more representative of certain simulated conditions.