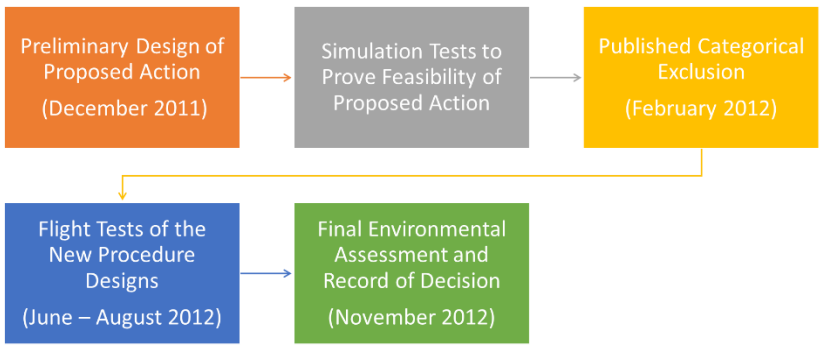
US/FAA NextGen: Greener Skies over Seattle – Case study

ICAO Good practice examples of environmental assessment (Draft V1.0)	
Organization/Company: **US/FAA NextGen**	
Project Title: **Greener Skies over Seattle: Proposed Arrival Procedures to Seattle-Tacoma International Airport**	Date of Assessment: **November 1 , 2012**
ASBU Module Code(s)[1]: **All**	States' Action Plan[2]: **N/A**

Project Description: Seattle-Tacoma International Airport (KSEA) serves the cities of Seattle and Tacoma, Washington, as well as the western portion of the entire state. SEA is the primary hub for Alaska Airlines and its regional subsidiary Horizon Air. SEA has service to destinations throughout North America, Europe and East Asia. In 2013, SEA served over 34.8 million passengers, making it the 16th busiest airport in the United States. It ranked 23rd in total annual aircraft operations and 18th in total cargo volume. The top airlines operating at SEA, in terms of the percentage of passengers carried in 2013, were Alaska Airlines (52%), Delta Air Lines (12%), United Airlines (10%), and Southwest Airlines (9%)[3].

In 2009, Alaska Air Group (AAG), the holding company for Alaska Airlines and Horizon Air and Seattle-Tacoma International Airport staff, in cooperation with The Boeing Company and the Federal Aviation Administration (FAA), developed a plan to evaluate new flight procedures that would utilize the latest navigational technologies and allow all appropriately equipped operators to fly optimal descent paths, while reducing their environmental impact during approaches to land at SEA. The project referred to as the "Greener Skies over Seattle" initiative is also popularly referred to as "Greener Skies"[4]. In 2010, the FAA took over responsibility for completing the final design and implementation of the procedures. Since then, the preliminary designs have been finalized and a Final Environmental Assessment (FEA) was prepared to identify potential environmental effects associated with the proposed procedures and their usage. A sequence of the elements of the Proposed Action are illustrated in Figure 1.

Figure 1 – Timeframes for Proposed Actions



Source: FEA November 2012

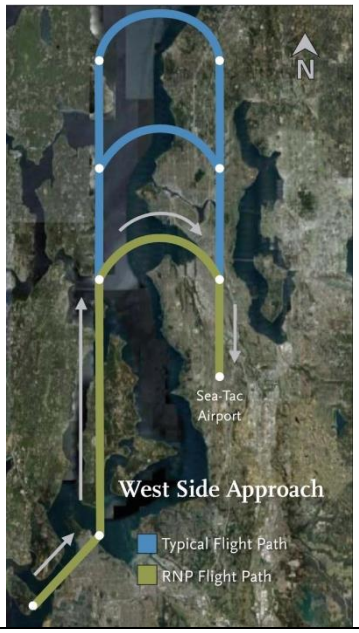
[1] **APTA**-Approach procedures including vertical guidance; **WAKE**-Wake vortex; **RSEQ**-AMAN / DMAN; **SURF**-A-SMGCS, ASDE-X; **ACDM**-Airport CDM; **FICE**-Increased efficiency through ground - ground integration; **DAIM**-Digital AIM; **AMET**-Meteorological information supporting enhanced operational efficiency; **FRTO**-En route Flexible Use of Airspace and Flexible routes; **NOPS**-Air Traffic Flow Management; **ASUR**-ADS-B satellite based and ground based surveillance; **ASEP**-Air Traffic Situational awareness; **OPFL**-In-Trail procedures (ADS-B); **ACAS**-ACAS improvements; **SNET**-Ground based safety nets; **CDO**-Continuous Descent Operations, PBN STARs; **TBO**-Data link en-route; **CCO**-Continuous Climb Operations

[2] http://www.icao.int/environmental-protection/Pages/action-plan.aspx

The Proposed Action considered the design, publication and implementation by the FAA of optimized standard instrument arrival procedures serving air traffic flows from the northwest and southwest into SEA. The initiative consisted of a set of new PBN arrival procedures[5] originating at existing navigational "waypoints" that will provide new guidance to appropriately-equipped aircraft and certified aircrews so that they may fly shorter routes to the runways than they are able to at present, and to do so with less pilot-controller interaction and at lower throttle settings than now. The initial waypoints for the Proposed Action are approximately 40 miles away from SEA to the northwest and as much as 140 miles away to the southwest. The set of new procedures that were proposed for the northwest and southwest arrivals supplement (not replace) current procedures, so that unequipped aircraft arriving from those areas can continue to operate on existing procedures.

Alaska Airlines estimates that these procedures will cut fuel consumption by 2.1 million gallons annually and reduce carbon emission by 22,000 metric tons, the equivalent of taking 4,100 cars off the road every year. In addition, they reduce overflight noise exposure for an estimated 750,000 people living the affected corridor[6].

Figure 2 – Example of Proposed Action



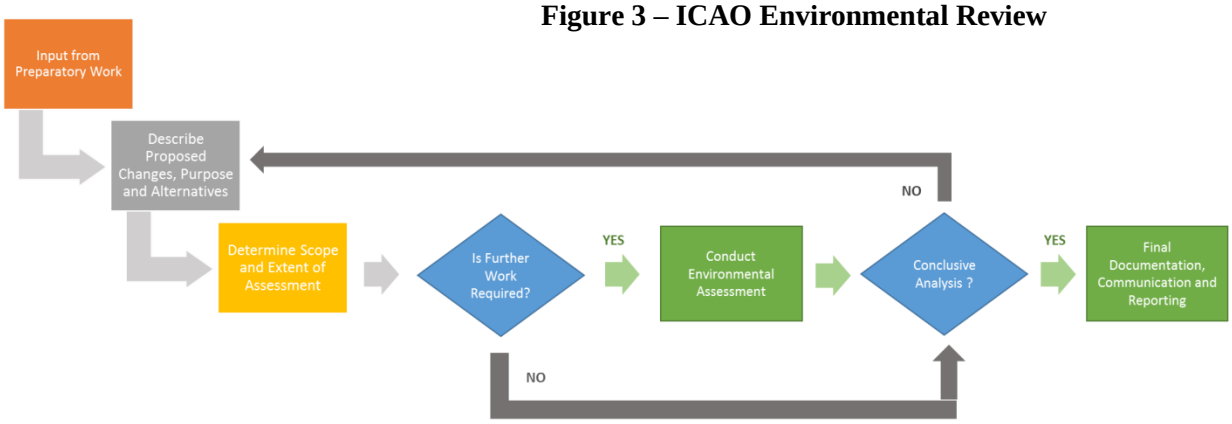
Reason for the environmental assessment: The Greener Skies EA was undertaken per the guidance for considering environmental impacts of aviation projects found within FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, FAA Order 7400.2K (Chapter 32) Procedures for Handling Airspace Matter) and also in the Council of Environmental Quality (CEQ's), Regulations for Implementing the National Environmental Policy Act (NEPA). Specifically, FAA Order 1050.1E requires environmental assessment of any new instrument approach procedures, departure procedures, en route procedures, or modifications to currently approved instrument procedures which routinely route aircraft over noise-sensitive areas at less than 3,000 feet above ground level (AGL)[7]. Several such routings were considered in this EA but no changes were proposed to alter runways, taxiways, navigational aids or other infrastructure on SEA itself.

Client or competent Authority: The environmental review of the Greener Skies project was complete in November 2012 in accordance with NEPA and applicable regulations and orders. This project was a collaborative project between the FAA, airlines, the Port of Seattle, and Boeing Corporation and the results of this analysis inform National Airspace System (NAS) Air Traffic Management (ATM) Stakeholders in particular those who were unsure as to what environmental benefits may be possible following the implementation of the new procedures. The stakeholders of this project included the Alaska Air Group (AAG), Seattle-Tacoma International Airport, The Boeing Company the FAA and local agencies (like the Port of Seattle, WSDOT Aviation, Puget Sound Regional Council, and the Department of Ecology), and the local community and tribes.

[3]Port of Seattle, "Port of Seattle - About the Port," 2014. [Online]. Available: ttp://www.portseattle.org/About/Pages/default.aspx. [Accessed 20 12 2014].
[4] Final Environmental Assessment for Greener Skies Over Seattle, Chapter 1
[5] Two Standard Terminal Arrival Procedures (STAR), and 2 Required Navigation Performance Procedures (RNP) – All procedures include Optimized Profile Descents (OPD)
[6] Greener Skies Over Seattle = Greener Skies Over the USA (http://www.faa.gov/nextgen/snapshots/stories/?slide=6)
[7] , [7] FAA, "Final Environmental Assessment for Greener Skies Over Seattle, Chapter 1", Renton, 2012.

Assessment Approach: The environmental review process followed for the Greener Skies project followed the all the steps included in the Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes (Doc10031). Figure 3 is an illustration of these steps:

Figure 3 – ICAO Environmental Review



Input from preparatory steps: The preparatory steps followed by the project team included the following[8]: (1) Identification of the specific regulations and orders that needed to be followed to fulfill the requirements of NEPA; (2) A description of the No Action case and data collection; (3) development and design of Proposed Action alternatives; (4) development of an estimated schedule of implementation; (5) Public scoping meetings that included an introductory workshop session, disseminated project information, formal presentations and solicitation of comments.

Determine scope and extent of assessment: FAA and its consultant conducted scoping of this project with to achieve the following specific goals:

- Identify significant issues to be analyzed in greater depth;
- Clarify legal responsibilities and areas of environmental analysis requiring special expertise;
- Encourage the public to provide their input and concerns;
- Identify and eliminate from detailed study any issues that are insignificant or which have been covered by prior environmental review;
- Establish the extent of the Study Area; and identify available technical information.[9]

Is further assessment work required? Further assessment is not required for the procedures reviewed and implemented in 2013.

Conduct environmental assessment. The environmental assessment was conducted per the guidance provided in FAA Order 1050.1E and CEQ's regulations.

Is it a conclusive analysis? Yes, this was a conclusive analysis and provided the basis for the Finding Of No Significant Impact/Record Of Decision (FONSI/ROD) issued in November 1st, 2012.

Final documentation, communication, and reporting. The format and content of this FEA conforms to requirements established in CEQ regulations that implement the procedural provisions of NEPA and also to the requirements of FAA Order 1050.1E.

Preparatory Work: In September 2009, the FAA received an industry task force report containing recommendations to expedite implementation of NextGen's top initiatives. A key component of the recommendations was the formation of study teams to leverage FAA and industry expertise to facilitate the design and implementation of optimized airspace. As such, the Greener Skies project was initiated by the FAA and multiple stakeholders in order to implement PBN procedures that would allow

[9] FAA, "Final Environmental Assessment for Greener Skies Over Seattle, Chapter 1", Renton, 2012.

for airlines and other stakeholders to reap the benefits from NextGen. The preparatory work included the following: (1) Identification of the specific regulations and orders that needed to be followed to fulfill the requirements of NEPA; (2) A description of the No Action case and data collection; (3) development and design of Proposed Action alternatives; (4) development of an estimated schedule of implementation; (5) Public scoping meetings that included an introductory workshop session, disseminated project information, formal presentations and solicitation of comments.
The years of analysis for the EA were as follows:

- 2012 – Baseline Case (No Action)
- 2014 – First full year of implementation of PBN procedures
- 2018 – Four years after implementation of PBN procedures
- 2013 – Nine years after implementation of PBN procedures

The No Action scenario was analyzed for each of the study years. The assessment steps and approach followed were as outlined in the guidance for considering environmental impacts of aviation projects found within FAA Order 1050.1E, FAA Order 7400.2K and CEQ Regulations for Implementing NEPA.
Once the decision to conduct an environmental assessment was taken, the proposed procedures were developed and then tested with the aim of (1) Collecting, sharing and experiencing the data for a mutually agreeable time; (2) Evaluating flight data, validating procedures, and cataloging the issues; identifying and implementing changes/improvements for pilots and ATC; documenting concurrent operations for KSEA/KBFI; and (3) Developing implementation plan for Phase 2 actions.

Describe the proposed [operational] change, its purpose and alternatives: FAA began to examine the feasibility of various measures, eliminating options that created irresolvable conflicts or did not otherwise improve inefficiencies. Additional measures were added for consideration if they resulted in fewer level-off segments and reduced radio communications while still maintaining safe separation standards. Ultimately, screening and evaluation of individual proposals resulted in the elimination of measures found to be ineffective, while those found to be viable and effective at reducing inefficiencies collectively became the Proposed Action. Elements of the final Proposed Action (summarized by 2 Standard Terminal Arrival procedure (STAR), 24 Required Navigation Performance (RNP) procedures – all implementing Optimized Profile Descents (OPD)) include the following major additions to the set of existing approach procedures into SEA:

- A new STAR for traffic arriving from the northwest to land on any of the six runway ends at SEA. The new procedure is expected to increase slightly the number of flight miles flown for some aircraft, taking them farther north than at present. However, compensating benefits derived from aircraft operating at slightly higher altitudes, undergoing fewer level-off segments, and maintaining lower thrust settings during the approach offset the dis-benefit of increased flight miles.
- A new STAR for aircraft arriving from the southwest that would reduce the number of flight miles flown when landing on any of the six runway ends at SEA.
- Implementation of new Required Navigation Performance (RNP) and RNP-to-Instrument Landing System (ILS) procedures northwest and southwest of SEA. New approach procedures would provide high-precision extensions of the STARs onto curved approach paths and short straight-in final approaches to touchdown with less need for intervening interaction by air traffic controllers.
- Fifteen of the RNP procedures would provide instrument guidance for landings on runways 16L, 16C, and 16R (five to each runway end). Twelve of the 15 would lead aircraft in over Elliott Bay and the industrial area south of Harbor Island, and the other three would provide guidance to aircraft generally overflying areas of north Seattle subject to overflights now but guided by instructions from Air Traffic Control (ATC).
- An additional six RNP procedures would guide aircraft along curved approach paths over the

Port of Tacoma, keeping them north of Interstate Route I-5 and lining them up to land on runways 34L, 34C and 34R. Three other procedures represent transitions to longer straight-in instrument approaches very similar to now.

- Optimized Profile Descents from both the northwest and southwest. Appropriately-equipped aircraft would begin their descents at cruise altitudes with near-idle thrust (referred to as "flight idle") and concomitant reductions in fuel burn, and would largely be able to maintain those thrust and fuel burn conditions along the STARs and RNP procedures all the way to touchdown.[10]

Describe the scope and extent of the assessment: FAA's development of alternatives for Greener Skies began in 2010 and the scoping of the project took place through February 2012. Evolving from a preliminary identification of measures aimed at reducing flight times, level-off segments, and confliction points in the Seattle-Tacoma airspace, concepts for airspace efficiencies tended to focus on measures that would minimize difficulties with implementation. Proposals that reduced the likelihood of adverse environmental impacts, particularly noise, thus focused on areas west of SEA where 70 percent of the arriving aircraft were already flying over large expanses of water. Along the three- to five-mile wide band of Puget Sound, FAA began to examine the feasibility of various measures, eliminating options that created unresolvable conflicts or did not otherwise improve inefficiencies.

Additional measures were added for consideration if they resulted in fewer level-off segments and reduced radio communications while still maintaining safe separation standards. Ultimately, this screening and evaluation of individual proposals resulted in the elimination of measures found to be ineffective, while those found to be viable and effective at reducing inefficiencies collectively became the Proposed Action. The impacts that were addressed for the Affected Environment (baseline) and Environmental Consequences (Proposed Action) included the following impact categories as listed in FAA Order 1050.1E.

- Noise
- Compatible Land Use
- Air Quality, Climate
- Natural Resources and Energy Supply (Fuel Usage)
- Socioeconomic Effects
- Secondary (induced) impacts
- Historical, architectural, archeological and cultural resources
- Department of Transportation Act 4 (f) sites (parks and natural areas)
- Fish, wildlife and plants (flyways for migratory birds)
- Light emissions and visual impacts

Under 40 CFR 1501.7 (NEPA and Agency Planning), scoping for a Draft Environmental Assessment (DEA) is optional, but because the FAA considered an open public process to be an important component of the Greener Skies DEA, the Agency decided to conduct scoping with the following specific goals in mind[11]:

- Identify significant issues to be analyzed in greater depth;
- Clarify legal responsibilities and areas of environmental analysis requiring special expertise;
- Encourage the public to provide their input and concerns;
- Identify and eliminate from detailed study any issues that are insignificant or which have been

[10] FAA, "Final Environmental Assessment for Greener Skies Over Seattle, Chapter 2", Renton, 2012.
[11] FAA, "Final Environmental Assessment for Greener Skies Over Seattle, Chapter 1", Renton, 2012.

covered by prior environmental review;
- Establish the extent of the Study Area; and identify available technical information.

The FAA disseminated project information, solicited comments, and conducted public agency scoping meetings in an effort to achieve these goals. Information about the project was distributed via invitations to scoping meetings, emails, advertisements in newspapers and the project website. An agency scoping meeting and a series of two (2) public scoping meetings held in January 2012. In addition to the scoping completed for the DEA, the FAA met with other stakeholders 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.[12]

Comments about noise expressed concern about possible noise impacts of the proposed action. Other comments requested clarification of the NEPA process or requests for additional information. Consequently, the project included a comprehensive outreach plan, including a project website. The FAA also provided project briefings to a number of local communities. Further, comments were made about air quality and aircraft emissions, with focus on understanding how the proposed action might alter concentrations of pollutants or otherwise change air quality in the region resulting in the inclusion of air quality analysis that addressed these comments in the DEA. The DEA also included a quantification of fuel burn benefits as a response to comments in support of the project and anticipated reduction in aircraft fuel burn the need to quantify fuel burn benefits.

Environmental reviews are an important aspect of FAA's efforts to implement new technologies through NextGen initiatives while ensuring that environmental considerations are full evaluated and analyzed so as to not have a significant impact the surrounding environment. While the proposed procedures for the Greener Skies project were categorically excluded per NEPA requirements, the FAA determined that the next level of environmental review, an EA, should be completed for all NextGen airspace actions. This ensures that a more detailed analysis of the all the impact categories including the categories that generate most concern such as noise and air quality.

The years of analysis for the EA were selected based upon the year of expected completion of the EA (Base year) and full implementation of the proposed action. Additional years were analyzed to evaluate the environmental consequences based on projected growth in operations and changes in aircraft fleet mix. The years analyzed for the EA are as follows:

- 2012 – Baseline Case (No Action)
- 2014 – First full year of implementation of PBN procedures
- 2018 – Four years after implementation of PBN procedures
- 2013 – Nine years after implementation of PBN procedures

Describe the assessment itself: The format and content of this FEA conforms to requirements established in CEQ regulations that implement the procedural provisions of NEPA and also to the requirements of FAA Order 1050.1E (FAA, 2012). Paragraph 14.5e. further specifies that for air traffic airspace actions on large study areas or at altitudes above 3,000 feet above ground level (AGL), noise modeling "will be conducted using Noise Integrated Routing System (NIRS)." NIRS, Version 7.0b.2 was used for all evaluations of noise, emissions, and fuel burn in the Greener Skies EA.[13]

Noise was examined for four study years – 2012 (No Action only), 2014, 2018 and 2023 (No Action and the Proposed Action). Computations of noise exposure were made at 40,788 population centroids and nearly 15,000 additional points disassociated with population but useful for representing noise levels in

[12] FAA, "Final Environmental Assessment for Greener Skies Over Seattle, Chapter 7", Renton, 2012.
[13] FAA, "Final Environmental Assessment for Greener Skies Over Seattle, Appendix G", Renton, 2012.

more remote areas such as parks or wildlife refuges. Several hundred additional points were selected to represent schools, specific historic sites and several locations directly under proposed flight paths or in areas of variable terrain representative of additional potentially sensitive locations.

The 2012 operational scenario was used to represent the current noise environment. The 2014 Proposed Action noise results was compared to the 2014 No Action alternative to determine if there were any increases in noise levels that met or exceeded FAA's criteria. The 2018 and 2023 Proposed Action results were also compared to the 2018 No Action alternatives and FAA criteria. Fuel burn and Green House Gas (GHG) emissions comparisons are also reported for the future scenarios.
The FAA criteria for noise thresholds are reportable changes – either a 1.5 dB or greater change in DNL 65 dB or above, or 3 dB or greater change in DNL from 60 to 65 dB, or a 5 dB or greater change in DNL from 45 to 60 dB. More details on FAA criteria are found in Order 1050.1e, Appendix 1, Sections 14.3, 14.4, and 14.5e.

Describe the results and how they were communicated: Implementation of the Proposed Action involves aircraft route changes and does not entail any physical development. For this reason, many of the environmental resource categories described in FAA Order 1050.1E, Chapter 4, Paragraph 403, Impact Categories, would not be affected. No Significant impacts to the quality of the human or natural environment were identified for any of the remaining categories evaluated in the EA.[14] The assessment demonstrated that thresholds of significance for any environmental impact category will not be exceeded due to the Proposed Action, therefore, no mitigation was proposed as part of the project.
This assessment was first drafted as a Draft Environmental Assessment (DEA) for consultation before being finalized as a Final Environmental Assessment (FEA)A Finding Of No Significant Impact/ Record Of Decision (FONSI/ROD) to support the implementation of RNAV/RNP Procedures at Seattle-Tacoma International Airport (Greener Skies over Seattle) was issued November 1st 2012 as a result of this EA. The consultant who prepared the document and conducted the associated analyses is responsible for ensuring that the methodologies used for modeling and results are accurate. There was no independent audit completed for this EA.

Lessons learned: The Greener Skies project is considered one of the NextGen success stories due to the collaborative approach that resulted in the implementation of 27 new PBN procedures that included the use of OPD, RNAV and RNP procedures. The environmental review was completed in November 2012 after the FAA carefully reviewed and addressed public comments received on the DEA in August 2012. The FAA followed a multi-step collaborative process also knows as the 18 step process that has since been streamlined further. The following lessons learned were highlighted by the Port of Seattle:

- FAA leadership and commitment is critical to the successful execution and completion of such a project and eventual implementation of the Proposed Action.
- It is imperative to engage the industry, major airlines, and all other airlines. The Greener Skies project was a collaborative effort that included 12 key participants that included the Port of Seattle, FAA and major airlines who operated at SEA.
- Clearly define scope, goals and timeline provide this to all stakeholders early
- Obtain local support, i.e. communities, nearby airports, and political figures
- Show the benefit, i.e. economic, social, and environmental
- The process takes time and therefore effective communication and engagement is critical to ensure that the project is completed successfully.[15]

[14] FAA, "Finding of No Significant Impact (FONSI) & Record of Decision (ROD) For the Implementation of RNAV/RNP Procedures at Seattle-Tacoma International Airport (Greener Skies Seattle- over Seattle)" Renton, 2012.
[15] E. Leavitt, "Greener Skies over Seattle RNP/OPD," Port of Seattle, Seattle.

As the FAA continues to implement PBN procedures at other airports it is important that the airports/regions are identified early so as to quantify potential benefits/impacts to the airports, regions and communities, understand the communities needs and potential response, identify whether the FAA and/or an airline/operator would take the deal in development of procedures and the level of environmental review required.
Comments*:*