Appendix A – Court Decision

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FOR PUBLICATION

UNITED STATES COURT OF APPEALS FOR THE NINTH CIRCUIT

MICHELLE BARNES, an individual; PATRICK CONRY, an individual; BLAINE ACKLEY,
Petitioners,

PORT OF PORTLAND,
Intervenor,

v.

UNITED STATES DEPARTMENT OF TRANSPORTATION; RAY LAHOOD, Secretary of Transportation; FEDERAL AVIATION ADMINISTRATION; J. RANDOLPH BABBITT, Administrator, Federal Aviation Administration; DONNA TAYLOR, Regional Administrator, Federal Aviation Administration, Northwest-Mountain Region; CAROL SUOMI, District Manager, Federal Aviation Administration Seattle Airports District; CAYLA MORGAN, Environmental Specialist, Federal Aviation Administration Seattle Airports District,
Respondents.

No. 10-70718

OPINION

On Petition for Review of an Order of the
Federal Aviation Administration

Argued and Submitted
February 9, 2011—Seattle, Washington

Filed August 25, 2011

Before: Betty B. Fletcher, Richard A. Paez, and
Sandra S. Ikuta, Circuit Judges.

Opinion by Judge B. Fletcher;
Dissent by Judge Ikuta

COUNSEL

Sean T. Malone and Andrew J. Orahoske, for the petitioners.

Ignacia S. Moreno, Assistant Attorney General; Hans Bjornson and Patricia A. Deem, the Federal Aviation Administration; David C. Shilton and Michael T. Gray, United States Department of Justice, Environment and Natural Resources Division, for the respondents.

Beth S. Ginsberg, Rita V. Latsinova, and Jason T. Morgan, Stoel Rives LLP, for the intervenor.

OPINION

B. FLETCHER, Circuit Judge:

Petitioners Michelle Barnes, Patrick Conry, and Blaine Ackley (collectively, "petitioners") challenge an order of the Federal Aviation Administration ("FAA") concerning the proposed construction by the Port of Portland ("the Port") of a new runway at Hillsboro Airport ("HIO"). The FAA issued a Finding of No Significant Impact ("FONSI"), thus relieving the agency of preparing an Environmental Impact Statement ("EIS"). Petitioners argue that the decision not to prepare an EIS was unreasonable for several reasons, chief among them the FAA's failure to consider the environmental impacts of any increased demand for HIO resulting from the addition of a runway. Petitioners also argue that the FAA did not afford them a public hearing within the meaning of 49 U.S.C. § 47106.

We have jurisdiction pursuant to 49 U.S.C. § 46110. We grant the petition and remand.

BACKGROUND

I. The Hillsboro Airport

HIO is located in the city of Hillsboro in Washington County, Oregon, 12 miles west of downtown Portland. The Port of Portland assumed ownership of HIO in 1966. In 2008, HIO become Oregon's busiest airport, surpassing Portland International Airport (PDX) in number of airport operations.[1]

HIO's increasingly important role in the Portland metropolitan area and the Oregon state system of airports is the result of its serving all three segments of the air transportation industry: commercial air carriers, military, and general avia-

[1]Airport operations include takeoffs and landings.

tion (GA). Commercial air carrier is broadly defined as any domestic or foreign aircraft carrying passenger or cargo for hire. HIO accommodates a broad range of commercial air carriers, including scheduled air carrier activity using aircraft with nine or fewer passenger seats; air cargo carriers using aircraft with a payload capacity less than 7,500 pounds; on-demand air carriers using aircraft with 30 or fewer passenger seats and a payload capacity of less than 7,500 pounds; and commuter operations with non-turbojet aircraft with nine or fewer passenger seats and a payload capacity of less then 7,500 pounds.[2] HIO also accommodates local and transient operations by military rotorcraft and occasionally military jet aircraft. Finally, GA is defined as all aviation other than military and commercial airlines. It includes a diverse range of activities such as pilot training, sightseeing, personal flying, agricultural spraying and seeding, fractional business jet operations,[3] and emergency medical services. Seventy percent of the hours flown by general aviation are for business purposes.

HIO's role is defined within both state and federal aviation plans. HIO is designated as a reliever airport in FAA's *National Plan of Integrated Airport Systems* (NPIAS). Reliever airports are specially designated to reduce congestion at large commercial service airports by segregating GA aircraft from commercial airlines and air cargo activities. HIO is classified as a reliever for PDX. At the state level, the *Oregon Aviation Plan* prepared by the Oregon Department of Aviation (ODA) classifies HIO as a Category 2, Business or High Activity General Aviation Airport. Neither the NPIAS nor the *Oregon Aviation Plan* anticipate HIO changing from a GA airport to a commercial service airport in the future.

[2]HIO is not certified to accommodate scheduled air carrier activity using aircraft with more than nine passenger seats. In the area, PDX exclusively is certified to accommodate such activity.

[3]Fractional business jet operations are the aviation equivalent of real estate time shares.

II. Hillsboro Airport Master Plan

In 2005, the Port of Portland undertook the HIO Master Plan to "forecast future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand" through the year 2025. The Master Plan states that HIO is "the most capable" GA airport out of the 23 public-use airports in the Portland-Vancouver metropolitan area, only one of which, PDX, is a commercial service airport.

In its current configuration, HIO has two intersecting runways, an airport traffic control tower, and an instrument landing system. The primary runway is 6,600 feet long and 150 feet wide (the longest runway at all GA airports in the area), and serves the mix of large business jet aircraft and GA aircraft which use HIO. The precision instrument approach is aligned with this primary runway. The second runway is a cross-wind runway 4,049 feet long and 100 feet wide, which serves primarily small GA aircraft. In addition, HIO has three taxiways parallel with the runways and three helicopter takeoff sites (or helipads). Two of the helipads are located at the end of each runway and the third, the Charlie helipad, is located parallel to the primary runway. Due to its capabilities —which cannot be readily replicated without significant capital investments—HIO has evolved as the primary GA airport in the Portland-Vancouver metropolitan area.

HIO's significant role in the region is reflected in its annual service volume ("ASV"). ASV is one dimension of airfield capacity and a fundamental tool in airport planning. As used in the HIO Master Plan, ASV represents a "reasonable estimate of the maximum level of aircraft operations that can be accommodated at [an airport] in a year"[4] at acceptable levels

[4]This is the definition used by the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, at 2 (Sept. 1983). ASV has another widely-used definition: the level of annual activity at which the average delay per operation is 4 minutes. *See, e.g.*, FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, at 20 (Dec.4, 2000).

of service. ASV accounts for differences in airfield characteristics, aircraft mix, weather conditions and demand characteristics (the mix of different types of aircraft operations) that would be encountered over a year's time. ASV is not a ceiling and airports often operate above the ASV. The FAA, however, requires that improvements for airfield capacity purposes be considered when operations reach 60 percent of ASV.[5] The goal of airfield capacity improvements is to increase ASV to a point where annual operations represent between 60 and 80 percent of ASV.

The HIO Master Plan forecast that the ASV for 2007 would be 169,000, the annual runway operations 166,033, and therefore HIO would operate at 98 percent of ASV. This would result in an average delay of 1.2 minutes, and a total aircraft delay of 3,321 hours a year. By 2010, ASV would increase to 176,000, the annual runway operations would increase to 196,600, and HIO would operate at 112 percent of ASV. The average delay would be 1.9 minutes, and the total aircraft delay 6,200 hours a year. By 2015, ASV would increase to 174,000, the annual runway operations to 214,600, and HIO would operate at 123 percent of ASV. The average delay would be 3.6 minutes, and the total aircraft delay 12,900 hours a year. For 2025, ASV would drop slightly to 171,000, but the annual runway operations would further increase to 249,300, and HIO would operate at 146 percent of ASV. The average delay would be 6 minutes, and the total aircraft delay 24,900 hours a year. Increasing levels of annual delay create undesirable conditions such as increased air emissions, increased operating costs, and extended air traffic patterns.

[5]*See* FAA Order 5090.3C at 24. That order, however, defines ASV as the level of annual activity at which the average delay per operation is 4 minutes. By contrast, the HIO Master Plan appears to calculate the ASV as the level of annual activity at which the average delay per operation is slightly more than 1.2 minutes. *See infra* at 16269-70. Whether the Master Plan's recommendations for airfield capacity improvements would have been the same had it relied on the ASV definition actually used by FAA Order 5090.3C is not before us.

After analyzing two alternative actions—increasing radar coverage and building additional exit taxiways to the primary runway—the Master Plan concluded that adding a runway for use by small GA aircraft exclusively is "the best means available for reducing delays and the undesirable conditions that occur due to delay." Adding a new runway would allow HIO to operate at 65 percent of ASV in 2012, 69 percent in 2015 and 81 percent in 2025.

III. The Proposed Project—Construction of a New Parallel Runway and Related Actions

Following the Master Plan's recommendations, the Port of Portland proposed to construct a new, 3,600-foot-long and 60-foot-wide, runway parallel to the existing primary runway, to construct associated taxiways, relocate the Charlie helipad, and make associated infrastructure improvements. The Port proposed to start the construction of the new runway and associated taxiways in 2010 and complete them by 2011. The relocation of the Charlie helipad would start in 2014 and the relocated helipad would be in operation by 2015. The modifications would be partially funded by FAA grants and would therefore require FAA approval and the preparation of an environmental assessment ("EA").

The FAA approved and published a Draft Environmental Assessment ("DEA") prepared by the Port on October 9, 2009.[6] For its purposes, the FAA approved the use of the HIO Master Plan's demand forecast.[7] The DEA stated the purpose of the project is "to reduce congestion and delay at HIO in accor-

[6]For an explanation of the roles of the FAA and the Port in the process of preparing the EA for the HIO expansion project, see *infra* p.16276.

[7]Although the FAA found that the Master Plan's forecast was outside the FAA's recommended range of variation from its own forecast at the 5-year mark (by then 2013), it found that it was within the range of variation at the 10-year mark (then, 2018). The FAA ultimately approved the use of the Master Plan's forecast for use in the DEA.

dance with planning guidelines established by the FAA." The DEA explained that as congestion and delay increase, HIO's ability to serve as an attractive, safe and efficient reliever for PDX diminishes:

> The proposed action is needed because the HIO airfield is currently operating at close to 100 percent of annual service volume (ASV) and current Airport activity levels exceed the FAA capacity planning criteria. . . . Forecast activity levels through 2025 are expected to substantially exceed the ASV of the current airfield, with increasing levels of unnecessary congestion and delay corresponding to the increased demand.

In the DEA, the Port considered the proposed project and seven alternative actions, including a "no action" alternative. The Port eliminated five of these alternatives as not meeting the purpose and need of the project and focused on the three remaining alternatives. Alternative 1, the "no action" alternative, would maintain the status quo and would not meet the purpose and need for the project. Under Alternatives 2 and 3, HIO would gain a new runway parallel to the primary runway, a taxiway parallel to the new runway, and additional infrastructure, including electrical service for lighting and signage, an access roadway, and drainage facilities for new impervious surfaces. The alternatives differed only as to the new location of the Charlie helipad, which needed to be moved in order to make room for the new runway.

The Port analyzed the environmental impacts of the three alternatives. It found that, due to its location, a new runway would increase the size of the area of significant noise impact compared to the "no action" alternative, but no residential or other noise-sensitive land uses occur in that area. In fact, Alternatives 2 and 3 would shift noise impacts modestly away from the most densely populated residential areas and towards farmlands. Construction noise impacts would be temporary and would not approach the FAA threshold of significance.

The Port stated that Alternatives 2 and 3 "would not lead to increased aviation activity compared to the No Action Alternative." It concluded, "In the absence of induced off-airport development, increased levels of aviation activity, or significant environmental impacts, [Alternatives 2 and 3] would not lead to secondary impacts with respect to shifts in patterns of population movements and growth, public service demands, or changes in business and economic activities."

The Port found that the construction of the new runway would temporarily increase air emissions, but estimated that they would not be significant. As to the operational emissions, the Port stated that "[o]nce constructed, operation of the proposed project would not increase emissions from other sources because all of the alternatives under consideration would experience the same level of aviation activity." In fact, by reducing congestion and delay, Alternatives 2 and 3 would reduce aircraft ground idle emissions compared to the "no action" alternative and result in "long-term, ongoing emission reductions." Relying on the fact that operations at HIO represent less than 1 percent of U.S. aviation activity, the Port stated that it did not expect the emissions of greenhouse gases from the project to be significant.

The Port further found that a new runway would slightly increase storm water runoff, impact some 70 acres of vegetation (which include 6.30 acres of Vegetated Corridor as defined by Clean Water Services), result in permanent loss of 2.22 acres of wetlands, affect some 50 acres of prime farmland or farmland of statewide importance, and raise electricity use slightly. To mitigate these impacts, the Port proposed compensating for damaged wetlands by restoring or enhancing the same acreage of historic wetlands in a nearby environmentally-sensitive area. It also provided a plan to reduce air emissions during construction, designed a strategy to absorb excess storm water runoff, proposed measures to protect wildlife and plants, and adopted a protocol for preserving any artifacts found during construction.

In light of the above, the Port concluded that a new runway would not have cumulative significant impacts.

The FAA made copies of the DEA available to the public and solicited public comment for 45 days. On November 10, 2009, the Port held a two-hour meeting with the public. The meeting had an open house format, which included tables with copies of the DEA, multiple stations with information about the project, and a stenographer for recording oral statements. Twice during the meeting, the Port made a presentation providing an overview of the project and summarizing the results of the DEA. Approximately 18 members of the public attended the meeting. Petitioner Barnes made oral statements. Seven individuals, including all three petitioners, submitted written comments.

The Port made minor revisions to the DEA in response to comments from the public and prepared a final environmental assessment ("EA"). The Port selected either Alternative 2 or 3 as the preferred alternative. The FAA approved the EA and issued a FONSI on January 8, 2010.

Petitioners filed a timely petition for review in this court pursuant to 49 U.S.C. § 46110. They argue that the FAA violated the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321 *et seq*. Specifically, they contend that: (1) the FAA failed to consider the indirect effects of increased aircraft operations; (2) the context and intensity of the project requires that the FAA prepare an environmental impact statement; (3) the FAA failed to take a hard look at the cumulative effects of the project; and (4) the FAA failed to consider a reasonable range of alternatives. Petitioners also argue that the FAA failed to provide them with a public hearing, in violation of the Airport and Airway Improvement Act of 1982, 49 U.S.C. §§ 47101 *et seq*. The Port intervened in this petition as an interested party pursuant to 49 U.S.C. § 46109.

ANALYSIS

I. The National Environmental Policy Act Claims

A. Statutory Background

The National Environmental Protection Act of 1969, commonly known as NEPA, is "our basic national charter for protection of the environment." 40 C.F.R. § 1500.1(a) (2006). Congress passed NEPA "to protect the environment by requiring that federal agencies carefully weigh environmental considerations and consider potential alternatives to the proposed action before the government launches any major federal action." *Lands Council v. Powell*, 395 F.3d 1019, 1026 (9th Cir. 2005). To accomplish this, "NEPA imposes procedural requirements designed to force agencies to take a 'hard look' at environmental consequences." *Earth Island Inst. v. U.S. Forest Serv.*, 351 F.3d 1291, 1300 (9th Cir. 2003). NEPA, however, does not contain substantive environmental standards, nor does it mandate that agencies achieve particular substantive environmental results. *Bering Strait Citizens for Responsible Res. Dev. v. U.S. Army Corps of Eng'rs*, 524 F.3d 938, 947 (9th Cir. 2008).

NEPA requires federal agencies to prepare an EIS before undertaking "major Federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C). An EIS must "provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1.

Under the Council on Environmental Quality regulations implementing NEPA, an agency prepares an EA in order to determine whether to prepare an EIS or to issue a FONSI, the latter of which excuses the agency from its obligation to prepare an EIS. *See* C.F.R. §§ 1500.1-.8; *Morongo Band of Mission Indians v. FAA*, 161 F.3d 569, 575 (9th Cir. 1998). Regulations consistent with this approach have also been promulgated by the FAA for the purpose of evaluating FAA actions, including airport developments. *See* F.A.A. Order 1050.1E, *Policies and Procedures for Considering Environmental Impacts* ¶ 201 (Mar. 20, 2006).

Under the FAA regulations, the FAA was required to conduct an environmental assessment of the HIO expansion project. *See id.* § 401k (EA required for "[f]ederal financial participation in, or unconditional airport layout plan approval of, the following categories of airport actions: . . . (2) New runway."). The FAA permitted the Port, as the proponent of the project, to prepare the draft and final environmental assessments, a task which the Port contracted to CH2M HILL. *See* 40 C.F.R. § 1506.5(b) (federal agencies may permit an applicant to prepare an EA). The FAA, however, was required to independently evaluate the information in the EA and was responsible for its accuracy. *Id*. § 1506.5(a). The FAA was also required to make "its own evaluation of the environmental issues and take responsibility for the scope and content of the environmental assessment." *Id*. § 1506.5(b). In light of the foregoing, we review the actions by the FAA—taken either independently or in conjunction with the Port,—and not separately the actions by the Port.

B. Standard of Review

The Administrative Procedure Act ("APA"), 5 U.S.C. §§ 701 *et seq.*, provides the authority for this court's review of agency decisions under NEPA. *See, e.g.*, *Pit River Tribe v. U.S. Forest Serv.*, 469 F.3d 768, 778 (9th Cir. 2006). A reviewing court may set aside an agency action only if it is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. § 706(2)(A). Review under the arbitrary and capricious standard is narrow, and we do not substitute our judgment for that of the agency. *Lands Council v. McNair*, 537 F.3d 981, 988 (9th Cir. 2008) (en banc), *overruled on other grounds by Winter v. Natural Res. Defense Council*, 129 S. Ct. 365 (2008). An agency decision will be upheld as long as there is a rational connection between the facts found and the conclusions made. *Siskiyou Reg'l Educ. Project v. U.S. Forest Serv.*, 565 F.3d 545, 554 (9th Cir. 2009).

In reviewing an agency's decision not to prepare an EIS, the arbitrary and capricious standard under the APA requires this court

> to determine whether the agency has taken a "hard look" at the consequences of its actions, "based [its decision] on a consideration of the relevant factors," and provided a "convincing statement of reasons to explain why a project's impacts are insignificant."

Envtl. Prot. Info. Ctr. v. U.S. Forest Serv., 451 F.3d 1005, 1009 (9th Cir. 2006) (quoting *Nat'l Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 730 (9th Cir. 2001)).

C. Waiver

[1] Preliminarily, the Port and the FAA argue that the petitioners waived their NEPA arguments because they failed to raise them during the public comment period.

[2] Persons challenging an agency's compliance with NEPA must "structure their participation so that it . . . alerts the agency to the [parties'] position and contentions," in order to allow the agency to give the issue meaningful consideration. *Dep't of Transp. v. Public Citizen*, 541 U.S. 752, 764 (2004) (quoting *Vermont Yankee Nuclear Power Corp. v. Natural Res. Def. Council, Inc.*, 435 U.S. 519, 553 (1978)). The agency, however, bears the primary responsibility to ensure that it complies with NEPA and an EA's flaws "might be so obvious that there is no need for a commentator to point them out specifically in order to preserve its ability to challenge a proposed action." *Public Citizen*, 541 U.S. at 765. This court has interpreted the "so obvious" standard as requiring that the agency have independent knowledge of the issues that concern petitioners. *'Ilio 'ulaokalani Coal. v. Rumsfeld*, 464 F.3d 1083, 1092 (9th Cir. 2006).

Our review of the record of the hearing held by the Port and the written materials submitted by petitioners persuades us that they raised some, but not all the arguments they raise now. We address them in turn.

Petitioners first argue that the EA is inadequate because the Port and the FAA failed to consider the indirect effects of increased aviation activities due to the proposed expansion in capacity at HIO. Although petitioners Barnes and Conry expressed generalized grievances about the negative effects of aviation activities, the HIO's role as a reliever airport for PDX, and the high level of operations at HIO, there is nothing in their comments to alert the agencies to petitioners' argument that a new runway would cause an increase in the level of operations at HIO and that the DEA should have addressed the environmental impacts of that increase.

[3] By contrast, petitioner Ackley stated in a letter responding to the DEA that he was "opposed to a third runway because such a development would adversely affect our property value and our quality of life," and that "[i]ncreased air traffic will affect our quality of life and the value of our property should we wish to sell it." We see no other way to read this comment than that petitioner Ackley equated the construction of a third runway with increased air traffic. He also identified indirect effects resulting from increased air traffic—greater noise pollution, decrease in property value, and a decrease in quality of life. Although the agencies might have preferred that petitioner Ackley be more expansive or more detailed in his comments, petitioners need not "incant [certain] magic words . . . in order to leave the courtroom door open to a challenge." *Idaho Sporting Congress, Inc. v. Rittenhouse*, 305 F.3d 957, 966 (9th Cir. 2002).

[4] Even if petitioner Ackley's letter were insufficient to alert the FAA to the issue of increased demand, we are persuaded that the agencies had independent knowledge that the HIO expansion project would cause an increase in aircraft activity.[8] Petitioners rely on three statements in the administrative record. First, while reviewing a draft of the Scope of Work document for the EA, an FAA official inquired whether the Air Quality section "need[s] to assume/consider a worst case scenario for maximum use of the 3rd runway." Second, the Scope of Work contained this statement: "The proposed action is expected to reduce aircraft emissions compared to the no action alternative, but it is possible that construction of the third runway would remove a constraint to growth in aircraft activity. . . . Preliminary analyses indicate that the degree of delay reduction per operation associated with the proposed action would more than offset the potential increase in aircraft operations." Third, an attachment to an email regarding the demand forecast at HIO stated that, even with a new runway, by 2015 operational demand at HIO will again exceed 60 percent of ASV and in 20 years will exceed 80 percent of ASV. Petitioners interpret this forecast as proving that the agencies were aware that the newly-created capacity would begin to be filled immediately.

The agencies challenge the significance of the three statements. They contend that the third statement is consistent with

[8]Petitioners also argue that the FAA and the Port were apprised of their objection when they filed with this court a Request to Stay Pending Review over three months before filing their opening brief. The Request for Stay was filed months after the issuance of the FONSI. It is therefore irrelevant to the issue of whether petitioners raised their objections during the public comment period.

the HIO Master Plan's demand forecast. The agencies are correct on this point. They further contend that the first two statements were made in the early stages of the administrative process and that the Supreme Court has cautioned that courts must focus on the final action by an agency. The Supreme Court, indeed, has held that the mere fact that a preliminary determination is overruled at a higher level within the agency does not render the decisionmaking process arbitrary and capricious:

> With regard to the various statements made by the involved agencies' regional offices during the early stages of consideration, the only "inconsistency" respondents can point to is the fact that the agencies changed their minds—something that, as long as the proper procedures were followed, they were fully entitled to do. The federal courts ordinarily are empowered to review only an agency's final action, *see* 5 U.S.C. § 704, and the fact that a preliminary determination by a local agency representative is later overruled at a higher level within the agency does not render the decisionmaking process arbitrary and capricious.

Nat'l Ass'n of Home Builders v. Defenders of Wildlife, 551 U.S. 644, 659-60 (2007). The Court did not hold, however, that such preliminary determinations are irrelevant in any context—such as the question of waiver raised by the FAA here, or that they may not be considered when reviewing an agency action. *See id.*; *cf. Wetlands Action Network v. U.S. Army Corps of Engineers*, 222 F.3d 1105, 1122, 1122 n. 8 (9th Cir. 2000) (considering the evidentiary value of an internal memorandum in analyzing whether an EA and subsequent FONSI were arbitrary and capricious), *abrogated on other grounds by Wilderness Soc. v. U.S. Forest Serv.*, 630 F.3d 1173 (9th Cir. 2011).

Two of the statements identified by petitioners show that the FAA officials involved in the planning process for the

HIO expansion project acknowledged the possibility that an additional runway would induce growth. The agencies contend these early opinions reflect thorough consideration of the issue, but were ultimately rejected, as confirmed by the fact that the DEA discussed growth-inducing effects and found none. The agencies fail to mention, however, that the entirety of the EA discussion of the growth-inducing effects on aviation activities consists of these two sentences:

> As described in Section 3.2.2, Alternative 2 would not lead to increased aviation activity compared to the No Action Alternative. . . . In the absence of induced off-airport development, increased levels of aviation activity, or significant environmental impacts, this alternative would not lead to secondary impacts with respect to shifts in patterns of population movement and growth, public service demands, or changes in business and economic activities.

On its part, Section 3.2.2 conclusorily states, "Total aircraft operations would be the same as under the No Action Alternative."

[5] The agencies are unable to point to anything in the record showing that they in fact considered the possibility that expanding HIO's capacity would lead to increased demand and increased aircraft operations, but discounted it in the face of evidence to the contrary. Furthermore, the FAA acknowledged that a new runway is "the most effective capacity-enhancing feature an airfield can provide," and repeatedly stated that HIO, a busy reliever airport, must accommodate all GA activity demand directed towards it. Most relevantly, as stated above, the two statements identified by petitioners demonstrate that FAA officials were aware that a new runway could induce growth and accordingly included a statement to this effect in the Scope of Work document.[9] Cumulatively,

[9]At oral argument, counsel for both the FAA and the Port expressly disclaimed the possibility that the new runway could induce increased demand at HIO.

this record demonstrates that the agencies had independent knowledge of a reasonable possibility that increasing capacity at HIO would lead to increased demand, but chose to gloss over it. We therefore hold that the agencies' failure to discuss the environmental impact of increased demand is a flaw "so obvious" that there was no need for petitioners to point it out specifically in order to preserve their ability to challenge the EA on this ground. *See Public Citizen*, 541 U.S. at 765; *'Ilio 'ulaokalani Coal.,* 464 F.3d at 1092.

[6] Petitioners' next argument is that the context and intensity of the project require an EIS. *See* 40 C.F.R. § 1508.27. During the comment period, petitioner Barnes stated that the DEA's conclusion that the HIO project would have no significant environmental impact is inappropriate for "this facility, which logs close to a quarter of a million annual operations" and accused the FAA of trying to downplay the negative effects of aviation activities at HIO, including pollution. The only fair reading of these comments, in light of petitioner Barnes' overall testimony, is that she thought that an EIS should be prepared for the project in light of its context and intensity. The argument is not waived.

[7] Petitioners also challenge the EA's assessment of the project's cumulative impacts. The argument is premised on the agencies' failure to consider the effects of a new control tower and two proposed zoning changes that would impact areas north of HIO. In her comments, petitioner Barnes contended that one of the zoning changes would "essentially [result in] an expansion of the Airport boundary" and would operate as a "taking of neighboring private properties." These comments alerted the agencies to the need to consider the effects of the proposed zoning changes while assessing the project's cumulative impacts. To that extent, the argument is not waived.

Petitioners' comments, however, did not include one single reference to a new control tower. They nevertheless point our attention to a series of emails in the administrative record discussing whether the new runway would be in the "line of sight" of the existing control tower. Although not couched in these terms, petitioners essentially argue that the EA's failure to consider the alleged new control tower falls under the "so obvious" exception discussed above. *See Ilio 'ulaokalani Coal.,* 464 F.3d at 1092.

The emails identified by petitioners reflect one FAA employee's concerns whether the existing control tower meets the current height and downward angle viewing requirements for control towers. Another FAA employee responded that regulations had changed since the tower had been built and that the tower may have been operating under a waiver or a grandfather clause in the new regulations. The employee stated that there were no safety concerns because the length and position of the new runway would allow for an enhanced downward angle compared to the primary, longer runway. The same employee clarified that HIO "is not in line for a new tower," although he also commented that "[t]his may be a backdoor way to get a new tower paid for by AIP."

[8] Consistent with this email, the agencies assert before this court that there is no new control tower project and that the FAA has no concerns about HIO's safety in the absence of a new tower. Because there is no plan, immediate or remote, to build a new control tower, according to the agencies, their alleged failure to address it in its cumulative impacts analysis is not a flaw, let alone one "so obvious" as to dispense with the requirement that petitioners raise it themselves before the agencies. *See* 40 C.F.R. § 1508.7 (as part of its cumulative impacts analysis, an agency must assess impacts of "reasonably foreseeable future actions"). The petitioners' argument is both meritless and waived.

[9] Petitioners further argue that the EA is inadequate for failing to consider a reasonable range of alternatives. In her comments, petitioner Barnes recommended that the monies earmarked for aviation be redirected "towards high-speed rail and environmentally sustainable transportation alternatives that provide protection for urban and rural communities from the negative impacts of aviation." An EA, however, need only discuss alternatives that advance the purpose of the project. *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1246-47 (9th Cir. 2005). Here, the purpose of the project is "to reduce congestion and delay at HIO in accordance with planning guidelines established by the FAA." Petitioner Barnes's recommendations of alternative modes of transportation failed to alert the agencies to the argument that the range of alternatives *to the project* actually discussed in the EA was not reasonable. The argument lacks merit and is waived.

In sum, petitioners' comments sufficiently raised the argument that the EA should have considered the indirect effects of increased demand for aviation activities due to increased capacity. Furthermore, the EA's failure to address this argument is a flaw "so obvious" that petitioners did not need to preserve it by raising it in their comments. Petitioners' arguments that the EA did not consider a reasonable range of alternatives and the impacts of a new control tower are both waived and unpersuasive. They preserved their arguments that an EIS should have been prepared because the context and intensity of the project is significant and that the cumulative impacts analysis was deficient for failing to address zoning changes related to the airport and neighboring properties. We address the arguments properly before us in order.

D. Indirect Effects

[10] Petitioners' main argument in this petition for review is that adding a new runway at HIO would result in increased demand and that the EA is deficient for failing to consider the impact of the indirect effects from this increased demand.

Petitioners emphasize that an EIS must be prepared if "substantial questions are raised as to whether a project . . . may cause significant degradation of some human environmental factor." *Ocean Advocates v. U.S. Army Corps of Eng'rs*, 402 F.3d 846, 864 (9th Cir. 2005) (internal quotations and quotation marks omitted). To trigger the need for an EIS, a plaintiff need not show that significant effects will in fact occur; "raising substantial questions whether a project may have a significant effect is sufficient." *Id*. at 864-65 (internal quotations omitted). The effects that must be considered are both direct and indirect. 40 C.F.R. § 1508.8. Indirect effects are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." *Id*. at § 1508.8(b). Indirect effects include growth inducing effects. *Id*. "While 'foreseeing the unforeseeable' is not required, an agency must use its best efforts to find out all that it reasonably can." *City of Davis v. Coleman*, 521 F.2d 661, 676 (9th Cir. 1975).

[11] The agencies' first line of defense is that the project will not have growth-inducing effects on aviation activity. They contend that, according to their forecast, aviation activity at HIO is expected to increase at the same rate regardless of whether a new runway is built or not. And they repeatedly point out that the FAA's expertise in forecasting air transportation demand is an area where courts accord significant deference. *See City of Los Angeles v. F.A.A.*, 138 F.3d 806, 807-08 & n. 2 (9th Cir. 1998).

[12] The agencies cannot point to any documents in the record that actually discusses the impact of a third runway on aviation demand at HIO. Tellingly, the Aviation Demand Forecasts chapter of the HIO Master Plan does not even mention the number of runways at HIO in its almost 50 pages, although it recognizes that aviation demand is affected, among other factors, by "the nature of available facilities." In essence, the agencies would like this court to take their word for it and not question their conclusory assertions in the EA that a new runway would not increase demand. Their word, however, is not entitled to the significant deference that courts give aviation activity forecasts actually performed by the FAA.

[13] As part of the same strategy, the agencies contend that, while a new runway at a major hub airport might enable airlines to schedule an increased number of connecting flights, thus increasing demand, a new runway at a GA airport is unlikely to attract more private aircraft. The agencies do not explain why this is so and do not refer to anything in the record backing their contention. It strains credulity to claim that increasing HIO's capacity significantly, which in turn would decrease congestion and delay, would have no bearing on the decision of flight schools, the military, emergency medical services, and business and private owners over whether to locate their aircraft at HIO or at other, considerably less busy, GA airports in the area. Ironically, while the pilot survey used to support the HIO Master Plan inquired whether the pilots would consider the availability of rental car services and a restaurant in choosing HIO over other airports, it did not inquire whether they would consider a new runway when making that decision.[10]

[14] The agencies are correct to point out that this court has recognized that, "[w]hen it comes to airport runways, it is not necessarily true that 'if you build it, they will come.' " *Nat'l Parks & Conservation Ass'n v. U.S. Dept. of Transp.*, 222 F.3d 677, 680 (9th Cir. 2000).[11] But whether that is true

[10]The brief for the federal respondents states that "some new runways . . . could be aimed at attracting new flights or be at an airport where [attracting new flights] would be reasonably foreseeable . . . ." In light of the FAA's concession that a new runway may increase demand at certain airports, as well as the HIO Master Plan's consideration of various facilities, we disagree that "[s]uch a study would indeed serve little purpose." *Dissent* at 16299. The FAA's position in numerous other cases also belies the dissent's assertion. *See infra*, p.16288-89.

[11]The dissent relies on *Nat'l Parks & Conservation Association*, as well as *Seattle Community Council Fed'n v. F.A.A.*, 961 F.2d 829 (9th Cir. 1992), to state that "aviation demand is driven primarily by variables such

or not here, we do not know because the agencies failed to take the required "hard look," *Earth Island Inst.*, 351 F.3d at 1300, and failed to conduct a demand forecast based on three, rather than two runways at HIO.

The agencies contend that whether the project will result in increased demand is, in any event, irrelevant. Relying chiefly on two cases involving airport improvements—neither of which involved a new runway—they contend that the case

as location, general aviation trends, the 'demand of the flying public,' historical trends, and economic conditions, not the efficiency of the airport." *Id*.

The dissent's overgeneralization is without support in the two cases. *Nat'l Parks & Conservation Association* involved the extension of the runway at Kahalui Airport on Maui from 7,000 feet to 9,600 feet. *Id*. at 679. Petitioners contended that the project would increase the number of international arrivals, which in turn would result in introduction of more alien, non-indigenous, species into Maui. *See id*. The FAA conducted an EIS. *Id*. The EIS was "replete with data regarding the project's impact on international arrivals," much of which indicated that the project would result in no or little increased number of international arrivals. *See id.* at 680. This court noted "airport demand projections are little more than guesses that depend on economic conditions, airlines routing decisions and other variables." *Id*. It then went on to discuss the extensive specific projections for Kahalui and concluded that "[w]hen it comes to airport runways, it is not necessarily true that 'if you build it, they will come.' " *Id.* Properly read, *Nat'l Parks & Conservation Association* merely holds that, in Kahalui Airport's case and based on the extensive projections in the EIS, the lengthening of the runway would not result in a demand increase. *Nat'l Parks & Conservation Association* does not stand for the proposition that the "efficiency of the airport," *Dissent* at 16299, is irrelevant to demand.

The same is true for *Seattle Community Council Fed'n.* The opinion quotes the FAA's projected demand increase for Sea-Tac, which concluded that "[a]ny increase in the number of operations experienced at Sea-Tac will be the result of demand of the flying public, which the FAA does not control." 961 F.2d at 835. Neither the FAA's demand projections for Sea-Tac nor the *Seattle Community Council Fed'n* opinion itself claims to be a definitive treatise on projecting aviation demand, as the dissent makes them out to be.

law holds that an EA need not account for the growth-inducing effects of a project designed to alleviate current congestion (also referred to as secondary growth inducing effects). In *Seattle Community Council Fed'n v. F.A.A.*, 961 F.2d 829 (9th Cir. 1992), we held that remand to the FAA was unnecessary although the FAA did not consider the impacts of an expected increase in air traffic after changes in flight patterns were implemented. *Id.* at 835. To so hold, we relied on the fact that the project's stated purpose was "not to facilitate that expansion, but to ensure that safety and efficiency will be maintained," meaning that the project "deal[t] with the *existing air traffic*." *Id.* (emphasis in original). In *Morongo Band of Mission Indians*, we similarly held that the FAA did not have to consider the impacts of an increase in air traffic resulting from a new flight arrival path because "the project was implemented in order to deal with existing problems; the fact that it might also facilitate further growth is insufficient to constitute a growth-inducing impact under 40 C.F.R. § 1508.8(b)." 161 F.3d at 580.

Unlike the flight patterns and the flight arrival path at issue in *Morongo Band of Mission Indians* and *Seattle Community Council Federation*, this case involves a major ground capacity expansion project. In the words of the FAA itself, a new runway is "the most effective capacity-enhancing feature an airfield can provide." Accordingly, our cases have consistently noted that a new runway has a unique potential to spur demand, which sets it apart from other airport improvements, like changing flight patterns, improving a terminal, or adding a taxiway, which increase demand only marginally, if at all. *See, e.g.*, *Seattle Cmty. Council Fed'n*, 961 F.2d at 835 ("The proposed [flight patterns changes] do not enhance the ground capacity of Sea-Tac. There is no need to do so since there is existing ground capacity that is not fully used. This would be true even if the proposed procedures were put into effect."); *Ocean Advocates*, 402 F.3d at 870 ("*Morongo* and *Seattle Community Council Federation* are also distinguishable because neither case dealt with any change in ground capacity."); *City of Los Angeles,* 138 F.3d at 808 (terminal improvement project had no impact on demand; "runway capacity is important, the agency concedes, but not affected by this project"). *See also Town of Winthrop v. F.A.A.*, 535 F.3d 1, 5 (1st Cir. 2008) (noting FAA's argument that building a taxiway would not lead to an increase in flight activity because "airport capacity is primarily a factor of runway capacity, not taxiway capacity"); *City of Olmstead Falls, Ohio v. F.A.A.*, 292 F.3d 261, 272 (D.C. Cir. 2002) (giving deference to the FAA's judgment that improvement by moving a runway will not induce demand; "[h]ere the improvements are to move an *existing* runway, not the addition of a runway"). *Cf. Nat'l Parks & Conservation Ass'n*, 222 F.3d at 679-60 (EIS conducted for expansion project that would have lengthened runway in order to accommodate rising demand).[12]

[15] In light of this unique potential to create demand, the analysis in *Morongo Band of Mission Indians* and *Seattle Community Council Federation*—which focuses inflexibly on the stated purpose of a project while ignoring its growth inducing effect —is completely inadequate for cases involving the construction of additional runways. For such cases, a case-by-case approach is needed. Thus, even if the stated purpose of the project is to increase safety and efficiency, the agencies must analyze the impacts of the increased demand attributable to the additional runway as growth-inducing effects falling under the purview of 40 C.F.R. § 1508.8(b).

[16] We hold that *Morongo Band of Mission Indians* and *Seattle Community Council Federation* do not control here and conclude that remand is necessary for the FAA to consider the environmental impact of increased demand resulting

[12]The dissent conveniently ignores the FAA's consistent position in these cases and would treat additional runways just like any other airport efficiency improvement project. *See Dissent* at 16299-16301. In contrast, our "completely unsupported intuition about airports," Dissent at 16305, is clearly supported by the FAA.

from the HIO expansion project, if any, pursuant to 40 C.F.R. § 1508.8(b).

E. The Context and the Intensity of the Project

[17] Petitioners also contend that the "context" and "intensity" of the project independently require an EIS.

Determining whether an action "significantly" affects the quality of the human environment, 42 U.S.C. § 4332(2)(C), requires "considerations of both context and intensity." 40 C.F.R. § 1508.27. "Context" is the setting in which the agency's action takes place. *Nat'l Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 731 (9th Cir 2001), *abrogated on other grounds by Monsanto Co. v. Geertson Seed Farms*, 130 S. Ct. 2743, 2757 (2010). The significance of an action must

> be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole.

40 C.F.R. § 1508.27(a).

[18] Building a new runway at HIO is a site-specific project. Petitioners therefore argue that the agencies cannot dilute their analysis of environmental impacts by averaging out across the nation or the globe. More specifically, they contend that the EA is deficient because its analysis of greenhouse gases is not specific to the locale. But the effect of greenhouse gases on climate is a *global* problem; a discussion in terms of percentages is therefore adequate for greenhouse gas effects. *See* Climate Change Division, Office of Atmospheric Programs, U.S. Environmental Protection Agency, *Technical Support Document for Endangerment and Cause or Contrib-*

ute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3 (2009) (emphasizing the global nature of climate change due to greenhouse gases; explaining that "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.").

"Intensity" refers to the degree to which the agency action affects the locale and interests identified in the context part of the inquiry. *Nat'l Parks*, 241 F.3d at 731. The Council on Environmental Quality regulations provide ten factors under which intensity of a project is evaluated. *See* 40 C.F.R. § 1508.27(b). Any of these factors may be sufficient to require preparation of an EIS in appropriate circumstances. *Nat'l Parks*, 241 F.3d at 731.

Petitioners first argue that the project has both beneficial and adverse effects, *see* 40 C.F.R. § 1508.27(b)(1), and that it affects public health and safety, *see id*. § 1508.27(b)(2). This argument is premised on the contention, discussed at length above, that a new runway will cause an increase in demand, thereby increasing air pollution, noise, and risks of accidents. Any further discussion of this issue is superfluous.

Petitioners next argue that the project's effects are highly uncertain or involve unique or unknown risks. *See id*. § 1508.27(b)(5). An agency must generally prepare an EIS if the environmental effects of a proposed agency action are highly uncertain. *Native Ecosystems*, 428 F.3d at 1240 (internal quotations and quotation marks omitted). Preparation of an EIS is mandated "where uncertainty may be resolved by further collection of data, or where the collection of such data may prevent speculation on potential . . . effects." *Id*.

Relying on the FAA's statement in the EA that it is leading or participating in several projects intended to clarify the role that commercial aviation plays in climate change, petitioners argue that the project's greenhouse gas effects are highly uncertain. We disagree. First, there is ample evidence that there is a causal connection between man-made greenhouse gas emissions and global warming. *See Massachusetts v. E.P.A.*, 549 U.S. 497, 508-10, 521-23 (2007) (discussing state of the science); *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act*, 74 Fed. Reg. 66496-01, 2009 WL 4767932 (2009) (EPA findings regarding effects of greenhouse gases in the atmosphere, their effect on climate, and the public health and welfare risks and impacts associated with such climate change). Second, the EA includes estimates that global aircraft emissions account for about 3.5 percent of the total quantity of greenhouse gas from human activities and that U.S. aviation accounts for about 3 percent of total U.S. greenhouse gas emissions from human sources. Because HIO represents less than 1 percent of U.S. aviation activity, greenhouse emissions associated with existing and future aviation activity at HIO are expected to represent less than 0.03 percent of U.S.-based greenhouse gases. Because this percentage does not translate into locally-quantifiable environmental impacts given the global nature of climate change, the EA's discussion of the project's in terms of percentages is adequate. The project's effects are not highly uncertain.

Finally, petitioners argue that this case would establish precedent that an additional runway can be constructed without preparing an EIS. *See* 40 C.F.R. § 1508.27(b)(6). Although we share this concern, we are confident that our refusal to extend the rule of *Morongo* and *Seattle Community Council Federation* to new runways will ensure that proper consideration will be given to all effects of such a project, including its growth inducing impacts. Also, EAs are usually highly specific to the project and the locale, thus creating no binding precedent. *See Town of Cave Creek v. FAA*, 325 F.3d 320, 332 (D.C. Cir. 2003) (rejecting a similar 40 C.F.R. § 1508.27(b)(6) argument because the airspace redesign plans in the case were developed to address the particular circumstances and problems encountered in and around Phoenix Sky Harbor International Airport and that decision would create no binding precedent which would control the FAA's future use of EISs for similar projects). An EIS is not warranted on this basis alone.

F. Cumulative Effects

[19] We next address petitioners' argument that the discussion of cumulative effects in the EA is deficient because the agencies failed to consider the effects of two recent zoning changes impacting HIO.

An EA must fully assess the cumulative impacts of a project. *Te-Moak Tribe of Western Shoshone of Nevada v. U.S. Dept. of Interior*, 608 F.3d 592, 603 (9th Cir. 2010). A cumulative impact is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." 40 C.F.R. § 1508.7.

[20] In 2009, the City of Hillsboro approved two zoning changes that amended the Hillsboro Comprehensive Plan and the Hillsboro Zoning Ordinance to create two new zones, the Airport Use zone and the Airport Safety and Compatibility Overlay zone. *See Barnes v. City of Hillsboro*, Or. LUBA No. 2010-011 at 3-5 (June 30, 2010) (describing zoning changes), available at http://www.oregon.gov/LUBA/docs/Opinions/2010/06-10/10011.pdf. Petitioner Barnes challenged these zoning changes before the State of Oregon's Land Use Board of Appeals ("LUBA"). In June 2010, LUBA invalidated both zoning changes. *See id.* at 6-28. The Oregon Court of Appeals affirmed. *See Barnes v. City of Hillsboro*, 243 P.3d 139 (Or. Ct. App. 2010). It therefore appears that the two zoning changes would not be implemented. If so, the agencies' failure to consider them as part of its cumulative impacts analysis is harmless error. *See* 5 U.S.C. § 706 (in reviewing agency action, "due account shall be taken of the rule of prejudicial error."). *See also Nat'l Ass'n of Home Builders*, 551 U.S. at 659 (same).

II. Public Hearing Under the Airport and Airway Improvement Act

[21] We now turn our attention to petitioners' argument that the FAA failed to hold a public hearing consistent with 49 U.S.C. § 47106(c)(1)(A)(i).

Under the Airport and Airway Improvement Act, the Secretary of Transportation may not approve an application for "an airport development project involving the location of an airport or runway or a major runway extension" unless "the sponsor certifies to the Secretary that-(i) an opportunity for a public hearing was given to consider the economic, social, and environmental effects" of the project. *Id.*

[22] The statute does not define "public hearing." *See id*. The FAA, however, defines it in its internal policy documents as "a gathering under the direction of a designated hearing officer for the purpose of allowing interested parties to speak and hear about issues of concern to interested parties." FAA Order 5050.4B, *National Environmental Policy Act Implementing (NEPA) Instructions for Airport Projects* ¶ 403.a (2006). When the FAA published Order 5050.4B in the Federal Register, it declined to further define "public hearing," explaining:

> "Public hearing" is a term of art under 49 U.S.C. 47106(c)(1)(A)(I). . . . [The FAA's Office of Airports] recognizes that the most important aspects of a traditional, formal hearing are that a designated hearing officer controls the gathering and there is an accurate record of the major public concerns stated during the gathering. . . . [The FAA's Office of Air-

> ports] declines for the first time in this final Order to define the term public hearing for purposes of 49 U.S.C. 47106(c)(1)(A)(i) and NEPA, including whether a public hearing may take forms other than the traditional one.

National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, 71 Fed. Reg. 29014, 29032 (2006).

Petitioners focus their arguments on the definition in FAA Order 5050.4B, and do not argue that a public hearing, as the term is used in 49 U.S.C. § 47106(c)(1)(A)(i), is more encompassing than that definition.

The FAA's orders, as agency manuals without the force of law, are not afforded deference under *Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837 (1984). *Natural Res. Def. Council, Inc. v. F.A.A.*, 564 F.3d 549, 564 (2d Cir. 2009). The FAA's interpretation of "public hearing," however, may be entitled to deference pursuant to *Skidmore v. Swift & Co.*, 323 U.S. 134 (1944). *Id*. Under *Skidmore*, the weight courts accord an agency interpretation depends on "the thoroughness evident in [the agency's] consideration, the validity of its reasoning, its consistency with earlier and later pronouncements, and all those factors which give it power to persuade, if lacking power to control." *Id*. (quoting *Skidmore*, 323 U.S. at 140).

[23] We need not decide whether the FAA Order 5050.4B's definition of "public hearing" is entitled to *Skidmore* deference. Even if that definition applies, petitioners still cannot prevail. The record shows that the meeting had a designated hearing officer. The members of the public were invited to talk to project team members, who were available to answer their questions and get their feedback. The members of the public were also invited to visit the oral testimony area to provide their feedback. Twice during the two-hour meeting, the FAA made a presentation about the project and the EA.

Petitioners argue that the hearing was deficient because there was no exchange of ideas among the members of the public and no facilitation of such exchange by the hearing officer. But all FAA Order 5050.4B requires is that the gathering be under the direction of a designated hearing officer for the purpose of allowing the members of the public to "speak and hear" about the project. This much petitioners were afforded.

Relying on *City of South Pasadena v. Slater*, 56 F. Supp. 2d 1106 (C.D. Cal. 1999), petitioners also argue that an "open house" format—the terminology used by the agencies to characterize the format of the meeting—does not satisfy the requirements of a public hearing. In *City of South Pasadena*, the sponsors of a freeway extension project held an "open house" by opening a storefront for two weeks to facilitate the taking of comments from the public. *Id*. at 1132. The plaintiffs argued that the "open house" was not a "public hearing" as required by 23 U.S.C. § 128 and 23 C.F.R. § 771.111(h) (concerning federal-aid highway programs; "public hearing" not defined). The district court acknowledged that plaintiffs had not shown that a public hearing was required in the first instance. *Id*. It nevertheless went on to say:

> [I]n the event that a hearing was required, the plaintiffs have raised serious questions about whether the format of an open house is the equivalent of a public hearing. . . . Public hearings provide the community and the decisionmakers a forum for the free and contemporaneous exchange of ideas. It is a dynamic process which has at its core the idea that it is only through a public meeting that details and intricacies of controversies can be best explored and understood.

Id.

City of South Pasadena, of course, is not binding upon us. Furthermore, not only is the quoted statement dictum, it also lacks any supporting authority. Finally, *City of South Pasadena* concerned an "open house" very different in nature from the hearing petitioners were afforded here. The case is inapposite.

[24] Petitioners' arguments are unpersuasive. We therefore hold that the hearing afforded petitioners was a "public hearing" within the meaning of 49 U.S.C. § 47106 and FAA Order 5050.4B.

CONCLUSION

For the foregoing reasons, we GRANT the petition for review. We REMAND this case to the FAA with instructions to consider the environmental impact of increased demand resulting from the HIO expansion project, if any, pursuant to 40 C.F.R. § 1508.8(b).

GRANTED and REMANDED.

IKUTA, Circuit Judge, dissenting:

It is conventional wisdom among aviators that "when the weight of the paper equals the weight of the airplane, only then you can go flying." The majority confirms the truth of this quotation: here a federal agency is trying to reduce airport delays and the concomitant negative environmental effects by commencing a project in anticipation of future growth, and the majority sides with delay and air pollution by imposing pointless paperwork on the agency before the necessary project can go forward. Because the majority's approach is contrary to our case law and the facts, I dissent.

I

A new highway interchange, a new cargo port, and the expansion of the only bridge leading to an offshore island may all attract or facilitate development and thus have "growth inducing effects" under NEPA, 40 C.F.R. § 1508.8(b). *See City of Davis v. Coleman*, 521 F.2d 661, 674-76 (9th Cir. 1975); *Sierra Club v. Marsh*, 769 F.2d 868, 878-89 (1st Cir. 1985); *Mullin v. Skinner*, 756 F. Supp. 904, 917-21 (E.D. N.C. 1990). Does expanding an existing airport have such an effect? Our case law, based on the informed input of the airport experts, says it does not. *See Morongo Band of Mission Indians v. F.A.A.*, 161 F.3d 569, 580 (9th Cir. 1998); *Seattle Cmty. Council Fed'n v. F.A.A.*, 961 F.2d 829, 835-36 (9th Cir. 1992); *see also Nat'l Parks & Conservation Ass'n v. U.S. Dep't of Transp.*, 222 F.3d 677, 680 (9th Cir. 2000); *City of Los Angeles v. F.A.A.*, 138 F.3d 806, 807-08 (9th Cir. 1998).

We have reached this conclusion for several reasons. Most important, airports are expanded to avoid the negative effects that occur when the increasing demand for an airport based on *existing conditions* swamps that airport's capacity, leading to increased delays and the environmental impacts such delays cause. *See Morongo Band of Mission Indians*, 161 F.3d at 572; *Seattle Cmty. Council Fed'n*, 961 F.2d at 835. In other words, before expanding an airport, the FAA engages in a complex process to project growth in demand, and plans the expansion to meet that growth. The goal is to prevent the airport from operating above its annual service volume (ASV), because when "demand reaches capacity, delays increase exponentially." More delays mean that airplanes will have to idle longer before taking off and circle longer before landing, which in turn leads to increased air emissions in the neighboring areas. It would be illogical to hold that after completing a study to determine future demand, and proposing a fix to avoid the negative impacts caused by the anticipated growth in demand, the FAA must then turn around and complete another study to determine whether the fix itself could possibly cause *additional* future demand. Where would this end? Thus, a leading NEPA treatise explains: "[A]n impact statement need not discuss growth-inducing impacts when a highway or other project is planned only to meet *existing needs*." Daniel R. Mandelker, *NEPA Law & Litigation*, § 8.41 (2d ed. 2010) (emphasis added).[1] Such a study would indeed serve little purpose, given that aviation demand is driven primarily by variables such as location, general aviation trends, the "demand of the flying public," historical trends, and economic conditions, rather than the efficiency of the airport. *See Seattle Cmty. Council Fed'n*, 961 F.2d at 835; *Nat'l Parks & Conservation Ass'n*, 222 F.3d at 680. Thus we have said, "[w]hen it comes to airport runways, it is not necessarily true that 'if you build it, they will come.' " *Nat'l Parks & Conservation Ass'n*, 222 F.3d at 680 *(quoting City of Los Angeles*, 138 F.3d at 807).

Applying this approach in *Seattle Community Council Federation*, we rejected the petitioner's argument that the FAA should have considered the potential for increased air traffic due to the project's improvements to the flight patterns of aircraft departing from and arriving at Seattle-Tacoma International Airport. 961 F.2d at 831. We explained that any material increase in air traffic would be due to existing trends, not due to the project itself. *See id.* at 835 (noting that "the volume of traffic at Sea-Tac will continue to increase" due to "the operational trend of the past three years and the population increase in the metropolitan area"). Indeed, these existing growth trends were the "impetus for proposing" the project in the first place. *Id.* Because the proposed changes "would sim-

[1]For the sake of its argument on appeal, the FAA entertained the counterfactual that a runway built for the very purpose of attracting new flights (or under other hypothetical circumstances not present in this case) "might require examining the impact of those new flights." Such a rhetorical device is scarcely a "concession that a new runway may increase demand at certain airports." Maj. op. at 16286 n.10.

ply accommodate the *existing* demand for landing and departing Sea-Tac more efficiently, thereby reducing delays," we concluded that the environmental "effects of [the potential] increased number of flights" were not "growth inducing effects" that needed to be considered under 40 C.F.R. § 1508.8(b). *Id.* at 835-36.

We applied the rule again in *Morongo Band of Mission Indians*, where the petitioner claimed that the "FAA improperly failed to consider the 'growth-inducing' impact" of a project which, by virtue of making the airport run more efficiently, would also remove "a constraint to growth." 161 F.3d at 580. Because "the project was implemented in order to deal with existing problems," we held that "the fact that it might also facilitate further growth is insufficient to constitute a growth-inducing impact under 40 C.F.R. § 1508.8(b)." *Id.* Therefore, the FAA did not violate NEPA in failing to include in the EA an analysis of what additional demand (if any) might be induced by the project. *See id.*; *cf. City of Carmel-by-the-Sea v. U.S. Dep't of Transp.*, 123 F.3d 1142, 1162 (9th Cir. 1997) (reasoning that any growth-inducing effect of the project would be "limited" because "Carmel is [already] a well developed area, and . . . it is the *existing* development that necessitates the freeway" (emphasis added)).

The FAA and the Port followed exactly this approach here. In 2005, Hillsboro Airport (HIO) was already operating above its ASV. That year, the Port started the process of developing a Master Plan that "evaluates the airport's capabilities and role, forecasts future aviation demand, and plans for the timely development of new or expanded facilities that may be required to meet that demand." The Master Plan included a comprehensive forecast of aviation activity at HIO through 2025. Taking into account factors such as "national and regional aviation trends, historical and forecast socioeconomic and demographic information of the area, and historical trends" at HIO for different types of aircraft, the Master Plan projected that aviation demand would continue to grow such that, by 2025, HIO would be operating at 146% of its ASV, with an average delay of 6.0 minutes per aircraft operation. This additional congestion and delay would lead to further increases in the airport's idle emissions. After examining a number of alternatives, the Master Plan concluded that the "best means available for reducing delays and the undesirable conditions that occur due to delay" over the next 20 years would be to add "a runway [at HIO] for use by small general aviation aircraft exclusively."

The EA for the runway project relied on and adopted the Master Plan's forecast of activity levels through 2025. As noted in the EA, the Port had conceived of and designed the runway project for the very purpose of meeting these forecasted needs, which were "expected to substantially exceed the ASV of the current airfield, with increasing levels of unnecessary congestion and delay corresponding to the increased demand." Thus the record shows that the HIO project will lessen the environmental impacts of the demand pressure at the airport. Nothing in the record suggests the project will have any effect in increasing demand. Given this record, our caselaw, and the FAA's expertise, there is no basis for concluding that the EA was deficient in not addressing the question whether the HIO project would have growth-inducing effects above and beyond the existing demand curve.

II

But that is not even an issue raised by this case, because the petitioners waived it. No petitioner raised a "growth-inducing effects" issue in a way that "alert[ed] the agency to the [parties'] position and contentions," *Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 764 (2004) (quoting *Vermont Yankee Nuclear Power Corp. v. Natural Res. Def. Council, Inc.*, 435 U.S. 519, 553 (1978)), such that the agency had an opportunity to "give the issue meaningful consideration," *id.* To be clear, the issue here is not simply that use of the airport will continue to increase, creating more noise and traffic. The record establishes that this will happen in any event, and indeed, the pollution and environmental problems will be worse without the addition of a third runway. Rather, the "growth-inducing effects" issue is whether the addition of a third runway will increase the use of the airport beyond the anticipated increase based on existing conditions that was predicted by the Master Plan and was to be addressed by the project. Nothing in the record shows any of the petitioners raising *that* issue.

In claiming otherwise, the majority relies solely on a letter by petitioner Ackley during the public comment process. But the entire thrust of Ackley's letter is to complain about the noise that is caused by air traffic.[2] He began with the complaint that "we live near the approach pattern to the present runway and the air traffic can be loud and distracting," and then continued with a lengthy discussion of "[t]he adverse

[2]In full, Ackley's letter said:

> We are opposed to a third runway at Hillsboro because such a development would adversely affect our property value and our quality of life. We live near the approach pattern to the present runway and the air traffic can be loud and distracting. Increased air traffic will affect our quality of life and the value of our property should we wish to sell it. This is not only our opinion but scientific studies document these affects as well.
>
> The adverse effect of air traffic noise on property values has been well documented by over 20 different scientific studies. A meta-analysis of those studies found that, "Stated differently, under these same circumstances, a $200,000 house would sell for $20,000 to $24,000 less" (from A meta-analysis of airport noise and hedonic property values: Problems and prospects By Jon P. Nelson, Department of Economics, Pennsylvania State University). A conclusion like the above from a meta-analysis is a very powerful statement because the study considers other valid studies from metropolitan airports around our country.
>
> Therefore, in the face of valid scientific research and the in name of property owners near the Hillsboro airport, we urge you to discontinue study of the third runway option for the Hillsboro Airport.

effect of air traffic noise on property values." In the midst of this discussion, he wrote the one sentence on which the majority hangs its entire argument: "Increased air traffic will affect our quality of life and the value of our property should we wish to sell it." In context, it is clear that Ackley is complaining about the noise caused by the ever increasing use of the airport, a topic the EA discusses at length. The letter's inclusion of the three words "increased air traffic" cannot be deemed to have put the FAA on notice that Ackley was complaining about the growth-inducing effects of the third runway *beyond* the growth that would be caused by current conditions. Even the most enlightened bureaucrat reading Ackley's letter could not possibly draw such an inference. Indeed, the majority's argument that the FAA should have known that these three words were raising the "growth-inducing effect" claim blurs into the majority's "so obvious" argument; in effect, the majority contends that in light of the "obvious" growth-inducing effect of a third runway, Ackley's three words in a complaint about air traffic noise should have alerted the FAA that he was making such a claim.

But the majority's "so obvious" argument likewise fails for a simple reason. It was not obvious that the HIO project would have growth-inducing effects, particularly since we have held exactly the opposite: when projects are designed to accommodate existing and projected demand, the FAA has no obligation to analyze the possibility that addressing these demands will also lead to a further increase in demand. *See Seattle Cmty. Council Fed'n*, 961 F.2d at 836. In fact, in the only case where we have addressed a runway project, we deferred to the FAA's determination that the project would have "*no or little lasting long-term growth-inducing impact*," despite the petitioners' arguments that, had the FAA "taken a harder look, it would have concluded that the project's alien species impact [would] be significant." *Nat'l Parks & Conservation Ass'n*, 222 F.3d at 680.

Nor does the majority have any basis for countering our longstanding conclusion that airport projects do not have a growth-inducing effect. Indeed, nothing in the record suggests that the mere four- to five-minute time savings that will be occasioned by the addition of the third runway will cause a significant increase in demand. In fact, the only basis for the majority's "so obvious" conclusion is its own conclusory statement that runways should be considered "unique" in their "potential to spur demand." Maj. op. at 16288. Given our deference to agency expertise, we cannot rely on such unsupported conclusions.

The majority's assertion that the FAA "had independent knowledge that the HIO expansion project would cause an increase in aircraft activity," Maj. op. at 16279, is likewise contrary to the record. Although the majority combs through the record, it can point to only two comments (a question in an e-mail and a statement in a preliminary scope of work document) that even arguably relate to the issue of demand induced by the runway project itself. *See* Maj. op. at 16279-80. All this shows is that two employees at the FAA gave preliminary thought to the possibility of demand being induced by the runway project at the beginning of the administrative process, but the FAA (presumably informed by our case law and its own experts) determined that the issue did not need to be addressed in the EA. Such early considerations by an agency, which are resolved and never appear in the final, official document, cannot color our analysis of whether a particular impact is obvious. *See Nat'l Ass'n of Home Builders v. Defenders of Wildlife*, 551 U.S. 644, 659 (2007) ("[T]he fact that a preliminary determination by a local agency representative is later overruled at a higher level within the agency does not render the decisionmaking process arbitrary and capricious."); *Butte Envtl. Council v. U.S. Army Corps of Eng'rs*, 620 F.3d 936, 946 (9th Cir. 2010) (stating that "[a]gencies are entitled to change their minds" and this means the review process is working "just as it should"). In other words, the fact that a couple of FAA employees made the same mistake as the majority does about the impact of an airport project (a mistake that was later corrected in the agency's review process) is not evidence that the HIO project will cause an increase in demand, let alone that the FAA failed to address an "obvious" issue.

In sum, the FAA did not err in not addressing the question whether the third runway would have an additional growth-inducing effect. In holding otherwise, the majority ignores the deference we owe to agency decisionmaking and substitutes its own completely unsupported intuition about airports. I dissent.

Appendix B – Unconstrained Forecasts

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Leigh | Fisher
Management Consultants

TECHNICAL MEMORANDUM

AVIATION DEMAND FORECASTS

Portland Hillsboro Airport

Prepared for

Port of Portland
Portland, Oregon

October 2012

PORT OF PORTLAND

Leigh | Fisher
Management Consultants

TECHNICAL MEMORANDUM

AVIATION DEMAND FORECASTS

Portland Hillsboro Airport

Prepared for

Port of Portland
Portland, Oregon

October 2012

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Chapter 1.

INTRODUCTION AND SUMMARY

This technical memorandum presents forecasts of aviation activity for Portland Hillsboro Airport (the Airport, or Hillsboro, or HIO) that update previous forecasts prepared for the 2005 Master Plan Update and used for the Hillsboro Airport Parallel Runway 12L/30R Environmental Assessment (EA). The forecasts presented in this memorandum are unconstrained and, therefore, do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. The unconstrained forecasts are the "preferred" forecasts recommended for FAA approval. Forecasts of aviation activity are presented for aircraft operations and based aircraft. Using calendar year 2011 as the base year, annual forecasts were prepared for four future demand years—2016, 2021, 2026, and 2031.

MASTER PLAN UPDATE FORECASTS

The 2005 Master Plan evaluated several industry standard approaches to aviation forecasts, including a linear trend line based on national general aviation trends; regression analyses based on Portland Metropolitan population, personal income, and employment trends; the constant share of U.S. active aircraft at HIO; the constant share of Washington County registered aircraft; and the FAA Terminal Area Forecast (TAF). Based on these forecast approaches, the Port developed a "Selected Planning Forecast" that was approved by the FAA for use in the Master Plan.

ROLE OF THE AIRPORT

Portland Hillsboro Airport is the busiest general aviation airport in Oregon, in terms of total aircraft operations, and is a general aviation reliever airport for Portland International Airport (PDX), as designated by the Federal Aviation Administration (FAA) in the National Plan of Integrated Airport Systems (NPIAS).* In addition to serving as a general aviation reliever airport to PDX, Hillsboro is also home to a flight training school for helicopter and fixed-wing aircraft, the corporate aviation facilities of major Portland companies, air ambulance services, four fixed base operators, and a classic aircraft aviation museum.

*U.S. Department of Transportation, Federation Aviation Administration, *Report to Congress on the National Plan of Integrated Airport Systems, 2011-2015*, September 2010. An excerpt from this report describes the role of a general aviation airport: "Due to different operating requirements between small general aviation aircraft and large commercial aircraft, general aviation pilots often find using a congested commercial service airport can be difficult. In recognition of this, FAA has encouraged the development of high capacity general aviation airports in major metropolitan areas. These specialized airports, called relievers, provide pilots with attractive alternatives to using congested hub airports. They also provide general aviation access to the surrounding area."

FORECAST PROCESS AND APPROACH

According to FAA guidance, "forecast methods used to project airport activity should reflect the underlying causal relationships that drive aviation activity. Aviation activity levels result from the interaction of demand and supply factors. The demand for aviation is largely a function of demographic and economic activity. Supply factors that influence activity levels include cost, competition, and regulations."** Although forecast methods differ by type of aviation activity, FAA guidance states that "general aviation activity is largely determined by local population and income levels, the cost of flying, and the number of based aircraft at the airport."

The standard approach for preparing aviation demand forecasts, as described in FAA guidance, includes the following key steps:

1. Identify aviation activity parameters and measures to forecast
2. Collect and review previous airport forecasts
3. Gather data (i.e., determine data requirements, identify data sources, collect and evaluate historical and forecast data)
4. Select forecast methods
5. Apply forecast methods and evaluate results
6. Summarize and document results
7. Compare airport planning forecast results with the FAA's Terminal Area Forecast (TAF) for the Airport

The HIO unconstrained forecasts were prepared using the standard approach described in FAA guidance and incorporated a collaborative process which included:

1. Review of the FAA 2011 TAF for the Airport and the other airports in the Portland region

2. Collection and analysis of data related to the key issues and trends affecting future aviation demand at the Airport and the Portland region

3. Development of statistical models to identify historical causal factors

4. Analysis of general aviation activity for the airports in the Portland region

5. Coordination with representatives of the Port of Portland and the FAA

The approach used in developing forecasts for the Airport included consideration of the Airport service region and the role of the Airport and the other airports in the Portland region in accommodating general aviation activity.

**U.S. Department of Transportation, Federation Aviation Administration, Office of Aviation Policy and Plans Statistics and Forecast Branch (APO-110), "Forecasting Aviation Activity by Airport," July 2001.

UNCONSTRAINED DEMAND FORECASTS

Unconstrained demand forecasts were developed using a variety of analytical tools, including trend analysis, regression models, and market share analysis, to address local and itinerant aviation activity and the Airport's share of total regional demand. Recent and forecast general aviation trends in the nation as a whole were also considered. The unconstrained forecasts were based on market conditions and do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. Similarly, the FAA TAF for individual airports "assumes an unconstrained demand for aviation services (i.e., an airport's forecast is developed independent of the ability of the airport and the air traffic control system to supply the capacity required to meet the demand.)" Therefore, the unconstrained forecasts for HIO are the "preferred" forecasts recommended for FAA approval and used as a basis for comparison with the FAA 2011 TAF for HIO presented in Chapter 6, "Comparison with the FAA 2011 TAF."

Aircraft Operation Forecasts

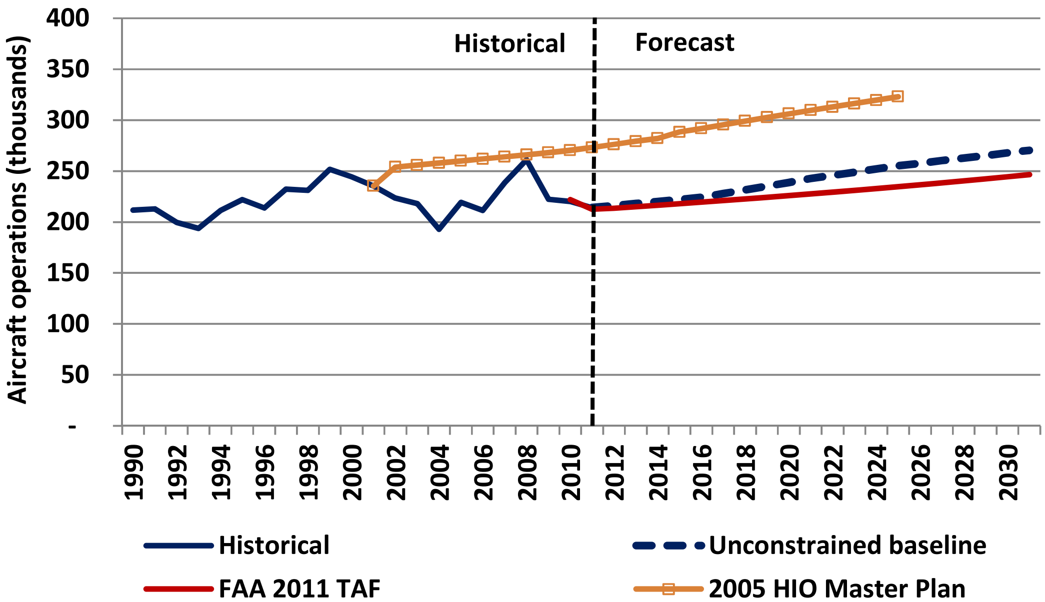
Figure 1-1 presents historical total aircraft operations for 1990 through 2011 and forecasts for 2012 through 2031, compared with the FAA 2011 TAF for the Airport. (Total aircraft operations include air carrier, air taxi and commuter, general aviation, and military takeoffs and landings.) The HIO forecasts are based on 2011 data and are within 2.2% of the FAA 2011 TAF in 2016 and 6.6% in 2021*. The aircraft operations average growth rate of 1.2% per year between 2011 and 2031 in the unconstrained forecast is higher than the rate forecast by the FAA in its 2011 TAF for the Airport—an average of 0.7% per year from Federal Fiscal Year (FFY) 2011 to FFY 2031.** A detailed comparison of the aircraft operations forecasts and the FAA 2011 TAF is presented in Chapter 6.

---

*U.S. Department of Transportation, Federal Aviation Administration, *Forecasting Aviation Activity by Airport*, July 2001, and Review and Approval of Aviation Forecasts, June 2008, http://www.faa.gov. "For all classes of airports, forecasts for total enplanements, based aircraft, and total operations are considered consistent with the TAF if they meet the following criterion: Forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period."

**The Federal Fiscal Year begins on October 1 and ends on September 30.

Figure 1-1
HISTORICAL AND FORECAST TOTAL AIRCRAFT OPERATIONS
Portland Hillsboro Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

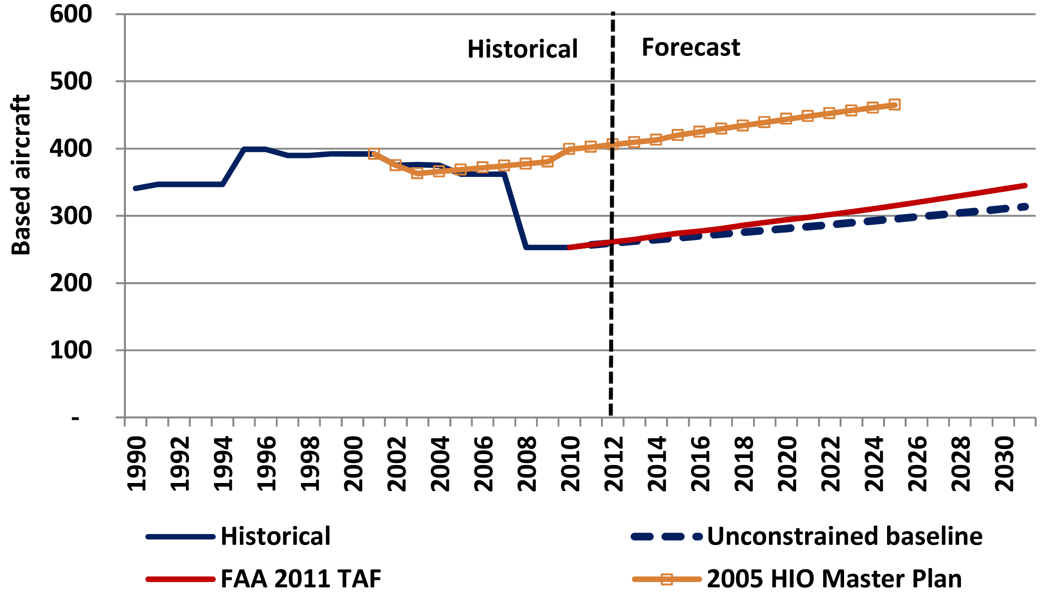
Source: Historical: Port of Portland records and Federal Aviation Administration, Air Traffic Activity System (ATADS), online database, and Terminal Area Forecasts, www.faa.gov, accessed January 2012. Forecast: LeighFisher, May 2012.

Based Aircraft Forecasts

Figure 1-2 presents historical based aircraft for 1990 through 2011 and forecasts for 2012 through 2031, compared with the FAA 2011 TAF for the Airport.* It is important to note that the decrease in based aircraft in 2007 is related to a change in the FAA's reporting methodology for based aircraft rather than a decrease in market demand. The based aircraft forecasts are based on a 2011 estimate and are within 2.5% of the FAA 2011 TAF in 2016 and 4.7% in 2021. The forecast average growth rate in based aircraft of 1.0% per year between 2011 and 2031 in the unconstrained forecast is lower than the rate forecast by the FAA in its 2011 TAF for the Airport—an average of 1.5% per year from FFY 2011 to FFY 2031. A detailed comparison of the based aircraft forecasts and the FAA 2011 TAF is presented in Chapter 6.

*As defined by the FAA as part of its National Based Aircraft Inventory Program, "a based aircraft at your facility is an aircraft that is operational & air worthy, which is typically based at your facility for a MAJORITY of the year." In 2007, the FAA instituted a new methodology for maintaining based aircraft counts which includes validating aircraft tail numbers with aircraft registration lists and eliminating duplicate records and aircraft that do not typically have tail numbers such as ultra-lights and experimental aircraft. www.basedaircraft.com

Figure 1-2
HISTORICAL AND FORECAST BASED AIRCRAFT
Portland Hillsboro Airport



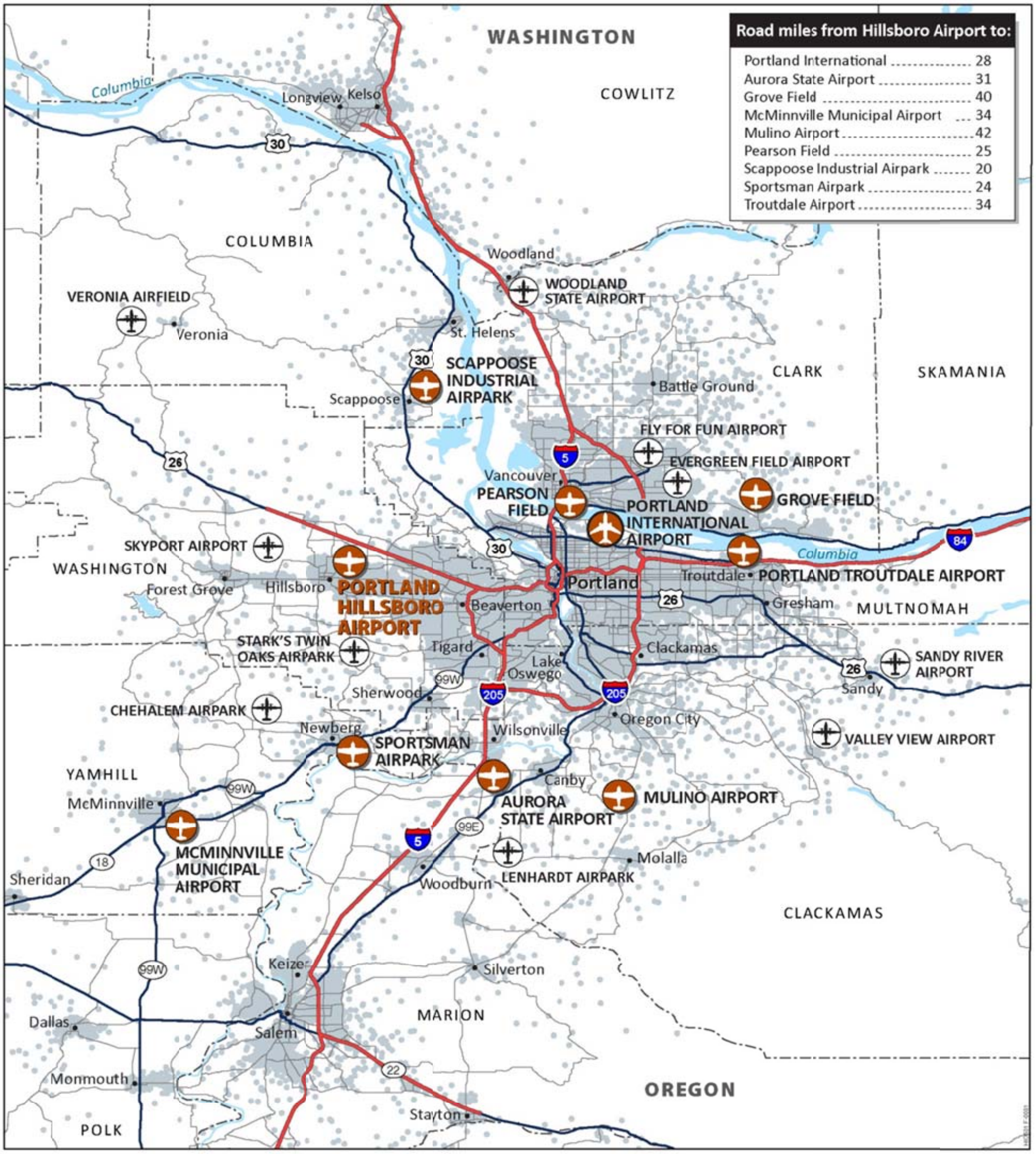
Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Source: Historical: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.
Forecast: LeighFisher, May 2012.

AIRPORT SERVICE REGION

Airport service regions for all classes of airports are defined both in terms of population and geography. For general aviation airports, the airport service region is also defined by the proximity of other general aviation airports and the availability and cost of facilities provided for owners and operators of general aviation aircraft including hangars, tie-downs, fuel, and fixed base operator services. In addition, the use of general aviation airports may also be related to the proximity to an aircraft owner's home or place of business; or for transient aircraft users, the proximity to their destination. As a result, the boundaries of a general aviation airport service region are difficult to define and are not necessarily consistent with the boundaries for counties or metropolitan statistical areas.

Figure 1-3 presents the population densities of the Portland region based on the 2010 U.S. Census relative to the location of Portland Hillsboro Airport and the other general aviation airports in the Portland region, including airports with FAA TAFs and all other general aviation airports. Using HIO as a base, each of the other nine airports with FAA TAFs is within 50 road miles of the Airport.



LEGEND

Airport with FAA 2011 TAF

Other general aviation airport

Population density: 1 dot equals 100 people

Major highways

County boundary

Source: U.S. Census Bureau, 2010 Census data.

Figure 1-3
AIRPORT SERVICE REGION
Portland Hillsboro Airport
October 2012

LeighFisher
Management Consultants

Data for the Portland-Vancouver-Hillsboro Metropolitan Statistical Area (or Portland MSA) are used to represent economic growth and activity that stimulates aviation demand at the Airport. Data for the Portland MSA not only reflect the demand generated in the immediate vicinity of the Airport and throughout Washington County but also demand from other counties in the Portland MSA and visitors from outside the Portland region who conduct businesses throughout the Portland MSA. As shown in Table 1-1, the population of the Portland MSA was 2.2 million in 2010, with Washington County accounting for 23.8% of the total.

Table 1-1
AIRPORT SERVICE REGION POPULATION

State/County	2010 Population	Percent of total
Portland-Vancouver-Hillsboro MSA		
Oregon		
Multnomah	735,334	33.0%
Washington	529,710	23.8
Clackamas	375,992	16.9
Yamhill	99,193	4.5
Columbia	49,351	2.2
	1,789,580	80.4%
Washington		
Clark	425,363	19.1%
Skamania	11,066	0.5
	436,429	19.6%
Total	2,226,009	100.0%

Source: U.S. Department of Commerce Bureau of the Census, www.census.gov, accessed February 2012.

Chapter 2.

ECONOMIC BASIS FOR AVIATION DEMAND

The economy of the Portland MSA is an important determinant of long-term aviation demand at the Airport. Generally, regions with large populations, high levels of employment, and high average per capita incomes will generate strong aviation demand. The demographics and economy of the region—as measured by changes in population, employment, and per capita income—as well as the cost of aviation fuel—are typically the most important factors affecting general aviation demand.

The following sections present a discussion of the economic basis for aviation demand at the Airport—the historical population, nonagricultural employment, and per capita income of the Portland MSA—as well as a listing of the largest employers in the Portland region. In addition, a summary of the historical and forecast trends in the price of aviation fuel is provided.

SOCIOECONOMIC TRENDS

Table 2-1 presents comparative trends in population, nonagricultural employment, and per capita personal income in the Portland MSA, the State of Oregon, and the United States in 1990 and from 2000 through 2011. Projections are also presented for 2016, 2021, 2026, and 2031.

Population

Historically, population growth in the Portland MSA and the State has exceeded that in the nation. From 1990 to 2010, population in the Portland MSA increased an average of 1.9% per year, compared with an average increase of 1.5% per year in the State and 1.1% per year in the nation. Population growth in the Portland MSA is projected to increase an average of 1.5% per year between 2011 and 2031, with stronger growth in the near-term—an average increase of 2.0% per year between 2010 and 2016.

Nonagricultural Employment

From 1990 to 2010, nonagricultural employment in the Portland MSA and the State increased an average of 1.4% and 1.2% per year, respectively, faster than that for the nation (an average of 0.9% per year). Since 2000, nonagricultural employment in the Portland MSA has decreased an average of 0.1% per year—similar to trends in the State and the nation, reflecting the effects of the national economic recessions in 2001 and 2008. Economic recovery in the Portland MSA began in 2011 with a 1.1% increase in nonagricultural employment. Nonagricultural employment in the Portland MSA is projected to increase an average of 1.8% per year between 2011 and 2031, with stronger growth in the near-term—an average increase of 2.2% per year between 2010 and 2016.

Table 2-1
HISTORICAL AND PROJECTED SOCIOECONOMIC DATA

	Population (thousands)			Nonagricultural employment (thousands)			Per capita personal income in 2000 dollars		
	Portland MSA	State of Oregon	United States	Portland MSA	State of Oregon	United States	Portland MSA	State of Oregon	United States
Historical									
1990	1,524	2,860	248,718	730	1,256	109,487	26,350	23,577	25,499
2000	1,928	3,431	281,425	973	1,618	131,785	32,779	28,728	30,319
2001	1,971	3,470	284,969	966	1,606	131,826	32,159	28,441	30,295
2002	2,003	3,503	287,625	944	1,585	130,341	31,562	28,522	30,134
2003	2,024	3,539	290,108	934	1,574	129,999	31,390	28,621	30,224
2004	2,039	3,579	292,805	954	1,607	131,435	31,497	28,852	30,911
2005	2,067	3,627	295,517	984	1,655	133,703	31,626	28,706	31,259
2006	2,103	3,685	298,380	1,015	1,704	136,086	32,493	29,645	32,223
2007	2,138	3,793	301,231	1,035	1,731	137,598	32,745	29,857	32,810
2008	2,173	3,784	304,094	1,034	1,718	136,790	32,293	29,912	32,750
2009	2,207	3,816	306,772	974	1,613	130,807	31,469	28,551	31,180
2010	2,226	3,837	308,746	966	1,600	129,874	32,054	28,767	31,545
2011	2,263	3,857	311,592	976	1,624	131,358	n.a.	n.a.	n.a.
Projected									
2016	2,492	4,075	326,873	1,086	1,764	140,119	34,571	30,699	34,406
2021	2,679	4,311	343,080	1,118	1,890	149,817	38,380	32,860	37,020
2026	2,852	4,550	359,482	1,284	2,022	160,186	41,584	35,464	40,126
2031	3,019	4,788	365,768	1,385	2,164	171,273	45,144	38,506	43,733
	Average annual percent increase (decrease)								
Historical									
1990-2000	2.4%	1.8%	1.2%	2.9%	2.6%	1.9%	2.2%	2.0%	1.7%
2000-2010	1.4	1.1	0.9	(0.1)	(0.1)	(0.1)	(0.2)	0.0	0.4
1990-2010	1.9	1.5	1.1	1.4	1.2	0.9	1.0	1.0	1.1
2010-2011	1.6	0.5	0.9	1.1	1.5	1.1	n.a.	n.a.	n.a.
Projected									
2011-2016	2.0%	1.1%	1.0%	2.2%	1.7%	1.3%	1.3%	1.1%	1.5%
2016-2021	1.5	1.1	1.0	1.8	1.4	1.3	2.1	1.4	1.5
2021-2026	1.3	1.1	0.9	1.6	1.4	1.3	1.6	1.5	1.6
2026-2031	1.1	1.0	0.9	1.5	1.4	1.3	1.7	1.7	1.7
2011-2031	1.5	1.1	0.9	1.8	1.4	1.3	1.6	1.4	1.6

Note: The Portland MSA consists of Clackamas, Columbia, Multnomah, Washington, and Yamhill counties in Oregon and Clark and Skamania counties in Washington.
The base year for the aviation demand forecasts is 2011.
n.a. = not available

Sources: Historical: U.S. Department of Commerce, Bureau of the Census, www.census.gov; U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov; U.S. Department of Commerce, Bureau of Economic Analysis, Regional Accounts Data, www.bea.gov.
Projected: Metro Data Resource Center, *Regional Population and Employment Range Forecasts, 20 and 50 year,* April 2009 draft and Woods & Poole, *Economic and Demographic Projections*, 2012.

Personal Income

From 1990 to 2010, per capita personal income in the Portland MSA and the State increased an average of 1.0% per year, slightly slower than that the nation (an average of 1.1% per year). Since 2000, per capita income in the Portland MSA has decreased slightly (an average decrease of 0.2% per year), compared with no growth in the State and an average increase of 0.4% in the nation. In 2010, per capita income in the Portland MSA exceeded that for the State and the nation. Per capita personal income in the Portland MSA is projected to increase an average of 1.6% per year between 2010 and 2031.

Major Employers

Table 2-2 lists the largest employers in the Portland MSA by number of employees in 2010, illustrating the diversity of the MSA's economy. Five of the listed employers are Fortune 500 companies, and 17 employers are headquartered in the Portland MSA.

PRICE OF AVIATION FUEL

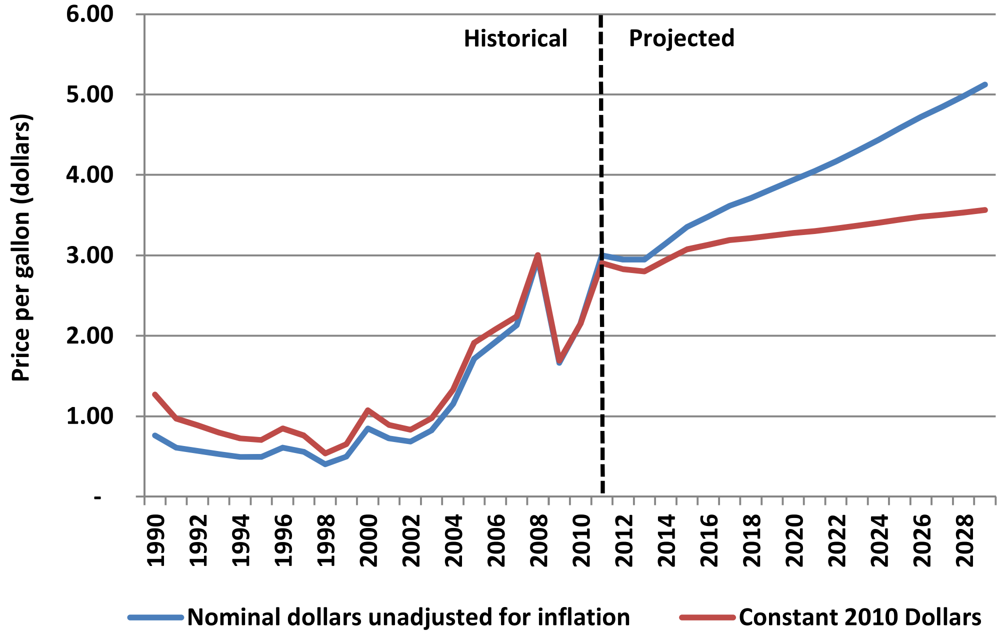
In recent years, the price of aviation fuel has had a significant impact on aviation demand. As shown in Figure 2-1, the price of aviation jet fuel per gallon (in nominal dollars unadjusted for inflation) increased from $0.76 in 1990 to $3.00 in 2011, an average increase of 6.7% per year, with the largest increases occurring between 2003 and 2008 (an average increase of 29.0% per year). In constant 2010 dollars, the price of aviation jet fuel increased an average of 4.0% per year between 1990 and 2011, faster than the 2.6% per year increase in inflation as measured by the Consumer Price Index.

Projections of the price of aviation jet fuel prepared by the U.S. Department of Energy are for an average increase of 3.0% per year between 2011 and 2029 (in nominal dollars unadjusted for inflation), reaching more than $5.00 per gallon in 2029.

ECONOMIC BASIS FOR FORECAST AVIATION DEMAND

The economic outlook for the United States, the State of Oregon, and the Portland MSA form a basis for anticipated growth in aviation demand at the Airport. Employment and income projections for the Portland MSA and the State of Oregon are for continued economic growth. Factors expected to contribute to economic growth in the Portland MSA and associated increases in aviation demand include: (1) the diversity in the economic base, which lessens its vulnerability to weaknesses in particular industry sectors, (2) growth in the existing and emerging Portland MSA industry sectors, (3) an educated labor force able to support the development of knowledge-based and service industries, and (4) continued reinvestment to support the business development. This outlook is reflected in the aviation demand forecasts presented in Chapter 6, "Aviation Demand Forecasts."

Figure 2-1
HISTORICAL AND PROJECTED AVIATION JET FUEL PRICES



Note: U.S. Gulf Coast Kerosene-Type Jet Fuel Spot Price FOB (Dollars per Gallon).

Source: U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2012 Early Release*, Reference Case, January 2012, www.eia.gov, accessed February 2012.

Table 2-2
LARGEST EMPLOYERS IN THE PORTLAND MSA
2010

Rank	Company	Headquartered in Portland Region	Fortune 500 Company	Principal industry	Number of employees
1	Intel Corp.		✓	Computer products	15,141
2	Providence Health System			Health care	13,825
3	Oregon Health & Science University	✓		Hospital and university	12,700
4	Fred Meyer Stores			Retail merchandising	9,630
5	Kaiser Foundation Health Plan of the Northwest			Health care	8,759
6	Legacy Health System	✓		Nonprofit health care	8,251
7	Nike Inc.	✓	✓	Athletic equipment	7,000
8	City of Portland	✓		Municipal government	6,900
9	Multnomah County.			Municipal government	6,659
10	Wells Fargo		✓	Financial institution	5,010
11	Beaverton School District	✓		Education	5,000
12	Portland School District	✓		Education	4,900
13	U.S. Bank		✓	Financial institution	3,948
14	Vancouver School District	✓		Education	3,697
15	Portland State University	✓		College	3,503
16	Southwest Washington Medical Center	✓		Health care	3,350
17	Evergreen School District	✓		Education	3,000
18	Daimler Trucks North America	✓		Commercial trucks	2,850
19	Portland General Electric	✓		Electric energy service	2,800
20	Bonneville Power Administration	✓		Utility	2,659
21	TriMet	✓		Public transportation	2,650
22	The Regence Group	✓		Health care	2,243
23	Xerox Corp.		✓	Document management	1,769
24	Adidas America			Athletic equipment	1,500
25	ATI Wah Chang	✓		Metal and chemical manufacturing	1,500
26	Greenbrier Cos. Inc.	✓		Transportation services	1,020

Note: The Portland MSA consists of Clackamas, Columbia, Multnomah, Washington, and Yamhill counties in Oregon and Clark and Skamania counties in Washington.

Source: Portland Development Commission, *Portland Metropolitan Region Fact Book*, July 2010 and Business Journal, *2010 Book of Lists*; Portland Business Alliance, Largest Employers 2010.

Chapter 3.
HISTORICAL AVIATION ACTIVITY

A review of aviation activity at the Airport provided the foundation for the aviation demand forecasts and included an analysis of: (1) total aircraft operations by type (corporate and charter, general aviation, and military); (2) local and itinerant general aviation operations (annual and monthly), (3) helicopter training operations, and (4) based aircraft by type (single engine, multi-engine, jet, helicopter, and other).

CORPORATE AND CHARTER

The Airport accommodates scheduled and unscheduled activity by corporate users and charter operators, including air carrier operations performed in revenue service and air taxi and commuter operations consisting of the unscheduled operations of "for hire" air taxis. The FAA defines an air carrier aircraft, for traffic counting purposes, as capable of carrying more than 60 passengers and provides a list of model types that are counted as air carrier operations (Appendix 3 in Order JO 7210.3W), even if the aircraft is conducting air freight operations.* As shown in Table 3-1, air carrier aircraft operations have historically varied and accounted for a very small number of aircraft operations at the Airport. The FAA defines air taxi and commuter operations as those performed by aircraft other than those listed in Appendix 3 noted above and which use three-letter company designators. Fractional ownership and management companies and corporate flight departments that use a three-letter company designator are included in air taxi operations. As shown in Table 3-1, air taxi and commuter aircraft operations increased an average of 5.7% per year between 1990 and 2011, the fastest growing category of aircraft operations. However, since 2005, air taxi and commuter have decreased an average of 7.1% between 2005 and 2011.

GENERAL AVIATION

General aviation operations include all civil aircraft operations not classified as air carrier or air taxi and commuter operations. As shown in Table 3-1, total general aviation aircraft operations (local and itinerant) increased an average of 0.1% per year between 1990 and 2011. Local general aviation operations, including fixed-wing and helicopter training operations, increased an average of 0.7% per year between 1990 and 2011, while itinerant operations decreased an average of 1.1% per year during the same period.

MILITARY

Military aircraft operations at the Airport averaged approximately 550 operations per year from 2001 through 2011. In 2011, military operations totaled 412, lower than the 10-year average. Historically, military operations have varied with geopolitical trends and changes to the mission.

*U.S. Department of Transportation, Federal Aviation Administration, Order JO 7210.3W, February 11, 2010, http://www.faa.gov/air_traffic/publications.

Table 3-1
HISTORICAL AIRCRAFT OPERATIONS
Portland Hillsboro Airport

	Corporate and charter		General aviation					Increase
	Air carrier	Air taxi	Local	Itinerant	Total	Military	Total	(decrease)
1990	--	1,946	120,015	87,979	207,994	1,669	211,609	--%
1991	--	3,039	121,054	87,479	208,533	1,211	212,783	0.6
1992	--	2,899	109,124	85,964	195,088	1,454	199,441	(6.3)
1993	--	3,112	102,632	86,797	189,429	1,262	193,803	(2.8)
1994	--	3,562	118,523	87,746	206,269	1,479	211,310	9.0
1995	--	3,371	127,233	89,467	216,700	1,783	221,854	5.0
1996	--	4,175	119,630	88,148	207,778	1,869	213,822	(3.6)
1997	--	5,631	129,381	96,284	225,665	1,099	232,395	8.7
1998	--	5,710	138,105	85,619	223,724	1,732	231,166	(0.5)
1999	--	6,553	154,123	89,386	243,509	1,695	251,757	8.9
2000	--	7,230	151,645	83,201	234,846	2,435	244,511	(2.9)
2001	12	7,931	141,880	84,639	226,519	921	235,383	(3.7)
2002	6	9,078	131,495	82,493	213,988	517	223,589	(5.0)
2003	--	9,386	129,141	78,942	208,083	649	218,118	(2.4)
2004	--	8,287	111,250	72,444	183,694	852	192,833	(11.6)
2005	--	9,689	140,311	68,940	209,251	287	219,227	13.7
2006	--	8,773	137,421	65,008	202,429	291	211,493	(3.5)
2007	3	6,571	162,032	69,755	231,787	244	238,605	12.8
2008	--	7,615	176,791	76,256	253,047	295	260,957	9.4
2009	--	5,749	147,478	68,724	216,202	320	222,271	(14.8)
2010	--	5,738	149,579	63,619	213,198	1,277	220,213	(0.9)
2011	4	6,235	137,822	69,770	207,592	412	214,243	(2.7)
	Average annual percent increase (decrease)							
1990-2000	--	14.0%	2.4%	(0.6%)	1.2%	3.8%	1.5%	
2000-2010	--	(2.3)	(0.1)	(2.6)	(1.0)	(6.3)	(1.0)	
2010-2011	--	8.7	(7.9)	9.7	(2.6)	(67.7)	(2.7)	
1990-2011	--	5.7	0.7	(1.1)	0.0	(6.4)	0.1	

Note: Sum of takeoffs and landings.

Source: Port of Portland records and U.S. Department of Transportation, Air Traffic Activity System (ATADS), www.faa.gov, accessed January 2012.

MONTHLY AIRCRAFT OPERATIONS

Table 3-2 presents monthly total aircraft operations data for the Airport for January 2000 through December 2011. The monthly data show the seasonal variation in total aircraft operations, with July and August accounting for 11.8% and 11.3%, respectively, of annual operations in 2011. From 2000 through 2011, July and August accounted for the peak share of annual aircraft operations at the Airport, with an average of approximately 11% of annual operations.

Table 3-3 presents monthly local general aviation aircraft operations data for the Airport for January 2000 through December 2011. The monthly data show the seasonal variation in local general aviation aircraft operations, with July and August accounting for 11.7% and 10.6%, respectively, of annual operations in 2011. From 2000 through 2011, the peak month for annual local general aviation aircraft operations at the Airport has varied although the peak share has averaged approximately 11% of annual operations.

Table 3-4 presents monthly itinerant general aviation aircraft operations data for the Airport for January 2000 through December 2011. The monthly data show the seasonal variation in total aircraft operations, with July and August accounting for 11.9% and 12.6%, respectively, of annual operations in 2011. From 2000 through 2011, July and August accounted for the peak share of annual aircraft operations at the Airport, with an average of approximately 12% of annual operations.

HELICOPTER TRAINING OPERATIONS

As noted in the 2005 HIO Master Plan, helicopter training operations at Hillsboro Airport operate to taxiways and other landing areas and are not considered in the capacity analysis. Table 3-5 presents helicopter training operations data by taxiway usage and month for the Airport in 2011. A total of 66,521 helicopter training operations were performed at the Airport in 2011 based on counts by the FAA Air Traffic Control Tower staff.

BASED AIRCRAFT

As shown in Table 3-6, a total of 257 general aviation aircraft were based at the Airport in 2011, including 147 single engine piston, 39 jet engine, 31 multi-engine turboprop, and 40 helicopters, according to the FAA 2011 TAF. The total number of based aircraft at the Airport decreased an average of 4.3% per year between 2000 and 2010, after increasing an average of 1.4% per year between 1990 and 2000. As noted in Chapter 1, the decrease in based aircraft in 2007 is related to a change in the FAA's reporting methodology for based aircraft rather than a decrease in market demand.* Single and multi-engine aircraft accounted for the decrease in the number of based aircraft since 2000, decreasing

*As defined by the FAA as part of its National Based Aircraft Inventory Program, "a based aircraft at your facility is an aircraft that is operational & air worthy, which is typically based at your facility for a MAJORITY of the year." In 2007, the FAA instituted a new methodology for maintaining based aircraft counts which includes validating aircraft tail numbers with aircraft registration lists and eliminating duplicate records and aircraft that do not typically have tail numbers such as ultra-lights and experimental aircraft. www.basedaircraft.com an average of 6.6% and 6.7% per year, respectively. In contrast, the number of jet based aircraft increased an average of 3.9% per year, reflecting increased activity by corporate flight departments and fractional ownership companies. Similarly, the number of helicopters based at the Airport increased an average of 8.3% per year as a result of increased training activity.

GENERAL AVIATION OPERATIONS PER BASED AIRCRAFT

As shown in Table 3-7, the number of annual and monthly general aviation operations per based aircraft at the Airport increased an average of 1.4% per year between 1990 and 2011, largely driven by increases in the local operations per based aircraft—an average increase of 2.0% per year during the same period.

Table 3-2
HISTORICAL TOTAL AIRCRAFT OPERATIONS BY MONTH
Portland Hillsboro Airport

	Month												
Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
2000	12,905	15,339	21,064	25,189	23,312	23,678	24,256	26,317	21,937	19,807	17,767	12,940	244,511
2001	16,740	18,278	21,843	19,977	27,763	25,676	21,748	22,229	14,647	19,621	14,634	12,227	235,383
2002	12,317	15,398	15,763	19,967	21,297	20,271	24,066	22,120	21,658	19,622	18,441	12,669	223,589
2003	13,889	17,505	18,569	20,076	24,951	20,392	25,982	24,783	17,748	15,513	10,271	8,439	218,118
2004	6,986	10,503	14,845	15,149	14,458	19,705	24,535	21,431	20,457	19,368	13,010	12,386	192,833
2005	14,063	15,502	16,623	17,186	18,971	19,675	23,608	25,714	22,939	17,744	14,920	12,282	219,227
2006	11,030	15,979	17,224	19,963	21,918	21,407	20,851	24,554	20,409	17,140	9,883	11,135	211,493
2007	11,676	14,744	22,916	22,337	22,952	21,519	22,308	25,136	22,715	22,005	18,622	11,675	238,605
2008	14,263	20,634	21,724	24,496	26,222	26,992	29,972	24,518	19,526	22,645	17,408	12,557	260,957
2009	16,343	19,469	20,637	20,493	19,717	20,070	22,339	20,068	18,633	18,179	15,142	11,181	222,271
2010	14,940	15,926	19,312	21,289	21,720	21,154	22,844	20,149	20,047	17,985	12,604	12,243	220,213
2011	11,335	14,730	14,655	17,105	19,533	21,073	25,257	24,181	21,841	17,874	13,192	13,467	214,243
	Percent of total												
2000	5.3%	6.3%	8.6%	10.3%	9.5%	9.7%	9.9%	10.8%	9.0%	8.1%	7.3%	5.3%	100.0%
2001	7.1	7.8	9.3	8.5	11.8	10.9	9.2	9.4	6.2	8.3	6.2	5.2	100.0
2002	5.5	6.9	7.0	8.9	9.5	9.1	10.8	9.9	9.7	8.8	8.2	5.7	100.0
2003	6.4	8.0	8.5	9.2	11.4	9.3	11.9	11.4	8.1	7.1	4.7	3.9	100.0
2004	3.6	5.4	7.7	7.9	7.5	10.2	12.7	11.1	10.6	10.0	6.7	6.4	100.0
2005	6.4	7.1	7.6	7.8	8.7	9.0	10.8	11.7	10.5	8.1	6.8	5.6	100.0
2006	5.2	7.6	8.1	9.4	10.4	10.1	9.9	11.6	9.6	8.1	4.7	5.3	100.0
2007	4.9	6.2	9.6	9.4	9.6	9.0	9.3	10.5	9.5	9.2	7.8	4.9	100.0
2008	5.5	7.9	8.3	9.4	10.0	10.3	11.5	9.4	7.5	8.7	6.7	4.8	100.0
2009	7.4	8.8	9.3	9.2	8.9	9.0	10.1	9.0	8.4	8.2	6.8	5.0	100.0
2010	6.8	7.2	8.8	9.7	9.9	9.6	10.4	9.1	9.1	8.2	5.7	5.6	100.0
2011	5.3	6.9	6.8	8.0	9.1	9.8	11.8	11.3	10.2	8.3	6.2	6.3	100.0

Note: Data include corporate and charter, general aviation, and military operations.

Sources: Port of Portland records and Federal Aviation Administration, Air Traffic Activity Data System (ATADS), online database, accessed January 2012.

Table 3-3
HISTORICAL LOCAL GENERAL AVIATION AIRCRAFT OPERATIONS BY MONTH
Portland Hillsboro Airport

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
	Month												
2000	8,090	9,706	13,282	16,896	15,142	14,505	14,828	15,790	13,558	11,878	11,433	7,869	152,977
2001	10,377	11,646	13,747	12,498	18,034	14,129	11,654	12,718	8,013	12,347	9,275	7,490	141,928
2002	7,548	8,720	9,427	12,144	11,776	11,480	13,775	12,170	12,903	11,770	11,800	8,073	131,586
2003	8,284	10,958	12,678	13,422	15,762	11,336	15,678	14,631	9,257	8,330	4,778	4,226	129,340
2004	3,391	4,962	6,758	7,046	7,198	11,799	14,985	13,460	12,823	12,581	8,009	8,256	111,268
2005	9,035	8,453	10,782	11,299	12,219	12,521	15,057	16,305	14,951	11,840	9,808	8,101	140,371
2006	7,566	10,175	11,429	13,600	14,450	13,843	12,659	15,743	12,960	11,029	6,613	7,383	137,450
2007	7,565	10,279	16,125	15,532	15,606	14,532	14,560	16,096	15,238	15,224	13,152	8,148	162,057
2008	9,715	13,553	15,653	17,422	17,809	18,505	20,272	16,256	12,090	15,275	11,706	8,562	176,818
2009	10,956	13,459	14,663	13,427	12,226	13,012	14,410	12,878	11,778	12,486	10,807	7,401	147,503
2010	10,567	10,977	13,866	15,378	15,722	13,832	14,662	12,713	13,544	12,104	9,046	8,269	150,680
2011	7,573	10,346	10,503	11,261	13,164	13,656	16,146	14,588	12,970	10,935	8,162	8,600	137,904
	Percent of total												
2000	5.3%	6.3%	8.7%	11.0%	9.9%	9.5%	9.7%	10.3%	8.9%	7.8%	7.5%	5.1%	100.0%
2001	7.3	8.2	9.7	8.8	12.7	10.0	8.2	9.0	5.6	8.7	6.5	5.3	100.0
2002	5.7	6.6	7.2	9.2	8.9	8.7	10.5	9.2	9.8	8.9	9.0	6.1	100.0
2003	6.4	8.5	9.8	10.4	12.2	8.8	12.1	11.3	7.2	6.4	3.7	3.3	100.0
2004	3.0	4.5	6.1	6.3	6.5	10.6	13.5	12.1	11.5	11.3	7.2	7.4	100.0
2005	6.4	6.0	7.7	8.0	8.7	8.9	10.7	11.6	10.7	8.4	7.0	5.8	100.0
2006	5.5	7.4	8.3	9.9	10.5	10.1	9.2	11.5	9.4	8.0	4.8	5.4	100.0
2007	4.7	6.3	10.0	9.6	9.6	9.0	9.0	9.9	9.4	9.4	8.1	5.0	100.0
2008	5.5	7.7	8.9	9.9	10.1	10.5	11.5	9.2	6.8	8.6	6.6	4.8	100.0
2009	7.4	9.1	9.9	9.1	8.3	8.8	9.8	8.7	8.0	8.5	7.3	5.0	100.0
2010	7.0	7.3	9.2	10.2	10.4	9.2	9.7	8.4	9.0	8.0	6.0	5.5	100.0
2011	5.5	7.5	7.6	8.2	9.5	9.9	11.7	10.6	9.4	7.9	5.9	6.2	100.0

Sources: Port of Portland records and Federal Aviation Administration, Air Traffic Activity Data System (ATADS), online database, accessed January 2012.

Table 3-4
HISTORICAL ITINERANT GENERAL AVIATION AIRCRAFT OPERATIONS BY MONTH
Portland Hillsboro Airport

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
	Month												
2000	4,815	5,633	7,782	8,293	8,170	9,173	9,428	10,527	8,379	7,929	6,334	5,071	91,534
2001	6,363	6,632	8,096	7,479	9,729	11,547	10,094	9,511	6,634	7,274	5,359	4,737	93,455
2002	4,769	6,678	6,336	7,823	9,521	8,791	10,291	9,950	8,755	7,852	6,641	4,596	92,003
2003	5,605	6,547	5,891	6,654	9,189	9,056	10,304	10,152	8,491	7,183	5,493	4,213	88,778
2004	3,595	5,541	8,087	8,103	7,260	7,906	9,550	7,971	7,634	6,787	5,001	4,130	81,565
2005	5,028	7,049	5,841	5,887	6,752	7,154	8,551	9,409	7,988	5,904	5,112	4,181	78,856
2006	3,464	5,804	5,795	6,363	7,468	7,564	8,192	8,811	7,449	6,111	3,270	3,752	74,043
2007	4,111	4,465	6,791	6,805	7,346	6,987	7,748	9,040	7,477	6,781	5,470	3,527	76,548
2008	4,548	7,081	6,071	7,074	8,413	8,487	9,700	8,262	7,436	7,370	5,702	3,995	84,139
2009	5,387	6,010	5,974	7,066	7,491	7,058	7,929	7,190	6,855	5,693	4,335	3,780	74,768
2010	4,373	4,949	5,446	5,911	5,998	7,322	8,182	7,436	6,503	5,881	3,558	3,974	69,533
2011	3,762	4,384	4,152	5,844	6,369	7,417	9,111	9,593	8,871	6,939	5,030	4,867	76,339
	Percent of total												
2000	5.3%	6.2%	8.5%	9.1%	8.9%	10.0%	10.3%	11.5%	9.2%	8.7%	6.9%	5.5%	100.0%
2001	6.8	7.1	8.7	8.0	10.4	12.4	10.8	10.2	7.1	7.8	5.7	5.1	100.0
2002	5.2	7.3	6.9	8.5	10.3	9.6	11.2	10.8	9.5	8.5	7.2	5.0	100.0
2003	6.3	7.4	6.6	7.5	10.4	10.2	11.6	11.4	9.6	8.1	6.2	4.7	100.0
2004	4.4	6.8	9.9	9.9	8.9	9.7	11.7	9.8	9.4	8.3	6.1	5.1	100.0
2005	6.4	8.9	7.4	7.5	8.6	9.1	10.8	11.9	10.1	7.5	6.5	5.3	100.0
2006	4.7	7.8	7.8	8.6	10.1	10.2	11.1	11.9	10.1	8.3	4.4	5.1	100.0
2007	5.4	5.8	8.9	8.9	9.6	9.1	10.1	11.8	9.8	8.9	7.1	4.6	100.0
2008	5.4	8.4	7.2	8.4	10.0	10.1	11.5	9.8	8.8	8.8	6.8	4.7	100.0
2009	7.2	8.0	8.0	9.5	10.0	9.4	10.6	9.6	9.2	7.6	5.8	5.1	100.0
2010	6.3	7.1	7.8	8.5	8.6	10.5	11.8	10.7	9.4	8.5	5.1	5.7	100.0
2011	4.9	5.7	5.4	7.7	8.3	9.7	11.9	12.6	11.6	9.1	6.6	6.4	100.0

Sources: Port of Portland records and Federal Aviation Administration, Air Traffic Activity Data System (ATADS), online database, accessed January 2012.

Table 3-5
HELICOPTER TRAINING OPERATIONS BY TAXIWAY USAGE IN 2011
Portland Hillsboro Airport

	Taxiway A		Taxiway B		Taxiway C		Taxiway Golf		Total training operations
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
January	1,260	32.0%	210	5.3%	2,443	62.1%	22	0.6%	3,935
February	1,794	30.4	56	0.9	4,036	68.4	18	0.3	5,904
March	1,583	29.9	276	5.2	3,361	63.6	66	1.2	5,286
April	1,584	24.3	330	5.1	4,574	70.1	38	0.6	6,526
May	1,753	31.6	165	3.0	3,615	65.1	23	0.4	5,556
June	2,054	36.1	206	3.6	3,431	60.3	--	0.0	5,691
July	2,697	33.4	140	1.7	5,221	64.7	6	0.1	8,064
August	2,359	33.3	30	0.4	4,686	66.1	12	0.2	7,087
September	1,927	34.1	56	1.0	3,661	64.7	12	0.2	5,656
October	1,557	31.7	141	2.9	3,156	64.2	64	1.3	4,918
November	1,210	31.6	187	4.9	2,406	62.8	26	0.7	3,829
December	1,793	44.1	48	1.2	2,222	54.6	6	0.1	4,069
Total	21,571	32.4	1,845	2.8	42,812	64.4	293	0.4	66,521

Sources: Port of Portland records and Federal Aviation Administration, Air Traffic Control Tower at Portland Hillsboro Airport.

Table 3-6
HISTORICAL BASED AIRCRAFT
Portland Hillsboro Airport

	Single engine	Jet	Multi-engine	Helicopter	Total	Percent change
1990	302	--	23	16	341	--%
1991	302	6	23	16	347	1.8
1992	302	6	23	16	347	--
1993	302	6	23	16	347	--
1994	302	6	23	16	347	--
1995	302	21	60	16	399	15.0
1996	302	21	60	16	399	--
1997	288	24	60	18	390	(2.3)
1998	288	24	60	18	390	--
1999	288	26	60	18	392	0.5
2000	288	26	60	18	392	--
2001	288	26	60	18	392	--
2002	265	30	60	20	375	(4.3)
2003	266	30	60	20	376	0.3
2004	265	30	60	20	375	(0.3)
2005	244	41	48	29	362	(3.5)
2006	244	41	48	29	362	--
2007	244	41	48	29	362	--
2008 *(a)*	145	38	30	40	253	(30.1)
2009	145	38	30	40	253	--
2010	145	38	30	40	253	--
2011	147	39	31	40	257	1.6
	Average annual percent increase (decrease)					
1990-2000	(0.5%)	--%	10.1%	1.2%	1.4%	
2000-2010	(6.6)	3.9	(6.7)	8.3	(4.3)	
2010-2011	1.4	2.6	3.3	0.0	1.6	
1990-2011	(3.4)	--	1.4	4.5	(1.3)	

Note: Data for 2011 are forecast.
As defined by the FAA as part of its National Based Aircraft Inventory Program, "a based aircraft at your facility is an aircraft that is operational and air worthy, which is typically based at your facility for a MAJORITY of the year."

(a) In 2007, the FAA instituted a new methodology for maintaining based aircraft counts which includes validating aircraft tail numbers with aircraft registration lists and eliminating duplicate records and aircraft that do not typically have tail numbers such as ultra-lights and experimental aircraft. www.basedaircraft.com

Source: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.

Table 3-7
GENERAL AVIATION AIRCRAFT OPERATIONS PER BASED AIRCRAFT
Portland Hillsboro Airport

	Total based aircraft	General aviation aircraft operations			General aviation aircraft operations per based aircraft					
					Annual			Monthly		
		Local	Itinerant	Total	Local	Itinerant	Total	Local	Itinerant	Total
1990	341	120,015	87,979	207,994	352	258	610	29	22	51
1991	347	121,054	87,479	208,533	349	252	601	29	21	50
1992	347	109,124	85,964	195,088	314	248	562	26	21	47
1993	347	102,632	86,797	189,429	296	250	546	25	21	45
1994	347	118,523	87,746	206,269	342	253	594	28	21	50
1995	399	127,233	89,467	216,700	319	224	543	27	19	45
1996	399	119,630	88,148	207,778	300	221	521	25	18	43
1997	390	129,381	96,284	225,665	332	247	579	28	21	48
1998	390	138,105	85,619	223,724	354	220	574	30	18	48
1999	392	154,123	89,386	243,509	393	228	621	33	19	52
2000	392	151,645	83,201	234,846	387	212	599	32	18	50
2001	392	141,880	84,639	226,519	362	216	578	30	18	48
2002	375	131,495	82,493	213,988	351	220	571	29	18	48
2003	376	129,141	78,942	208,083	343	210	553	29	17	46
2004	375	111,250	72,444	183,694	297	193	490	25	16	41
2005	362	140,311	68,940	209,251	388	190	578	32	16	48
2006	362	137,421	65,008	202,429	380	180	559	32	15	47
2007	362	162,032	69,755	231,787	448	193	640	37	16	53
2008	253	176,791	76,256	253,047	699	301	1,000	58	25	83
2009	253	147,478	68,724	216,202	583	272	855	49	23	71
2010	253	149,579	63,619	213,198	591	251	843	49	21	70
2011	257	137,822	69,770	207,592	536	271	808	45	23	67
	Average annual percent increase (decrease)									
1990-2000	1.4%	2.4%	(0.6%)	1.2%	0.9%	(1.9%)	(0.2%)	0.9%	(1.9%)	(0.2%)
2000-2010	(4.3)	(0.1)	(2.6)	(1.0)	4.3	1.7	3.5	4.3	1.7	3.5
2010-2011	1.6	(7.9)	9.7	(2.6)	(9.3)	8.0	(4.1)	(9.3)	8.0	(4.1)
1990-2011	(1.3)	0.7	(1.1)	0.0	2.0	0.2	1.3	2.0	0.2	1.3

Sources:Port of Portland records and Federal Aviation Administration, Air Traffic Control Tower at Portland Hillsboro Airport.

Chapter 4.

REGIONAL GENERAL AVIATION DEMAND

This chapter summarizes historical and forecast regional general aviation demand in terms of local and itinerant general aviation aircraft operations and based aircraft using the FAA 2011 TAF for each airport in the Portland region.* The objective of this task is to evaluate the regional trends in general aviation demand and the Airport's current and future share of total regional demand. Four future demand years are presented from the FAA 2011 TAF—2016, 2021, 2026, and 2031; the same years reported for the HIO planning forecasts. As shown earlier on Figure 1-3, the airports used to represent total regional general aviation demand are limited to the 10 airports with FAA 2011 TAFs, including:

1. Aurora State Airport
2. Grove Field
3. Portland Hillsboro Airport
4. McMinnville Municipal Airport
5. Pearson Field
6. Portland International Airport
7. Portland Mulino Airport
8. Scappoose Industrial Airpark
9. Sportsman Airpark
10. Portland Troutdale Airport

Three of the 10 airports in the Portland region—Portland Hillsboro, Portland Troutdale, and Portland International—are towered airports; the remaining 7 airports do not have a tower. Activity at non-towered airports is included in the TAF based on estimates filed with FAA Airports District Offices on FAA Form 5010. Estimates of aircraft operations at non-towered airports may be based on a variety of data collection methods, including video review and other forms of human counting, and pneumatic, electromagnetic, or acoustical machine counts. As a result, operation counts for non-towered airports may not be as accurate as those for towered airports.

GENERAL AVIATION AIRCRAFT OPERATIONS

As shown in Table 4-1, total general aviation aircraft operations at the 10 airports in the Portland region increased an average of 0.9% per year between 1990 and 2011, compared with an average increase of 1.0% per year at Hillsboro. The FAA forecasts general aviation operations at the Portland region airports to increase an average of 1.0% per year between 2011 and 2031, compared with an average increase of 0.5% per year at Hillsboro. The Airport's share of total regional general aviation operations is forecast to decrease from 34.1% in 2011 to 31.0% in 2031.

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*According to the 2005 Hillsboro Master Plan, the Portland region includes 23 airports, including 10 airports with FAA TAFs noted above and 11 other general aviation airports. See Figure 1-1.

Local Operations

As shown in Table 4-2, local general aviation operations at the 10 airports in the Portland region increased an average of 1.2% per year between 1990 and 2011, compared with an average increase of 1.7% per year at Hillsboro. The FAA forecasts local general aviation operations at the Portland region airports to increase an average of 1.0% per year between 2011 and 2031, compared with an average increase of 0.7% per year at Hillsboro. The Airport's share of local general aviation operations at the 10 airports in the Portland region is forecast to decrease from 46.2% in 2011 to 43.1% in 2031.

Itinerant Operations

As shown in Table 4-3, itinerant general aviation operations at the 10 airports in the Portland region increased an average of 0.5% per year between 1990 and 2011, compared with an average decrease of 0.4% per year at Hillsboro. The FAA forecasts itinerant general aviation operations at the Portland region airports to increase an average of 11.0% per year between 2011 and 2031, compared with an average increase of 0.3% per year at Hillsboro. The Airport's share of regional itinerant general aviation operations is forecast to decrease from 22.0% in 2011 to 19.0% in 2031.

BASED AIRCRAFT

As shown in Table 4-4, based aircraft at the 10 airports in the Portland region increased an average of 0.6% per year between 1990 and 2011, compared with an average decrease of 1.3% per year at Hillsboro. The FAA forecasts based aircraft at the Portland region airports to increase an average of 1.1% per year between 2010 and 2031, compared with an average increase of 1.5% per year at Hillsboro. The Airport's share of total regional based aircraft is forecast to increase from 17.6% in 2011 to 18.9% in 2031.

As shown in Table 4-5, single engine aircraft accounted for the largest share of based aircraft in 2011, with 76.8% of total, followed by multi-engine aircraft with 19.9%, helicopters with 7.7%, and jet aircraft with 5.6%. The FAA forecasts decreases in the shares of single engine and multi-engine aircraft by 2031, to 74.7% and 9.1%, respectively. The shares of helicopter and jet aircraft are forecast to increase to 8.0% and 8.2%, respectively, by 2031.

GENERAL AVIATION OPERATIONS PER BASED AIRCRAFT

As shown in Table 4-6, the number of annual and monthly general aviation operations per based aircraft at the 10 airports in the Portland region increased an average of 0.3% per year between 1990 and 2011, largely driven by increases in the local operations per based aircraft—an average increase of 0.7% per year during the same period. The FAA forecasts decreases in the number of total general aviation operations per based aircraft (an average decrease of 0.1% between 2011 and 2031).

Table 4-7 presents a summary of annual and monthly general aviation operations per based aircraft at the other airports in the Portland region, excluding Hillsboro. In 2011, the 9 other airports in the Portland region together averaged 27.5 monthly general aviation operations per based aircraft.

Table 4-1
HISTORICAL AND FORECAST TOTAL GENERAL AVIATION AIRCRAFT OPERATIONS AT AIRPORTS IN THE PORTLAND REGION

Year	Hillsboro Aircraft operations	Hillsboro Percent of region	Troutdale	Portland International	Mulino State	Scappoose Airpark	Aurora State	McMinnville Municipal	Sportsman Airpark	Pearson Field	Grove Field	Portland region
Historical												
1990	168,619	33.6%	73,883	61,070	16,200	7,500	50,000	57,075	11,000	45,000	12,000	502,347
1995	214,451	36.9%	97,158	48,639	16,200	30,360	50,000	57,528	10,450	45,000	12,000	581,786
2000	241,367	36.7%	74,138	37,903	34,248	49,409	81,000	69,570	10,450	46,710	12,000	656,795
2005	209,063	34.2%	63,199	30,338	36,568	57,781	74,054	74,283	11,550	47,820	7,000	611,656
2010	215,067	37.0%	52,982	20,601	21,300	70,000	67,455	62,000	11,550	49,781	10,000	580,736
2011	205,857	34.1%	54,854	24,029	21,793	71,641	90,163	62,916	11,715	50,183	10,000	603,151
Forecast												
2016	211,005	33.2%	57,244	24,539	24,261	79,844	96,480	67,712	12,540	52,245	10,000	635,870
2021	216,865	32.4%	58,208	24,887	26,728	88,047	103,238	72,871	13,365	54,395	10,000	668,604
2026	222,912	31.7%	59,196	25,239	29,203	96,279	110,470	78,422	14,184	56,633	10,000	702,538
2031	229,158	31.0%	60,207	25,595	31,849	105,083	118,208	84,398	15,029	58,972	10,000	738,499
	Average annual percent increase (decrease)											
Historical												
1990-1995	4.9%	1.9%	5.6%	(4.4)%	0.0%	32.3%	0.0%	0.2%	(1.0)%	0.0%	0.0%	3.0%
1995-2000	2.4	(0.1)	(5.3)	(4.9)	16.2	10.2	10.1	3.9	0.0	0.7	0.0	2.5
2000-2005	(2.8)	(1.4)	(3.1)	(4.4)	1.3	3.2	(1.8)	1.3	2.0	0.5	(10.2)	(1.4)
2005-2010	0.6	1.6	(3.5)	(7.4)	(10.2)	3.9	(1.8)	(3.6)	0.0	0.8	7.4	(1.0)
2010-2011	(4.3)	(7.8)	3.5	16.6	2.3	2.3	33.7	1.5	1.4	0.8	0.0	3.9
1990-2011	1.0	0.1	(1.4)	(4.3)	1.4	11.3	2.8	0.5	0.3	0.5	(0.9)	0.9
Forecast												
2011-2016	0.8	(0.6)	0.9	0.4	2.2	2.2	1.4	1.5	1.4	0.8	0.0	1.1
2016-2021	0.5	(0.5)	0.3	0.3	2.0	2.0	1.4	1.5	1.3	0.8	0.0	1.0
2021-2026	0.6	(0.4)	0.3	0.3	1.8	1.8	1.4	1.5	1.2	0.8	0.0	1.0
2026-2031	0.6	(0.4)	0.3	0.3	1.7	1.8	1.4	1.5	1.2	0.8	0.0	1.0
2011-2031	0.5	(0.5)	0.5	0.3	1.9	1.9	1.4	1.5	1.3	0.8	0.0	1.0

Note: . Data for Aurora State and Pearson Field are estimated for 1990 and 1995. Data for Grove Field are estimated for 1990, 1995, and 2000.
n.a. = Not available.

Source: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.

Table 4-2
HISTORICAL AND FORECAST LOCAL GENERAL AVIATION AIRCRAFT OPERATIONS AT AIRPORTS IN THE PORTLAND REGION

	Hillsboro											
Year	Aircraft operations	Percent of region	Troutdale	Portland International	Mulino State	Scappoose Airpark	Aurora State	McMinnville Municipal	Sportsman Airpark	Pearson Field	Grove Field	Portland region
Historical												
1990	97,049	41.7%	59,940	3,403	12,000	1,500	20,000	20,547	3,500	10,000	5,000	232,939
1995	126,234	45.2%	69,036	1,963	12,000	10,800	20,000	21,000	3,250	10,000	5,000	279,283
2000	156,822	47.7%	42,826	4,569	13,700	18,904	45,000	27,827	3,250	11,016	5,000	328,914
2005	139,409	47.8%	30,807	2,809	14,627	20,872	33,628	29,711	3,875	11,089	5,000	291,827
2010	150,858	50.1%	33,262	1,182	13,000	30,000	27,980	22,000	3,875	11,377	7,500	301,034
2011	139,533	46.2%	36,186	1,422	13,299	30,630	36,065	22,325	3,931	11,435	7,500	302,326
Forecast												
2016	143,143	44.8%	40,118	1,449	14,797	33,778	38,592	24,027	4,211	11,731	7,500	319,346
2021	148,261	44.2%	41,077	1,449	16,294	36,926	41,295	25,859	4,491	12,036	7,500	335,188
2026	153,560	43.7%	42,060	1,449	17,796	40,084	44,188	27,829	4,758	12,348	7,500	351,572
2031	159,050	43.1%	43,066	1,449	19,400	43,442	47,283	29,953	5,015	12,670	7,500	368,828
	Average annual percent increase (decrease)											
Historical												
1990-1995	5.4%	1.6%	2.9%	(10.4)%	0.0%	48.4%	0.0%	0.4%	(1.5)%	0.0%	0.0%	3.7%
1995-2000	4.4	1.1	(9.1)	18.4	2.7	11.8	17.6	5.8	0.0	2.0	0.0	3.3
2000-2005	(2.3)	0.0	(6.4)	(9.3)	1.3	2.0	(5.7)	1.3	3.6	0.1	0.0	(2.4)
2005-2010	1.6	1.0	1.5	(15.9)	(2.3)	7.5	(3.6)	(5.8)	0.0	0.5	8.4	0.6
2010-2011	(7.5)	(7.9)	8.8	20.3	2.3	2.1	28.9	1.5	1.4	0.5	0.0	0.4
1990-2011	1.7	0.5	(2.4)	(4.1)	0.5	15.4	2.8	0.4	0.6	0.6	1.9	1.2
Forecast												
2011-2016	0.5	(0.6)	2.1	0.4	2.2	2.0	1.4	1.5	1.4	0.5	0.0	1.1
2016-2021	0.7	(0.3)	0.5	0.0	1.9	1.8	1.4	1.5	1.3	0.5	0.0	1.0
2021-2026	0.7	(0.3)	0.5	0.0	1.8	1.7	1.4	1.5	1.2	0.5	0.0	1.0
2026-2031	0.7	(0.3)	0.5	0.0	1.7	1.6	1.4	1.5	1.1	0.5	0.0	1.0
2011-2031	0.7	(0.3)	0.9	0.1	1.9	1.8	1.4	1.5	1.2	0.5	0.0	1.0

Note: Data for Aurora State and Pearson Field are estimated for 1990 and 1995. Data for Grove Field are estimated for 1990, 1995, and 2000.
n.a. = Not available.

Source: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.

Table 4-3
HISTORICAL AND FORECAST ITINERANT GENERAL AVIATION AIRCRAFT OPERATIONS AT AIRPORTS IN THE PORTLAND REGION

Year	Hillsboro Aircraft operations	Hillsboro Percent of region	Troutdale	Portland International	Mulino State	Scappoose Airpark	Aurora State	McMinnville Municipal	Sportsman Airpark	Pearson Field	Grove Field	Portland region
Historical												
1990	71,570	26.6%	13,943	57,667	4,200	6,000	30,000	36,528	7,500	35,000	7,000	269,408
1995	88,217	29.2%	28,122	46,676	4,200	19,560	30,000	36,528	7,200	35,000	7,000	302,503
2000	84,545	25.8%	31,312	33,334	20,548	30,505	36,000	41,743	7,200	35,694	7,000	327,881
2005	69,654	21.8%	32,392	27,529	21,941	36,909	40,426	44,572	7,675	36,731	2,000	319,829
2010	64,209	23.0%	19,720	19,419	8,300	40,000	39,475	40,000	7,675	38,404	2,500	279,702
2011	66,324	22.0%	18,668	22,607	8,494	41,011	54,098	40,591	7,784	38,748	2,500	300,825
Forecast												
2016	67,862	21.4%	17,126	23,090	9,464	46,066	57,888	43,685	8,329	40,514	2,500	316,524
2021	68,604	20.6%	17,131	23,438	10,434	51,121	61,943	47,012	8,874	42,359	2,500	333,416
2026	69,352	19.8%	17,136	23,790	11,407	56,195	66,282	50,593	9,426	44,285	2,500	350,966
2031	70,108	19.0%	17,141	24,146	12,449	61,641	70,925	54,445	10,014	46,302	2,500	369,671
	Average annual percent increase (decrease)											
Historical												
1990-1995	4.3%	1.9%	15.1%	(4.1)%	0.0%	26.7%	0.0%	0.0%	(0.8)%	0.0%	0.0%	2.3%
1995-2000	(0.8)	(2.4)	2.2	(6.5)	37.4	9.3	3.7	2.7	0.0	0.4	0.0	1.6
2000-2005	(3.8)	(3.3)	0.7	(3.8)	1.3	3.9	2.3	1.3	1.3	0.6	(22.2)	(0.5)
2005-2010	(1.6)	1.1	(9.4)	(6.7)	(17.7)	1.6	(0.5)	(2.1)	0.0	0.9	4.6	(2.6)
2010-2011	3.3	(4.0)	(5.3)	16.4	2.3	2.5	37.0	1.5	1.4	0.9	0.0	7.6
1990-2011	(0.4)	(0.9)	1.4	(4.4)	3.4	9.6	2.8	0.5	0.2	0.5	(4.8)	0.5
Forecast												
2011-2016	0.5	(0.6)	(1.7)	0.4	2.2	2.4	1.4	1.5	1.4	0.9	0.0	1.0
2016-2021	0.2	(0.8)	0.0	0.3	2.0	2.1	1.4	1.5	1.3	0.9	0.0	1.0
2021-2026	0.2	(0.8)	0.0	0.3	1.8	1.9	1.4	1.5	1.2	0.9	0.0	1.0
2026-2031	0.2	(0.8)	0.0	0.3	1.8	1.9	1.4	1.5	1.2	0.9	0.0	1.0
2010-2031	0.3	(0.8)	(0.4)	0.3	1.9	2.1	1.4	1.5	1.3	0.9	0.0	1.0

Note: Data for Aurora State and Pearson Field are estimated for 1990 and 1995. Data for Grove Field are estimated for 1990, 1995, and 2000.
n.a. = Not available.

Source: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.

Table 4-4
HISTORICAL AND FORECAST BASED AIRCRAFT AT AIRPORTS IN THE PORTLAND REGION

Year	Hillsboro Aircraft operations	Hillsboro Percent of region	Troutdale	Portland International	Mulino State	Scappoose Airpark	Aurora State	McMinnville Municipal	Sportsman Airpark	Pearson Field	Grove Field	Portland region
Historical												
1990	341	26.3%	155	109	39	75	233	105	54	126	61	1,298
1995	399	29.1%	176	113	45	75	233	110	31	126	61	1,369
2000	392	25.9%	177	98	53	75	265	140	31	220	61	1,512
2005	362	21.7%	196	93	42	151	387	140	53	175	67	1,666
2010	253	19.0%	154	87	44	45	324	115	64	175	73	1,334
2011	257	17.6%	156	86	45	45	440	116	66	175	73	1,459
Forecast												
2016	277	17.8%	171	91	50	45	474	131	70	175	73	1,557
2021	298	18.1%	181	94	55	45	509	140	75	175	73	1,645
2026	320	18.5%	191	97	60	45	543	151	79	175	73	1,734
2031	345	18.9%	201	102	65	45	579	161	84	175	73	1,830
	Average annual percent increase (decrease)											
Historical												
1990-1995	3.2%	2.1%	2.6%	0.7%	2.9%	0.0%	0.0%	0.9%	(10.5)%	0.0%	0.0%	1.1%
1995-2000	(0.4)	(2.3)	0.1	(2.8)	3.3	0.0	2.6	4.9	0.0	11.8	0.0	2.0
2000-2005	(1.6)	(3.5)	2.1	(1.0)	(4.5)	15.0	7.9	0.0	11.3	(4.5)	1.9	2.0
2005-2010	(6.9)	(2.7)	(4.7)	(1.3)	0.9	(21.5)	(3.5)	(3.9)	3.8	0.0	1.7	(4.3)
2010-2011	1.6	(7.1)	1.3	(1.1)	2.3	0.0	35.8	0.9	3.1	0.0	0.0	9.4
1990-2011	(1.3)	(1.9)	0.0	(1.1)	0.7	2.4	3.1	0.5	1.0	1.6	0.9	0.6
Forecast												
2011-2016	1.5	0.2	1.9	1.1	2.1	0.0	1.5	2.5	1.2	0.0	0.0	1.3
2016-2021	1.5	0.4	1.1	0.7	1.9	0.0	1.4	1.3	1.4	0.0	0.0	1.1
2021-2026	1.4	0.4	1.1	0.6	1.8	0.0	1.3	1.5	1.0	0.0	0.0	1.1
2026-2031	1.5	0.4	1.0	1.0	1.6	0.0	1.3	1.3	1.2	0.0	0.0	1.1
2011-2031	1.5	0.3	1.3	0.9	1.9	0.0	1.4	1.7	1.2	0.0	0.0	1.1

Note: Data for 2011 are estimated. Data for Aurora State and Pearson Field are estimated for 1990 and 1995. Data for Grove Field are estimated for 1990, 1995, and 2000. n.a. = Not available.

Source: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.

Table 4-5
HISTORICAL AND FORECAST BASED AIRCRAFT
AT GENERAL AVIATION AIRPORTS IN THE PORTLAND REGION

Year	Number of based aircraft by type					
	Single engine	Jet	Multi-engine	Helicopter	Other	Total
Historical						
1990	615	16	65	55	52	803
1995	622	37	107	51	57	874
2000	1,105	41	152	98	55	1,451
2005	1,321	72	124	86	63	1,666
2010	1,023	75	134	102	--	1,334
2011	1,120	81	145	113	--	1,459
Forecast						
2016	1,180	100	151	126	--	1,557
2021	1,240	115	156	134	--	1,645
2026	1,302	129	161	142	--	1,734
2031	1,367	150	166	147	--	1,830
	Percent of total region					
Historical						
1990	76.6%	2.0%	8.1%	6.8%	6.5%	100.0%
1995	71.2	4.2	12.2	5.8	6.5	100.0
2000	76.2	2.8	10.5	6.8	3.8	100.0
2005	79.3	4.3	7.4	5.2	3.8	100.0
2010	76.7	5.6	10.0	7.6	0.0	100.0
2011	76.8	5.6	9.9	7.7	0.0	100.0
Forecast						
2016	75.8	6.4	9.7	8.1	0.0	100.0
2021	75.4	7.0	9.5	8.1	0.0	100.0
2026	75.1	7.4	9.3	8.2	0.0	100.0
2031	74.7	8.2	9.1	8.0	0.0	100.0

Note: Data for 2011 are estimated. Data for 1990, 1995, and 2000 do not include based aircraft at Aurora State, Pearson Field, and Grove Field.
n.a. = Not available.

Source: Federal Aviation Administration, Terminal Area Forecast, online database, accessed February 2012.

Table 4-6
HISTORICAL AND FORECAST GENERAL AVIATION AIRCRAFT OPERATIONS
PER BASED AIRCRAFT AT AIRPORTS IN THE PORTLAND REGION

	Total based aircraft	General aviation aircraft operations			General aviation aircraft operations per based aircraft					
					Annual			Monthly		
		Local	Itinerant	Total	Local	Itinerant	Total	Local	Itinerant	Total
Historical										
1990	1,298	232,939	269,408	502,347	179.5	207.6	387.0	15.0	17.3	32.3
1995	1,369	279,283	302,503	581,786	204.0	221.0	425.0	17.0	18.4	35.4
2000	1,512	328,914	327,881	656,795	217.5	216.9	434.4	18.1	18.1	36.2
2005	1,666	291,827	319,829	611,656	175.2	192.0	367.1	14.6	16.0	30.6
2010	1,334	301,034	279,702	580,736	225.7	209.7	435.3	18.8	17.5	36.3
2011	1,459	302,326	300,825	603,151	207.2	206.2	413.4	17.3	17.2	34.5
Forecast										
2016	1,557	319,346	316,524	635,870	205.1	203.3	408.4	17.1	16.9	34.0
2021	1,645	335,188	333,416	668,604	203.8	202.7	406.4	17.0	16.9	33.9
2026	1,734	351,572	350,966	702,538	202.8	202.4	405.2	16.9	16.9	33.8
2031	1,830	368,828	369,671	738,499	201.5	202.0	403.6	16.8	16.8	33.6
	Average annual percent increase (decrease)									
Historical										
1990-1995	1.1%	3.7%	2.3%	3.0%	2.6%	1.3%	1.9%	2.6%	1.3%	1.9%
1995-2000	2.0	3.3	1.6	2.5	1.3	(0.4)	0.4	1.3	(0.4)	0.4
2000-2005	2.0	(2.4)	(0.5)	(1.4)	(4.2)	(2.4)	(3.3)	(4.2)	(2.4)	(3.3)
2005-2010	(4.3)	0.6	(2.6)	(1.0)	5.2	1.8	3.5	5.2	1.8	3.5
2010-2011	9.4	0.4	7.6	3.9	(8.2)	(1.7)	(5.0)	(8.2)	(1.7)	(5.0)
1990-2011	0.6	1.2	0.5	0.9	0.7	(0.0)	0.3	0.7	(0.0)	0.3
Forecast										
2011-2016	1.3	1.1	1.0	1.1	(0.2)	(0.3)	(0.2)	(0.2)	(0.3)	(0.2)
2016-2021	1.1	1.0	1.0	1.0	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
2021-2026	1.1	1.0	1.0	1.0	(0.1)	0.0	(0.1)	(0.1)	0.0	(0.1)
2026-2031	1.1	1.0	1.0	1.0	(0.1)	0.0	(0.1)	(0.1)	0.0	(0.1)
2011-2031	1.1	1.0	1.0	1.0	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)

Source: U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

Table 4-7
HISTORICAL AND FORECAST GENERAL AVIATION AIRCRAFT OPERATIONS
PER BASED AIRCRAFT AT NINE OTHER AIRPORTS IN THE PORTLAND REGION (EXCLUDING HILLSBORO)

	Total based aircraft	General aviation aircraft operations			General aviation aircraft operations per based aircraft — Annual			General aviation aircraft operations per based aircraft — Monthly		
		Local	Itinerant	Total	Local	Itinerant	Total	Local	Itinerant	Total
Historical										
1990	957	135,890	197,838	333,728	142	207	349	12	17	29
1995	970	153,049	214,286	367,335	158	221	379	13	18	32
2000	1,120	172,092	243,336	415,428	154	217	371	13	18	31
2005	1,304	152,418	250,175	402,593	117	192	309	10	16	26
2010	1,081	150,176	215,493	365,669	139	199	338	12	17	28
2011	1,202	162,793	234,501	397,294	135	195	331	11	16	28
Forecast										
2016	1,280	176,203	248,662	424,865	138	194	332	11	16	28
2021	1,347	186,927	264,812	451,739	139	197	335	12	16	28
2026	1,414	198,012	281,614	479,626	140	199	339	12	17	28
2031	1,485	209,778	299,563	509,341	141	202	343	12	17	29
	Average annual percent increase (decrease)									
Historical										
1990-1995	0.3%	2.4%	1.6%	1.9%	2.1%	1.3%	1.7%	2.1%	1.3%	1.7%
1995-2000	2.9	2.4	2.6	2.5	(0.5)	(0.3)	(0.4)	(0.5)	(0.3)	(0.4)
2000-2005	3.1	(2.4)	0.6	(0.6)	(5.3)	(2.5)	(3.6)	(5.3)	(2.5)	(3.6)
2005-2010	(3.7)	(0.3)	(2.9)	(1.9)	3.5	0.8	1.8	3.5	0.8	1.8
2010-2011	11.2	8.4	8.8	8.6	(2.5)	(2.1)	(2.3)	(2.5)	(2.1)	(2.3)
1990-2011	1.1	0.9	0.8	0.8	(0.2)	(0.3)	(0.3)	(0.2)	(0.3)	(0.3)
Forecast										
2011-2016	1.3	1.6	1.2	1.4	0.3	(0.1)	0.1	0.3	(0.1)	0.1
2016-2021	1.0	1.2	1.3	1.2	0.2	0.2	0.2	0.2	0.2	0.2
2021-2026	1.0	1.2	1.2	1.2	0.2	0.3	0.2	0.2	0.3	0.2
2026-2031	1.0	1.2	1.2	1.2	0.2	0.3	0.2	0.2	0.3	0.2
2010-2031	1.1	1.3	1.2	1.2	0.2	0.2	0.2	0.2	0.2	0.2

Source: U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

Chapter 5.
UNCONSTRAINED DEMAND FORECASTS

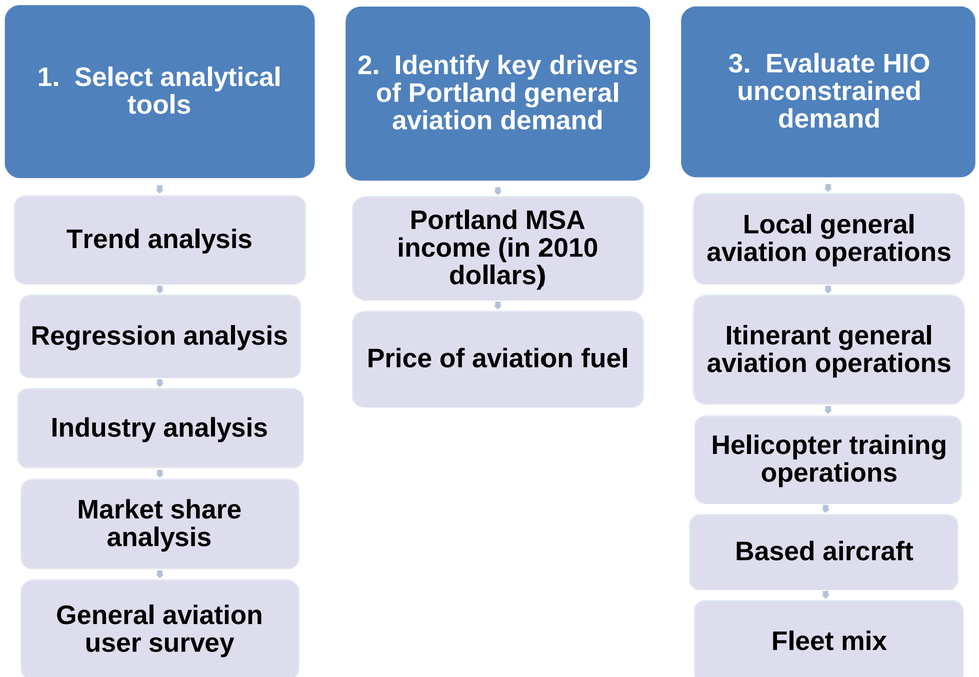
This chapter summarizes the unconstrained demand forecasts of aircraft operations, based aircraft, and fleet for the Airport, including the forecast approach, methodology, and assumptions. As noted earlier, the baseline forecasts presented in this report are unconstrained and, therefore, do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. The unconstrained forecasts are the "preferred" forecasts recommended for FAA approval. Four future demand years are presented in this report, including forecasts for 2016, 2021, 2026, and 2031. The base year for the forecasts is 2011.

FORECAST APPROACH AND METHODOLOGY

The key elements considered in the preparation of forecasts for the Airport included (1) socioeconomic factors such as population, employment, and income, (2) historical and forecast aircraft aviation trends for Hillsboro and the other general aviation airports in the Portland region, (3) the Airport's share of regional aviation operations, (4) the cost of aviation fuel, and (5) key factors affecting future aviation demand such as national and global economic conditions, oil price volatility, and general aviation industry trends.

As shown in Figure 5-1, the unconstrained demand forecast approach incorporated a multi-tiered approach to evaluate aircraft operations at Hillsboro and other airports in the Portland region. It was recognized that no one approach would provide input on all of the key factors that affect general aviation activity. For example, an econometric analysis would provide input on the relationships between historical general aviation activity and regional economic conditions but little to no input on such factors as (1) the role of general aviation facilities (availability, costs, and location) in the decisions of based aircraft owners, (2) regional general aviation trends and the Airport's role in providing general aviation facilities, and (3) recent trends in the general aviation industry that reflect current conditions nationally and inform future trends. Input from these factors is important to the development of reliable forecasts that can serve as the basis for planning efforts at the Airport.

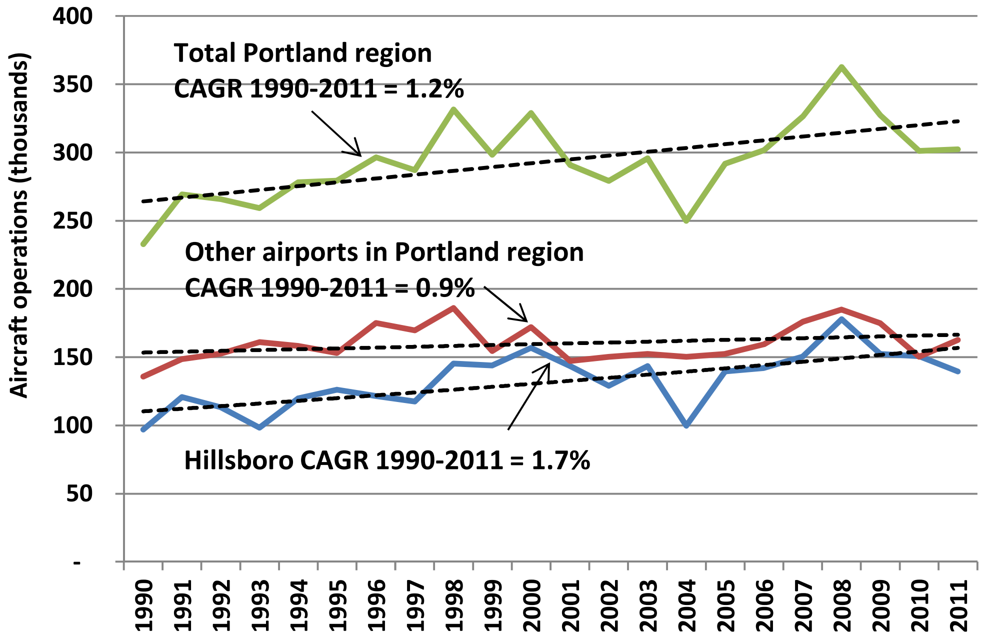
Figure 5-1
UNCONSTRAINED DEMAND FORECAST APPROACH
Portland MSA General Aviation Demand



Historical Trend Analysis

Trend analysis is used in aviation forecasting to examine changes in traffic characteristics or underlying factors over time. Simple mathematical techniques such as linear and exponential trends are used to represent changes in the historical data. The calculation of compound average annual growth rates is an example of trend analysis and is frequently used in aviation forecasting to benchmark future growth against historical trends. As shown on Figure 5-2, the compound average annual growth rate for local general aviation operations at Hillsboro is 1.7% between 1990 and 2011, including faster growth between 1990 and 2000 (an average increase of 4.9% per year), slower growth between 2000 and 2008 (an average increase of 1.6% per year), and decreases in operations between 2008 and 2011 (an average decrease of 7.8% per year). The growth in local general aviation operations at other airports in the Portland region was slower than that for Hillsboro between 1990 and 2011 (an average increase of 0.9% per year), including faster growth between 1990 and 2000 (an average of 2.4% per year), similar growth between 2000 and 2008 (an average of 0.9% per year), and decreases in operations between 2008 and 2011 (an average decrease of 4.1% per year). The decreases in local general aviation operations since 2008 are likely related to the effects of the 2008-2009 economic recession and increasing fuel prices.

Figure 5-2
HISTORICAL TREND ANALYSIS:
LOCAL GENERAL AVIATION AIRCRAFT OPERATIONS
Portland MSA

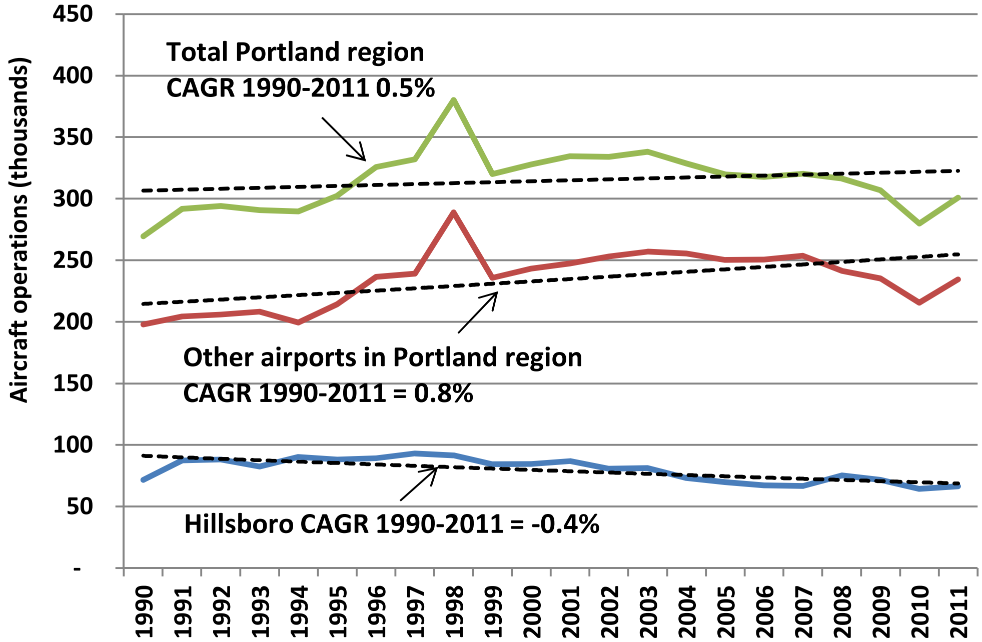


Note: Data for 2011 are forecast.
CAGR = Compound average annual growth rate

Source: U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

In contrast, as shown on Figure 5-3, itinerant general aviation operations at Hillsboro decreased an average of 0.4% per year between 1990 and 2011, including positive growth between 1990 and 2000 (an average increase of 1.7% per year) and then decreases in operations between 2000 and 2008 (an average decrease of 1.5% per year) and 2008 and 2011 (an average decrease of 4.1% per year). Itinerant general aviation operations at other airports in the Portland region increased between 1990 and 2011 (an average increase of 0.8% per year), including faster growth between 1990 and 2000 (an average of 2.1% per year) and decreases in operations 2000 and 2008 (an average decrease of 0.1% per year), and between 2008 and 2011 (an average decrease of 1.0% per year). Similar to recent trends in local general aviation operations, the decreases in itinerant general aviation operations since 2008 are likely related to the effects of the 2008-2009 economic recession and increasing fuel prices. Decreases in itinerant and local general aviation operations at Hillsboro since 2008 may also reflect increased delays and the associated costs.

Figure 5-3
HISTORICAL TREND ANALYSIS:
ITINERANT GENERAL AVIATION AIRCRAFT OPERATIONS
Portland MSA

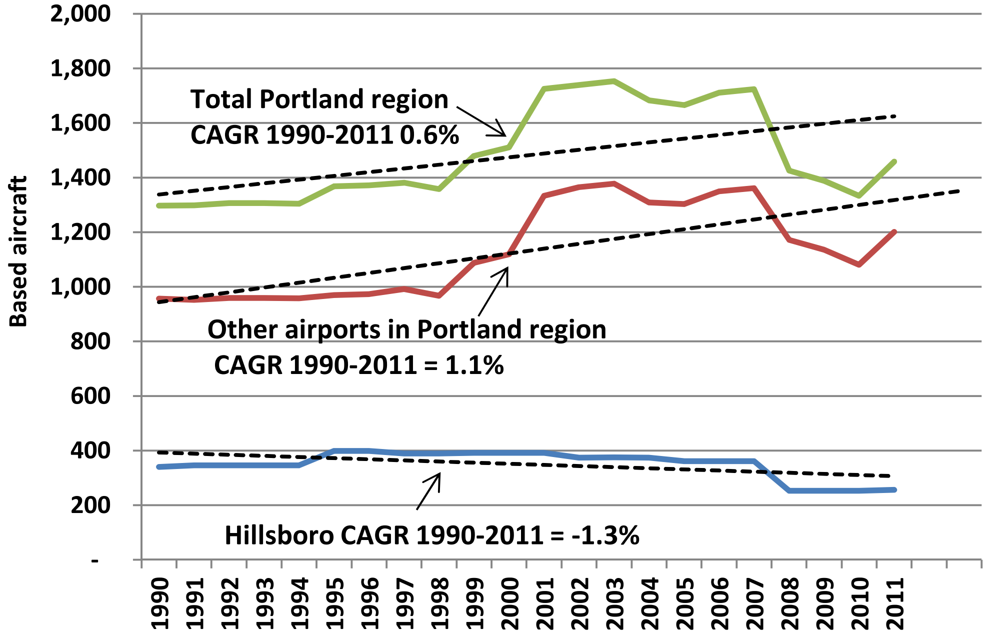


Note: Data for 2011 are forecast.
CAGR = Compound average annual growth rate

Source: U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

Figure 5-4 presents the historical trends in based aircraft at Hillsboro and the other airports in the Portland region between 1990 and 2011. The number of based aircraft at Hillsboro decreased an average of 1.3% per year between 1990 and 2011, including positive growth between 1990 and 2000 (an average increase of 1.4% per year), decreases in based aircraft between 2000 and 2008 (an average decrease of 5.3% per year), and relatively no change between 2008 and 2011 (an average increase of 0.5% per year). As noted in Chapter 3, the decrease in based aircraft in 2007 is related to a change in the FAA's reporting methodology for based aircraft rather than a decrease in market demand. The growth in the number of based aircraft at other airports in the Portland region was faster than that for Hillsboro between 1990 and 2011 (an average increase of 1.1% per year), including faster growth between 1990 and 2000 (an average of 1.6% per year), slower growth between 2000 and 2008 (an average of 0.6% per year), and relatively no change between 2008 and 2011 (an average increase of 0.8% per year).

Figure 5-4
HISTORICAL TREND ANALYSIS: BASED AIRCRAFT
Portland MSA



Note: Data for 2011 are forecast.
CAGR = Compound average annual growth rate

Source: U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

Although trend analysis can be a valuable benchmarking tool, this technique does not model causal relationships, relies on the assumption that historical trends will continue into the future, and is unable to reflect changes in the underlying causal factors such as economic conditions or fuel prices. As a result, regression analysis was also used as a forecast tool, with the trend analysis informing the regression results.

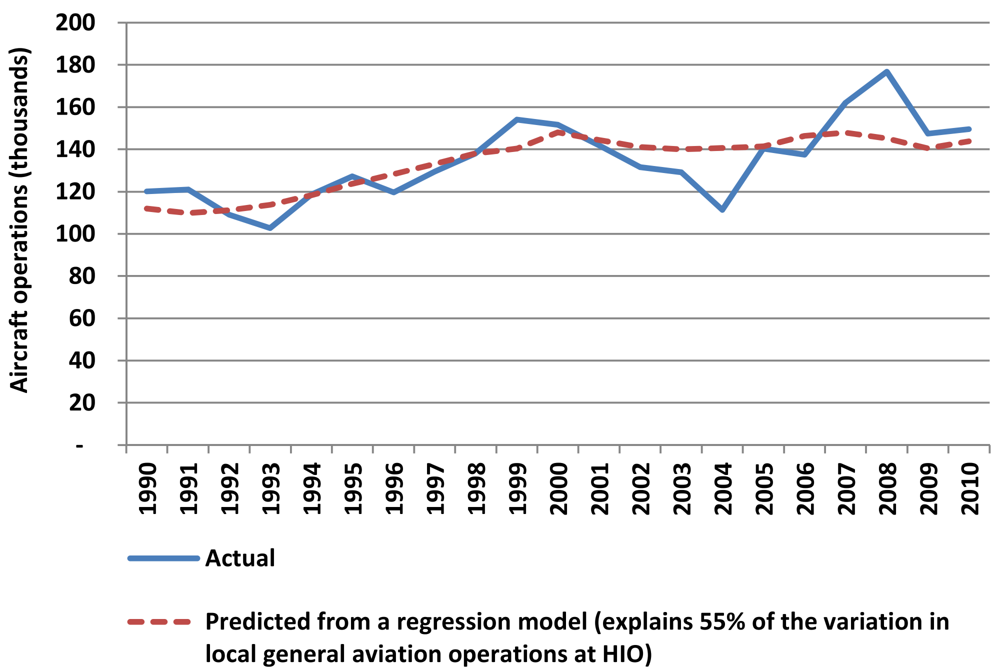
Regression Analysis

In regression analysis, a mathematical equation defines causal relationships between general aviation activity and socioeconomic, flying costs, and other factors. This analytical tool typically requires independent forecasts of causal factors to produce aviation forecasts. To prepare general aviation demand forecasts for Hillsboro, regressions analyses of local and itinerant general aviation operations and based aircraft were conducted. The regression analysis results are summarized in the following paragraphs. Appendix A presents the regression model equations and statistical tests.

Local General Aviation Operations. The trend in general aviation operations at Hillsboro can be explained by a regression analysis relating operation trends to economic and flying cost metrics. Typically, an aviation demand regression model includes an income variable (e.g., total personal income, per capita income, or GDP—all expressed in constant dollars) and a cost of travel variable (e.g., the price of aviation fuel—also expressed in constant dollars). The primary objective is to represent the key variables that affect aviation demand, i.e., how much people have to spend and how much it costs to travel. Other variables may be important as well, depending on the traffic market characteristics.

As shown in Figure 5-5, the historical trend in local general aviation operations at Hillsboro relates to the predicted values from a regression model based on annual data which includes per capita personal income in the Portland MSA, in 2000 dollars. Regression models which included data for the price of aviation fuel were not effective in explaining the trends in local general aviation operations although it is likely that, in practice, the price of aviation fuel affects general aviation demand. Using the projections of per capita personal income in the Portland MSA, presented in Table 2-1 in Chapter 2, forecasts of local general aviation operations using this regression model produced an average annual growth rate of 2.2% per year between 2011 and 2031, which exceeds the historical growth rate of 1.7% per year between 1990 and 2011. This result suggests that factors in addition to per capita income likely affect local general aviation aircraft operations.

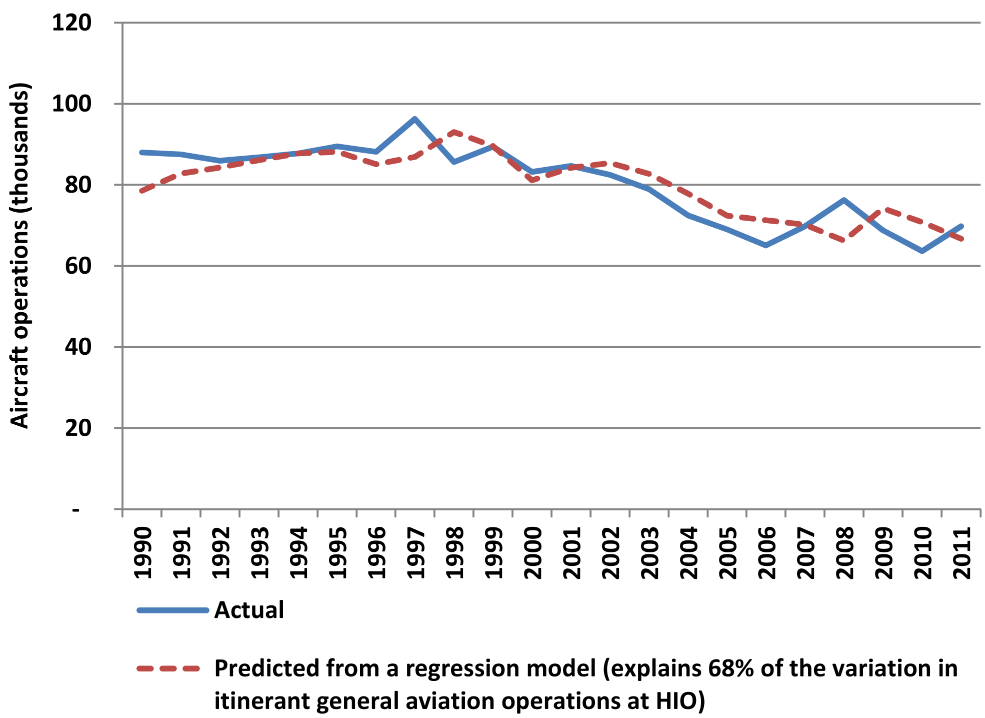
Figure 5-5
HISTORICAL AND PREDICTED LOCAL GENERAL AVIATION OPERATIONS
Portland Hillsboro Airport



Sources: Actual—Port of Portland records and Federal Aviation Administration, Air Traffic Activity System (ATADS), online database.
Predicted—LeighFisher, May 2012.

Itinerant General Aviation Operations. The trend in itinerant general aviation operations can also be explained by a regression analysis relating operation trends to economic and flying cost metrics. As shown in Figure 5-6, the historical trend in itinerant general aviation operations at Hillsboro relates to the predicted values from a regression model based on annual data which includes the price of aviation fuel, in 2000 dollars. Regression models which included per capita personal income in the Portland MSA were not effective in explaining the trends in itinerant general aviation operations, most likely because itinerant operations are more closely related to the income levels of the region where the itinerant aircraft are based. Using the projections of the price of aviation fuel from the FAA Aerospace Forecasts, forecasts of itinerant general aviation operations using this regression model produced an average annual decrease of 0.6% per year between 2011 and 2031, which exceeds the historical trend (an average decrease of 0.4% per year between 1990 and 2011).

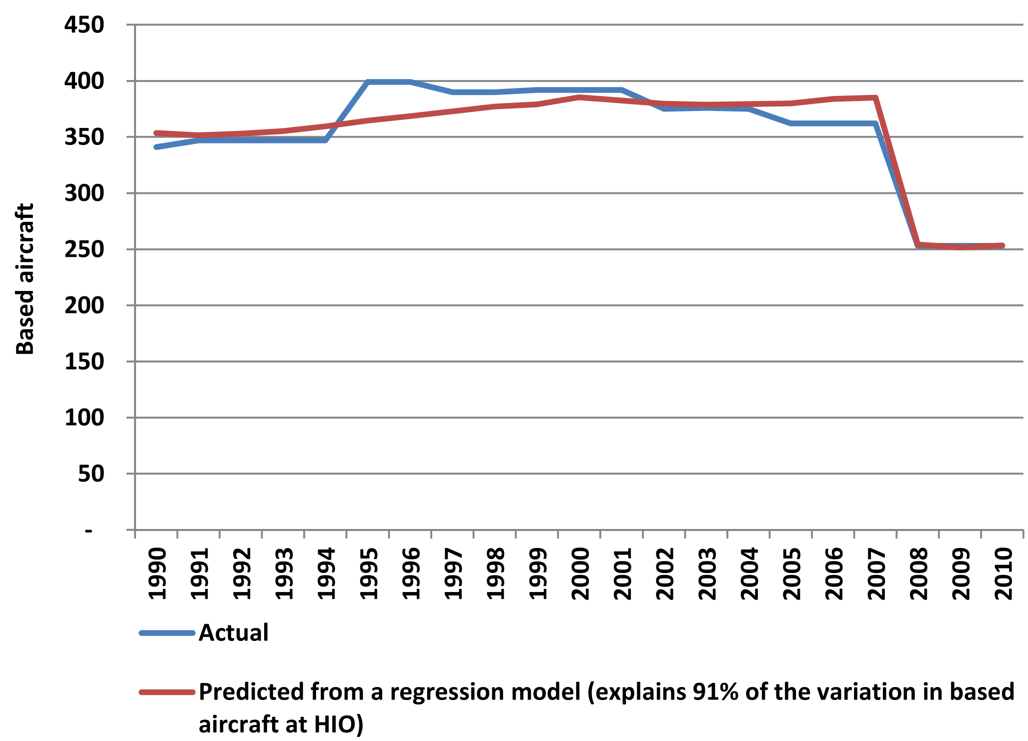
Figure 5-6
HISTORICAL AND PREDICTED ITINERANT GENERAL AVIATION OPERATIONS
Portland Hillsboro Airport



Source: Actual—Port of Portland records and Federal Aviation Administration, Air Traffic Activity System (ATADS), online database.
Predicted—LeighFisher, May 2012.

Based Aircraft. The trend in based aircraft can also be explained by a regression analysis relating operation trends to economic and flying cost metrics. As shown in Figure 5-7, the historical trend in based aircraft at Hillsboro relates to the predicted values from a regression model based on annual data which includes the per capita personal income in the Portland MSA, in 2000 dollars and a dummy variable for the 2008 through 2011 period to represent the effects of the national economic recession and increased fuel prices. It is important to note that an adjustment to the historical data series also appears to have occurred in 2008. Regression models which included the price of aviation fuel were not as effective but they did explain as much as 49% of the trends in based aircraft. Using projections of per capita personal income in the Portland MSA, presented in Table 2-1 in Chapter 2, forecasts of based aircraft using this regression model produced an average annual growth rate of 0.7% per year between 2011 and 2031.

Figure 5-7
HISTORICAL AND PREDICTED BASED AIRCRAFT
Portland Hillsboro Airport



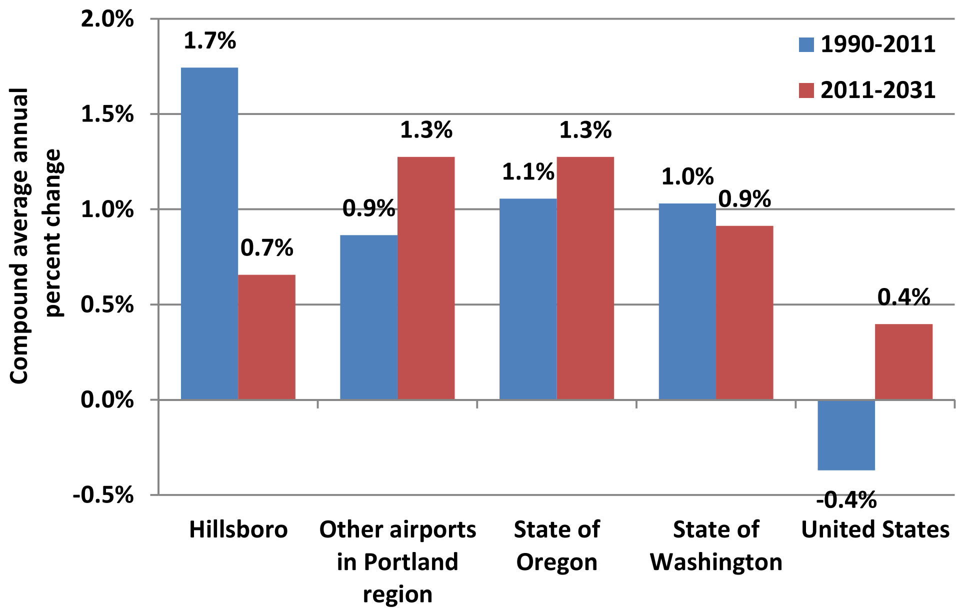
Source: Actual— U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.
Predicted—LeighFisher, May 2012.

The regression analyses for Hillsboro provide an indication of the variables—per capita personal income, the price of aviation fuel, and overall economic conditions—that have influenced historical general aviation trends at the Airport. Projections of these variations together with the regression models provide an indication of future trends. However, these models do not explain all of the variation in general aviation activity or include such factors as the availability, costs, and location of general aviation facilities in the Portland region and recent trends in the general aviation industry.

General Aviation Industry Analysis

Industry trends, both past and present, are important in considering the reasonableness of the forecasts generated by the trends and statistical analysis. As shown in Figure 5-8, the growth in local general aviation operations historically has ranged from an average increase of 0.9% per year to a high of 1.7% per year between 1990 and 2011, with an overall decrease in the nation as a whole during this period. Local general aviation operations are forecast to increase an average of 0.4% per year to a high of 1.3% per year between 2011 and 2031, as reported in the FAA 2011 TAF.

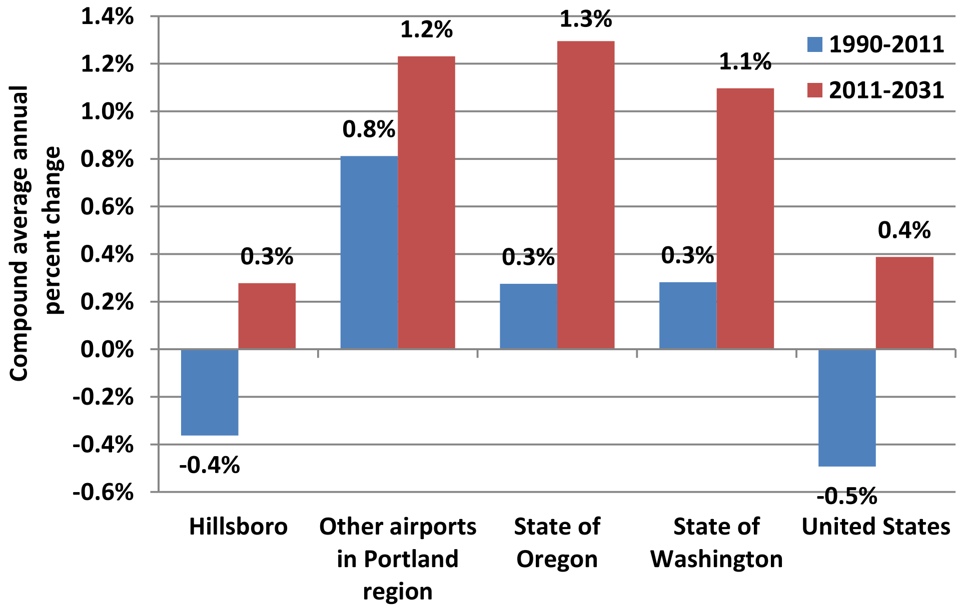
Figure 5-8
HISTORICAL AND FORECAST INDUSTRY TRENDS:
LOCAL GENERAL AVIATION OPERATIONS



Source: Actual— U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

As shown in Figure 5-9, the growth in itinerant general aviation operations historically has ranged from an average increase of 0.3% per year to a high of 0.8% per year between 1990 and 2011, with overall decreases at Hillsboro and in the nation as a whole during this period. Itinerant general aviation operations are forecast to increase an average of 0.3% per year to a high of 1.3% per year between 2011 and 2031, as reported in the FAA 2011 TAF.

Figure 5-9
HISTORICAL AND FORECAST INDUSTRY TRENDS:
ITINERANT GENERAL AVIATION OPERATIONS



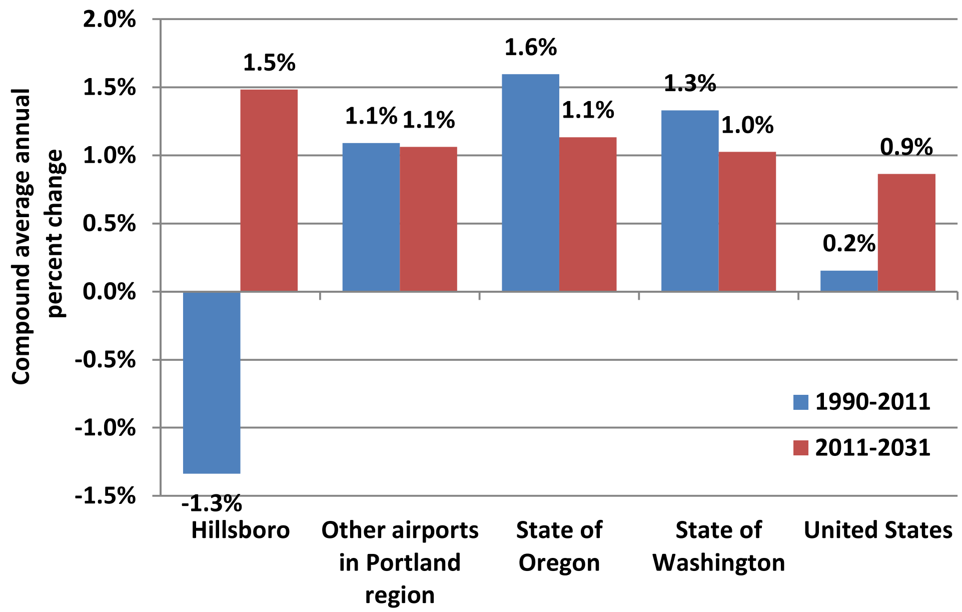
Source: Actual— U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

As shown in Figure 5-10, the growth in based aircraft historically has ranged from an average increase of 0.2% per year to a high of 1.6% per year between 1990 and 2011, with an overall decrease at Hillsboro during this period. Based aircraft are forecast to increase an average of 0.9% per year to a high of 1.5% per year between 2011 and 2031, as reported in the FAA 2011 TAF.

FORECASTS OF AIRCRAFT OPERATIONS

The unconstrained forecasts of aircraft operations at Hillsboro are based on historical trends, the regression analysis of causal variables, and trends in the general aviation industry nationally and in the Portland region. Professional judgment was also used to account for factors that are not reflected in the historical data such as the effect of increases in fuel prices on general aviation activity and potential changes in the services and facilities offered at other airports in the Portland region but that may affect future general aviation demand. As shown in Table 5-1, total aircraft operations at the Airport are forecast to increase an average of 1.2% per year between 2011 and 2031, with slower growth in the near-term (an average increase of 0.9% per year between 2011 and 2016) as the economic recovery continues and fuel prices remain an historically high levels. Local general aviation operations are forecast to increase an average of 1.3% per year between 2011 and 2031, with fixed-wing operations increasing at a slightly faster rate (1.5% per year) than helicopter training operations (1.1% per year). Itinerant general aviation operations are forecast to increase an average of 0.5% per year between 2011 and 2031.

Figure 5-10
HISTORICAL AND FORECAST INDUSTRY TRENDS:
BASED AIRCRAFT



Source: Actual—U.S. Department of Transportation, Terminal Area Forecast, www.faa.gov, accessed January 2012.

Corporate and charter aircraft operations are forecast to increase an average of 1.0% per year between 2011 and 2031. The forecasts of military aircraft operations are based on data for the base year of the forecasts and carried forward through the forecast period. Military operations typically increase and decrease with geopolitical trends and therefore this activity may vary in a given year.

Figure 5-11 presents the forecasts of aircraft operations by type at the Airport from 2011 through 2031.

FORECASTS OF BASED AIRCRAFT

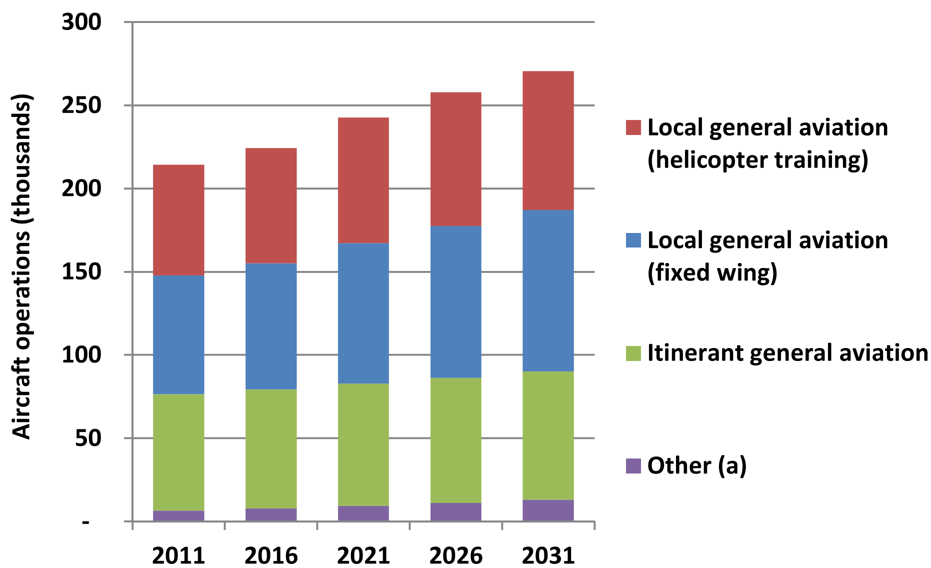
As shown in Table 5-1, total based aircraft at the Airport are forecast to increase an average of 1.0% per year between 2011 and 2031, reflecting the projected growth in the population and economy of the Portland as well as the offsetting effect of increases in future fuel prices which is likely to limit based aircraft demand. Single engine aircraft are forecast to increase an average of 0.4% per year between 2011 and 2031. Multi-engine (non-jet) aircraft are forecast to increase an average of 1.8% per year between

2011 and 2031. Jet aircraft and helicopters are forecast to increase an average of 1.6% per year between 2011 and 2031.

FORECASTS OF GENERAL AVIATION OPERATIONS PER BASED AIRCRAFT

As shown in Table 5-1, the total number of general aviation operations per based aircraft at the Airport is forecast to increase an average of 0.1% per year between 2011 and 2031, including a slight decrease through 2016 reflecting slow economic growth. Itinerant general aviation operations per based aircraft are forecast to decrease an average of 0.5% per year between 2011 and 2031, reflecting increased fuel costs and forecast growth in itinerant aircraft operations (an average increase of 0.5% per year) less than the forecast growth in based aircraft (an average of 1.0% per year). Local general aviation operations per based aircraft are forecast to increase an average of 0.3% per year between 2011 and 2031, reflecting continued growth in helicopter and fixed-wing training operations that are performed at the Airport.

Figure 5-11
UNCONSTRAINED AVIATION DEMAND FORECASTS OF AIRCRAFT OPERATIONS
Portland Hillsboro Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

(a) Includes corporate, charter, and military aircraft operations.

Source: Historical: Port of Portland records and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database.
Forecast: LeighFisher, May 2012.

Table 5-1
UNCONSTRAINED AVIATION DEMAND FORECASTS
Portland Hillsboro Airport
2011-2031

	Historical	Unconstrained baseline forecast				Compound average annual percent increase (decrease)				
	2011	2016	2021	2026	2031	2011-2016	2016-2021	2021-2026	2026-2031	2011-2031
BASED AIRCRAFT										
Single Engine (Nonjet)	147	150	154	157	161	0.5%	0.5%	0.4%	0.4%	0.4%
Multi Engine (Nonjet)	31	34	37	40	44	1.8	1.8	1.8	1.7	1.8
Jet Engine	39	42	46	50	54	1.7	1.6	1.6	1.6	1.6
Helicopter	40	43	47	51	55	1.6	1.6	1.6	1.6	1.6
Total based aircraft	257	270	284	298	314	1.0%	1.0%	1.0%	1.0%	1.0%
AIRCRAFT OPERATIONS										
Corporate and charter	6,239	7,484	9,014	10,704	12,714	3.7%	3.8%	3.5%	3.5%	3.6%
General aviation										
Itinerant	69,770	71,530	73,340	75,190	77,090	0.5	0.5	0.5	0.5	0.5
Local										
Fixed-wing	71,301	75,660	84,340	91,260	96,820	1.2%	2.2%	1.6%	1.2%	1.5%
Helicopter training	66,521	69,190	75,590	80,180	83,360	0.8	1.8	1.2	0.8	1.1
Subtotal--local	137,822	144,850	159,930	171,440	180,180	1.0%	2.0%	1.4%	1.0%	1.3%
Subtotal--general aviation	207,592	216,380	233,270	246,630	257,270	0.8%	1.5%	1.1%	0.8%	1.1%
Military	412	400	400	400	400	(0.6)	0.0	0.0	0.0	(0.1)
Total aircraft operations	214,243	224,264	242,684	257,734	270,384	0.9%	1.6%	1.2%	1.0%	1.2%
GENERAL AVIATION OPERATIONS PER BASED AIRCRAFT										
Itinerant	271	265	258	252	246	(0.5%)	(0.5%)	(0.5%)	(0.5%)	(0.5%)
Local										
Fixed wing	277	280	297	306	309	0.2	1.2	0.6	0.2	0.5
Helicopter training	259	256	266	269	266	(0.2)	0.8	0.2	(0.2)	0.1
Total local	536	536	563	575	575	0.0	1.0	0.4	0.0	0.3
Total general aviation operations	808	801	822	827	820	(0.2%)	0.5%	0.1%	(0.2%)	0.1%
FIXED WING/ITINERANT HELICOPTER AIRCRAFT OPERATIONS	147,722	155,070	167,090	177,550	187,020	1.0%	1.5%	1.2%	1.0%	1.2%
Percent of ASV										
2003 (ASV = 169,000)	--	92%	99%	105%	111%					
2011 (ASV = 178,000)	83%	87%	94%	100%	105%					
New runway (ASV = 315,000)	--	49%	53%	56%	59%					

The forecasts presented in this table were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Note: Aircraft operations include departures and arrivals.
ASV = Annual Service Volume, in terms of annual operations by fixed-wing and itinerant helicopters, as reported in the Hillsboro Master Plan, 2005. 2011 ASV reflects the addition of high-speed taxiways.
Corporate and charter activity includes air carrier and air taxi operations.

Sources: Historical: Port of Portland records and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database.
Forecast: LeighFisher, May 2012.

FORECASTS OF GENERAL AVIATION AIRCRAFT FLEET MIX

Table 5-2 presents the general aviation aircraft fleet mix in 2011 and forecasts for 2016, 2021, 2026, and 2031 summarized in terms of the number of annual general aviation aircraft operations at the Airport. The 2011 estimate is based on the number of helicopter training operations reported by the HIO Air Traffic Control Tower presented earlier in Table 3-5 in Chapter 3, data on aircraft types and models collected from a survey of general aviation users, and actual counts of general aviation aircraft operations at the Airport in 2011.

Single engine aircraft accounted for an estimated 37.9% of general aviation operations in 2011 and are forecast to decrease gradually to 33.9% in 2031. Multi-engine aircraft are forecast to account for an increasing share of general aviation operations, increasing from an estimated 14.5% in 2011 to 15.3% in 2031. Business jets accounted for an estimated 14.1% of general aviation operations in 2011 and are forecast to increase to 16.1% in 2031. Helicopters are forecast to increase from an estimated 32.6% in 2011 to 33.0% in 2031. Other aircraft, including gliders, experimental, and sports aircraft are forecast to increase from an estimated 0.9% in 2011 to 1.7% in 2031.

Table 5-2
UNCONSTRAINED DEMAND FORECASTS OF THE GENERAL AVIATION AIRCRAFT FLEET
Portland Hillsboro Airport

	Number of general aviation operations					Percent of total general aviation operations				
	Estimated	Unconstrained baseline forecast				Estimated	Unconstrained baseline forecast			
	2011 *(a)*	2016	2021	2026	2031	2011 *(a)*	2016	2021	2026	2031
Single engine										
Cessna 172	28,010	28,420	29,810	30,640	31,050	13.5%	13.1%	12.8%	12.4%	12.1%
Cessna 152	18,941	19,220	20,160	20,720	21,000	9.1	8.9	8.6	8.4	8.2
Cessna 182	5,078	5,150	5,400	5,550	5,630	2.4	2.4	2.3	2.3	2.2
Cirrus SR22	3,543	3,600	3,770	3,880	3,930	1.7	1.7	1.6	1.6	1.5
Cessna 162	3,424	3,480	3,640	3,750	3,800	1.6	1.6	1.6	1.5	1.5
Cessna 206	3,401	3,450	3,620	3,720	3,770	1.6	1.6	1.6	1.5	1.5
Diamond DA-40	2,881	2,920	3,070	3,150	3,190	1.4	1.4	1.3	1.3	1.2
Other	13,391	13,590	14,250	14,650	14,840	6.5	6.3	6.1	5.9	5.8
Subtotal single engine	78,668	79,830	83,730	86,060	87,200	37.9%	36.9%	35.9%	34.9%	33.9%
Multi-engine										
Piper 44	12,729	13,450	14,700	15,750	16,650	6.1%	6.2%	6.3%	6.4%	6.5%
Beech King Air	5,904	6,240	6,820	7,300	7,720	2.8	2.9	2.9	3.0	3.0
Rockwell Turbo Commander	4,487	4,740	5,180	5,550	5,870	2.2	2.2	2.2	2.3	2.3
Other	6,980	7,380	8,060	8,640	9,130	3.4	3.4	3.5	3.5	3.5
Subtotal multi-engine	30,101	31,810	34,760	37,240	39,360	14.5%	14.7%	14.9%	15.1%	15.3%
Business Jet										
Learjet 35	5,833	6,300	7,020	7,670	8,250	2.8%	2.9%	3.0%	3.1%	3.2%
IAI Westwind 1124/1125	2,480	2,680	2,980	3,260	3,510	1.2	1.2	1.3	1.3	1.4
Learjet 31	2,362	2,550	2,840	3,100	3,340	1.1	1.2	1.2	1.3	1.3
Bombardier Challenger 600	2,362	2,550	2,840	3,100	3,340	1.1	1.2	1.2	1.3	1.3
Gulfstream IV	2,362	2,550	2,840	3,100	3,340	1.1	1.2	1.2	1.3	1.3
Grumman Gulfstream II	2,362	2,550	2,840	3,100	3,340	1.1	1.2	1.2	1.3	1.3
Learjet 45	2,291	2,470	2,760	3,010	3,240	1.1	1.1	1.2	1.2	1.3
Raytheon Hawker 800	2,291	2,470	2,760	3,010	3,240	1.1	1.1	1.2	1.2	1.3
Bombardier Global Express	2,291	2,470	2,760	3,010	3,240	1.1	1.1	1.2	1.2	1.3
Other	4,638	5,010	5,580	6,100	6,560	2.2	2.3	2.4	2.5	2.6
Subtotal business jet	29,270	31,590	35,220	38,470	41,420	14.1%	14.6%	15.1%	15.6%	16.1%

Table 5-2 (Page 2 of 2)
UNCONSTRAINED DEMAND FORECASTS OF THE GENERAL AVIATION AIRCRAFT FLEET
Portland Hillsboro Airport

	Number of general aviation operations					Percent of total general aviation operations				
	Estimated	Unconstrained baseline forecast				Estimated	Unconstrained baseline forecast			
	2011 *(a)*	2016	2021	2026	2031	2011 *(a)*	2016	2021	2026	2031
Helicopter										
Robinson R22	25,151	26,300	28,440	30,160	31,550	12.1%	12.2%	12.2%	12.2%	12.3%
Robinson R44	24,041	25,140	27,180	28,830	30,160	11.6	11.6	11.7	11.7	11.7
Schwiezer 269/300/333	18,493	19,340	20,910	22,170	23,200	8.9	8.9	9.0	9.0	9.0
Subtotal helicopter	67,675	70,760	76,510	81,140	84,900	32.6%	32.7%	32.8%	32.9%	33.0%
Other										
Vans RV	1,661	2,120	2,700	3,290	3,890	0.8%	1.0%	1.2%	1.3%	1.5%
Other	208	260	340	410	490	0.1	0.1	0.1	0.2	0.2
Subtotal other	1,868	2,380	3,030	3,700	4,370	0.9%	1.1%	1.3%	1.5%	1.7%
Total GA operations	207,592	216,380	233,270	246,630	257,270	100.0%	100.0%	100.0%	100.0%	100.0%

The forecasts presented in this table were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Note: Aircraft operations include departures and arrivals.

(a) Estimated based on the number of helicopter training operations provided by the HIO Air Traffic Control Tower, Riley & Associates, Port of Portland General Aviation Survey, February 2012, Port of Portland records, and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database, www.faa.gov.

Sources: Forecast: LeighFisher, May 2012.

Chapter 6.

COMPARISON WITH THE FAA 2011 TAF

Table 6-1 presents a comparison of the unconstrained aviation demand forecasts prepared for Portland Hillsboro Airport and the FAA 2011 TAF for the Airport. The unconstrained forecasts are the "preferred" forecasts recommended for FAA approval. The forecasts are compared for the components of commercial aircraft operations and total aircraft operations. The format of Table 6-1 is based on the template provided by the FAA for the comparison of airport planning forecasts and the FAA TAF.* As required, the results are presented for the base year of 2011 and forecast horizons years which are equal to the base year, plus 1, 5, 10 and 15 years (2011, 2016, 2021, and 2026). The HIO aviation demand forecasts have been compared graphically with the FAA 2011 TAF in the figures presented throughout this report, including Figures 1-1 and 1-2 in Chapter 1.

The unconstrained forecasts were based on market conditions and do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. Similarly, the FAA TAF for individual airports "assumes an unconstrained demand for aviation services (i.e., an airport's forecast is developed independent of the ability of the airport and the air traffic control system to supply the capacity required to meet the demand.)" Therefore, the unconstrained forecasts are used as a basis for comparison with the FAA 2011 TAF for HIO.

The key findings of the comparison of the HIO aviation demand forecasts with the FAA 2011 TAF are:

- The forecast of commercial operations for Hillsboro varies from the FAA 2011 TAF by less than 10.0% in 5 years (6.8% in 2016) and less than 15.0% in 10 years (12.5% in 2021).
- The forecast of total aircraft operations for Hillsboro varies from the FAA 2011 TAF by less than 10.0% (2.2% in 2016 and 6.6% in 2021).
- The forecast of total based aircraft for Hillsboro varies from the FAA 2011 TAF by less than 10.0% (2.5% in 2016 and 4.7% in 2021).
- Overall, the HIO aviation demand forecasts are similar to the FAA 2011 TAF for the Airport and "differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period", as stipulated in the FAA forecast guidance.

*U.S. Department of Transportation, Federal Aviation Administration, *Forecasting Aviation Activity by Airport*, July 2001, and *Review and Approval of Aviation Forecasts*, June 2008, http://www.faa.gov.

Table 6-1 presents a summary of the HIO aviation demand forecasts using a second template provided by the FAA.

Table 6-1
FAA TAF FORECAST COMPARISON
Portland Hillsboro Airport
2011 – 2026

	Year *(a)*	HIO planning forecast	FAA 2011 TAF	HIO forecast vs. 2011 TAF (percent variance)
Passenger enplanements				
Base yr.	2011	n.a.	n.a.	n.a.
Base yr. + 5 yrs.	2016	n.a.	n.a.	n.a.
Base yr. + 10 yrs.	2021	n.a.	n.a.	n.a.
Base yr. + 15 yrs.	2026	n.a.	n.a.	n.a.
Commercial operations *(b)*				
Base yr.	2011	6,239	6,264	(0.4)%
Base yr. + 5 yrs.	2016	7,484	8,033	(6.8)
Base yr. + 10 yrs.	2021	9,014	10,299	(12.5)
Base yr. + 15 yrs.	2026	10,704	13,204	(18.9)
Total operations *(c)*				
Base yr.	2011	214,243	212,542	0.8%
Base yr. + 5 yrs.	2016	224,264	219,459	2.2
Base yr. + 10 yrs.	2021	242,684	227,585	6.6
Base yr. + 15 yrs.	2026	257,734	236,537	9.0
Total based aircraft				
Base yr.	2011	257	257	0.0%
Base yr. + 5 yrs.	2016	270	277	(2.5)
Base yr. + 10 yrs.	2021	284	298	(4.7)
Base yr. + 15 yrs.	2026	298	320	(6.8)

n.a. = not applicable

(a) The HIO planning forecasts were prepared on a calendar year basis and the FAA 2011 TAF was prepared on a U.S. government fiscal year basis (October through September).
(b) Commercial operations include corporate and charter operations.
(c) Total operations include commercial operations plus operations by general aviation and military.

Sources: Base year 2011 (actual)—Port of Portland records and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database.

HIO Forecasts—LeighFisher, May 2012.

FAA 2011 TAF for HIO—U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov, accessed January 2012.

Table 6-2
SUMMARY OF HIO FORECASTS USING FAA TEMPLATE
Portland Hillsboro Airport

		Forecast				Average annual compound growth rates			
	Base year 2011	Base year + 1 year 2012	Base year + 5 years 2016	Base year + 10 years 2021	Base year + 15 years 2026	Base year to +1 year 2011 - 2012	Base year to +5 years 2011 - 2016	Base year to +10 years 2011 - 2021	Base year to +15 years 2011 - 2026
Passenger enplanements (millions)									
Air carrier *(a)*	n.a.	n.a.	n.a.	n.a.	n.a.	--	--	--	--
Commuter *(b)*	n.a.	n.a.	n.a.	n.a.	n.a.	--	--	--	--
Total	n.a.	n.a.	n.a.	n.a.	n.a.	--	--	--	--
Aircraft operations (thousands)									
Itinerant									
Air carrier	4	4	4	4	4	0.0%	0.0%	0.0%	0.0%
Commuter/air taxi	6,235	6,450	7,480	9,010	10,700	3.4%	3.7%	3.8%	3.7%
Total commercial operations	6,239	6,454	7,484	9,014	10,704	3.4%	3.7%	3.7%	3.7%
General aviation	69,770	70,120	71,530	73,340	75,190	0.5%	0.5%	0.5%	0.5%
Military	412	400	400	400	400	(2.9)%	(0.6)%	(0.3)%	(0.2)%
Local									
General aviation	137,822	139,200	144,850	159,930	171,440	1.0%	1.0%	1.5%	1.5%
Military	--	--	--	--	--	--	--	--	--
Total operations	214,243	216,174	224,264	242,684	257,734	0.9%	0.9%	1.3%	1.2%
Instrument Operations	20,037	20,530	21,950	24,140	26,900	2.5%	1.8%	1.9%	2.0%
Peak Hour Operations	n.a	n.a	n.a	n.a	n.a	--	--	--	--
Cargo/mail (enplaned + deplaned tons)	n.a	n.a	n.a	n.a	n.a	--	--	--	--
Based Aircraft									
Single-engine (nonjet)	147	148	150	154	157	0.5%	0.5%	0.5%	0.4%
Multiengine (nonjet)	31	32	34	37	40	1.8%	1.8%	1.8%	1.8%
Jet engine	39	40	42	46	50	1.7%	1.7%	1.6%	1.6%
Helicopter	40	41	43	47	51	1.6%	1.6%	1.6%	1.6%
Other	--	--	--	--	--	--	--	--	--
Total	257	260	270	284	298	1.0%	1.0%	1.0%	1.0%
Operational factors									
Average aircraft size (seats)									
Air Carrier *(a)*	n.a	n.a	n.a	n.a	n.a				
Commuter *(b)*	n.a	n.a	n.a	n.a	n.a				
Average enplaning load factor									
Air Carrier *(a)*	n.a	n.a	n.a	n.a	n.a				
Commuter *(b)*	n.a	n.a	n.a	n.a	n.a				
GA operations per based aircraft	808	806	801	822	827				

Note: The HIO planning forecasts were prepared on a calendar year basis and the FAA 2011 TAF was prepared on a U.S. government fiscal year basis (October through September).

(a) Includes mainline and charter airline activity as summarized in the previous tables in this report.

(b) Includes regional affiliate airline activity, which includes flights using regional aircraft with more than 60 seats.

Sources: Base year 2010 (actual)—Port of Portland records. HIO Forecasts—LeighFisher, May 2012. FAA 2011 TAF for HIO—U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov, accessed January 2012.

Appendix A

REGRESSION ANALYSIS

Regression analysis compares the historical relationship between a dependent variable, in this case, enplaned passengers, and an independent or "predictor" variable. The predictor variable is eventually used to project future levels of the dependent variable. In aviation demand forecasts, the predictor variable is typically represented by an economic or demographic metric such as population, employment, or personal income. Regression analyses produce a mathematical equation that identifies the strength or reliability of the historical correlation between the dependent variable (enplaned passengers) and predictor variables. The statistical reliability of this equation is typically measured by a regression statistic known as "R-squared." An R-squared of 1.0 would represent a perfect historical correlation between the dependent and predictor variable and suggest that the measurement of this historical relationship will be a reliable predictor of future results.

Three regression models were defined during the forecast process to evaluate historical trends in local and itinerant general aviation aircraft operations and based aircraft and are presented in Table A-1.

Table A-1
REGRESSION MODELS
Portland Hillsboro Airport

	Coefficient	t-statistic	P-value
Local general aviation aircraft operations			
Dependent variable = ln(Hillsboro local general aviation aircraft operations)			
Independent variables			
ln(Portland MSA per capita personal income, 2000 dollars)	1.28	5.02	0.0001
Constant	-1.41	-0.53	0.5995
Observations	21		
Adjusted R-squared	0.55		
Itinerant general aviation aircraft operations			
Dependent variable = ln(Hillsboro itinerant general aviation aircraft operations)			
Independent variables			
ln(price of aviation fuel, 2010 dollars per gallon)	-0.20	-6.70	0.0000
Constant	11.32	737.65	0.0000
Observations	22		
Adjusted R-squared	0.68		
Based aircraft			
Dependent variable = ln(Hillsboro based aircraft)			
Independent variables			
ln(Portland MSA per capita personal income, 2000 dollars)	0.39	3.18	0.0052
Dummy variable (2008 = 1.0)	-0.41	-14.63	0.0000
Constant	1.86	1.46	0.1628
Observations	21		
Adjusted R-squared	0.91		

Source: LeighFisher, May 2012.

U.S. Department
of Transportation

**Federal Aviation
Administration**

Northwest Mountain Region
Colorado, Idaho, Montana
Oregon, Utah, Washington,
Wyoming

1601 Lind Avenue, S. W., Ste 315
Renton, Washington 98057

December 12, 2012

Ms. Renee Dowlin, AICP
Aviation Environmental Program Manager
Port of Portland
7200 NE. Airport Way
Portland, OR 97218

Dear Ms. Dowlin:

Aviation Demand Forecasts
Draft Supplemental Environmental Assessment (EA)
Portland-Hillsboro Airport

The Federal Aviation Administration (FAA) hereby approves the unconstrained aviation demand forecasts for Portland-Hillsboro Airport (HIO), dated October 29, 2012, and submitted in support of the draft Supplemental EA currently being prepared. The approved forecasts include the revised Table A-1, which uses aviation fuel costs as a variable. FAA will use the approved HIO forecasts for the Terminal Area Forecasts (TAF) and other purposes.

If you have any questions, please contact me at (425) 227-2615.

Sincerely,

Don M. Larson

Don M. Larson
Airport Capacity Program Manager

ec:
Linda Perry, Leigh Fisher Consultants
APP-400
APO-110
SEA-600

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Appendix C – Constrained Forecasts

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Appendix C – Constrained Forecasts

Constrained Forecasts were developed to reflect the estimated capacity of the Airport, in terms of annual fixed-wing aircraft operations. Since the 2005 Hillsboro Master Plan and Environmental Assessment were prepared, high-speed exit taxiways have been constructed at Hillsboro that increased the Annual Service Volume (ASV) from 169,000 to 178,000 annual fixed-wing aircraft operations. Notwithstanding this capacity enhancement, fixed-wing aircraft operations accounted for 83% of the Airport's ASV in 2011.

This appendix summarizes the Constrained Forecasts of aircraft operations and based aircraft for the Airport, including the forecast approach and assumptions. Although the Constrained Forecasts are not part of the standard process of preparing planning forecasts, they were developed to address the capacity constraints at the Airport. Four future demand years are presented, including forecasts for 2016, 2021, 2026, and 2031.

FORECAST APPROACH AND ASSUMPTIONS

The approach for developing Constrained Forecasts included consideration of:

- The Unconstrained Forecasts presented in Appendix B.
- The ASV of the Airport as calculated in the 2005 Hillsboro Master Plan. The FAA defines ASV as "a reasonable estimate of an airport's annual capacity. It accounts for differences in runway use, aircraft mix, weather conditions, etc., that would be encountered over a year's time."*
- The ASV for Hillsboro is calculated using only those operations utilizing the runway system. For Hillsboro, this includes all fixed-wing aircraft operations (both itinerant and local) and itinerant helicopter operations. Since helicopter training operations at Hillsboro Airport operate to taxiways and other landing areas, they are not considered in the capacity analysis since they do not dictate the need for additional runways.
- Estimates of total fixed-wing operations using counts of helicopter training operations provided by the Airport Air Traffic Control Tower.
- It is assumed that the growth in the number of general aviation aircraft operations will be similar to the unconstrained demand forecasts until the number of fixed-wing aircraft operations approach the ASV for the Airport.

FORECASTS OF AIRCRAFT OPERATIONS

The Constrained Forecasts of aircraft operations are presented in **Table C-1** and **Figure C-1**. Beginning in about 2024, capacity constraints begin to impact the growth in aircraft operations at the Airport. At this point, the growth rates are no longer driven by the recent growth trends or causal factors evaluated in the Unconstrained Forecasts, but are steadily decreased until the ASV is reached. The estimated ASV in 2011 is 178,000 operations with the addition of high-speed

* U.S. Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5060-5, "Airport Capacity and Delay," September 23, 1983.

exit taxiways since the 2005 Master Plan was completed. The shape of the curve reflects how general aviation users will change behavior as demand approaches capacity. Typically, general aviation users may initially accept higher delays and then eventually respond by flying at off-peak times or moving activity to other airports. This process typically evolves slowly over many years resulting in a slow but steady decline in growth rates.

As shown in **Table C-1**, in the Constrained Forecasts, total aircraft operations at the Airport are forecast to increase an average of 0.9% per year between 2011 and 2031. Local general aviation operations are forecast to increase an average of 1.1% per year between 2011 and 2031, with helicopter training operations increasing at a slightly slower rate (1.0% per year) than fixed-wing operations (1.3% per year). Itinerant general aviation operations are forecast to increase an average of 0.3% per year between 2011 and 2031.

Air carrier and air taxi aircraft operations are forecast to increase an average of 2.7% per year between 2011 and 2031. The forecasts of military aircraft operations are based on data for the base year of the forecasts and carried forward through the forecast period. Military operations typically increase and decrease with geopolitical trends and therefore this activity may vary in a given year.

Figure C-1 presents the forecasts of aircraft operations by type at the Airport from 2011 through 2031.

FORECASTS OF BASED AIRCRAFT

As shown in **Table C-1**, in the Constrained Forecasts, total based aircraft at the Airport are forecast to increase an average of 0.3% per year between 2011 and 2031. Single engine aircraft are forecast to decrease an average of 0.3% per year between 2011 and 2031. Multi-engine (non-jet) aircraft are forecast to increase an average of 1.1% per year between 2011 and 2031. Jet aircraft and helicopters are forecast to increase an average of 0.9% per year between 2011 and 2031.

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Table C-1
CONSTRAINED FORECASTS
Portland Hillsboro Airport
2011-2031

	Historical	Constrained Forecasts				Compound average annual percent increase (decrease)			
	2011	2016	2021	2026	2031	2011-2016	2016-2021	2021-2026	2026-2031
BASED AIRCRAFT									
Single Engine (Nonjet)	147	146	145	143	139	(0.1%)	(0.2%)	(0.3%)	(0.5%)
Multi Engine (Nonjet)	31	33	35	37	38	1.3	1.1	1.0	0.8
Jet Engine	39	41	43	45	47	1.1	1.0	0.9	0.7
Helicopter	40	42	44	46	48	1.1	1.0	0.8	0.7
Total based aircraft	257	263	268	271	272	0.5	0.4	0.2	0.1
AIRCRAFT OPERATIONS									
Air carrier and air taxi	6,239	7,480	9,010	10,400	10,730	3.7%	3.8%	2.9%	0.6%
General aviation									
Itinerant	69,770	71,530	73,340	74,300	74,520	0.5	0.2	0.3	0.1
Local									
Fixed-wing	71,301	75,660	84,340	91,900	92,520	1.2	2.2	1.7	0.1
Helicopter training	66,521	69,190	75,590	80,650	80,670	0.8	1.8	1.3	0.0
Subtotal--local	137,822	144,850	159,930	172,550	173,190	1.0%	2.0%	1.5%	0.1%
Subtotal--general aviation	207,592	216,380	233,270	246,850	247,710	0.8%	1.5%	1.1%	0.1%
Military	412	400	400	400	400	(0.6)%	0.0%	0.0%	0.0%
Total aircraft operations	214,243	224,260	242,680	257,650	258,840	0.9%	1.6%	1.2%	0.1%
GENERAL AVIATION OPERATIONS PER BASED AIRCRAFT									
Itinerant	271	272	274	274	274	0.0%	0.1%	0.0%	0.0%
Local									
Fixed wing	277	288	315	339	340	0.7	1.8	1.5	0.0
Helicopter training	259	263	282	298	296	0.3	1.4	1.1	(0.1)
Total local	536	541	597	637	636	0.5	1.6	1.3	0.0
TOTAL FIXED WING AIRCRAFT OPERATIONS	147,722	155,070	167,090	177,000	178,170	1.0%	1.5%	1.2%	0.1%
Fixed-wing percent of ASV									
2003 (ASV = 169,000)	-- %	92%	99%	105%	105%				
2011 (ASV = 178,000)	83%	87%	94%	99%	100%				
New runway (ASV = 315,000)	--	49%	53%	56%	57%				

The forecasts presented in this table were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

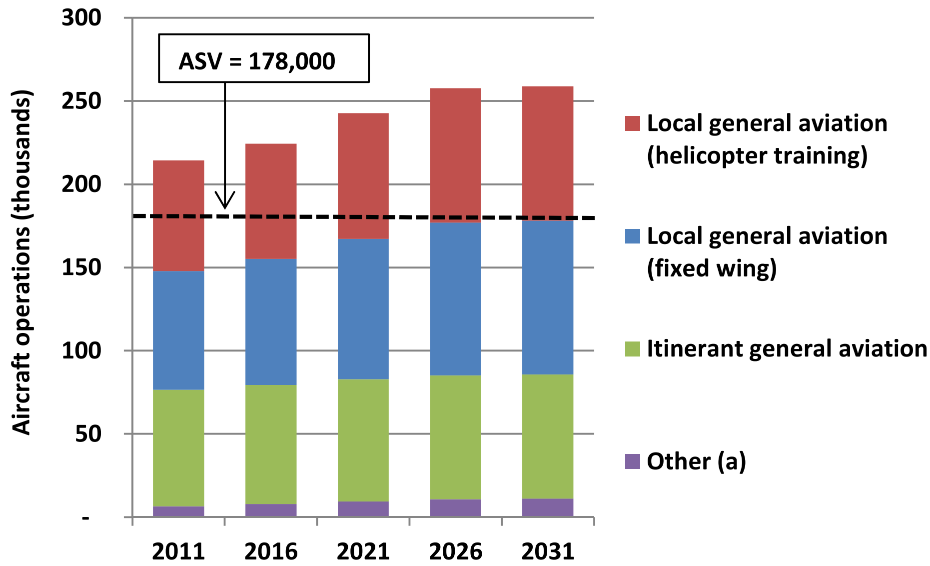
Note: Aircraft operations include departures and arrivals.
ASV = Annual Service Volume, in terms of annual operations, as reported in the Hillsboro Master Plan, 2005. 2011 ASV reflects the addition of high-speed taxiways.

Sources: Historical: Port of Portland records and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database.
Forecast: LeighFisher, May 2012.

Figure C-1

CONSTRAINED FORECASTS OF AIRCRAFT OPERATIONS

Portland Hillsboro Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

(a) Includes air carrier, air taxi, and military aircraft operations.

Source: Historical: Port of Portland records and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database.
Forecasts: LeighFisher, May 2012.

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Appendix D – Remand Forecasts

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Appendix D – Remand Forecasts

In response to the Court's finding and to provide a basis for the induced demand forecast, surveys were conducted of registered pilots, existing Hillsboro tenants, corporate and business users, and aviation-related businesses at the general aviation airports in the Portland region (see Attachment A).[1] Based on the survey of aviation users, an estimate was developed of the induced demand that could result from both a potential reallocation of demand in the region and the potential for growth exceeding the organic growth forecast in the unconstrained. The Remand Forecasts incorporates the potential for additional activity related to changes in general aviation user behavior as a result of the existence and availability of the new parallel runway at Hillsboro and the use of separate runways for single-engine propeller and jet aircraft operations.

Figure D-1 illustrates how three potential interpretations of induced demand might relate to one another and to the Constrained/Unconstrained Forecasts discussed in Chapter 2:

- Interpretation A: **A portion** of induced demand is included in unconstrained demand. Therefore, an induced demand forecast is the sum of unconstrained demand and a portion of induced demand.
- Interpretation B: **No** induced demand is included in unconstrained demand. Therefore, an induced demand forecast is the sum of unconstrained demand and all induced demand.
- Interpretation C: **All** induced demand is included in unconstrained demand. Therefore, an induced demand forecast is equal to the unconstrained forecast.

In both interpretation A and B, induced demand would be above that discussed in Appendix B.[2] While the FAA believes induced demand is included in Interpretation C, this appendix explores the effects on total airport activity from Interpretation B, which would be the most conservative of the various interpretations. Interpretation B would represent a conservative approach that potentially overestimates operations at the Airport. In this evaluation, induced demand is defined as the sum of the activity in the unconstrained demand forecast and the induced demand estimate of the potential additional activity related to the existence and availability of the new runway.

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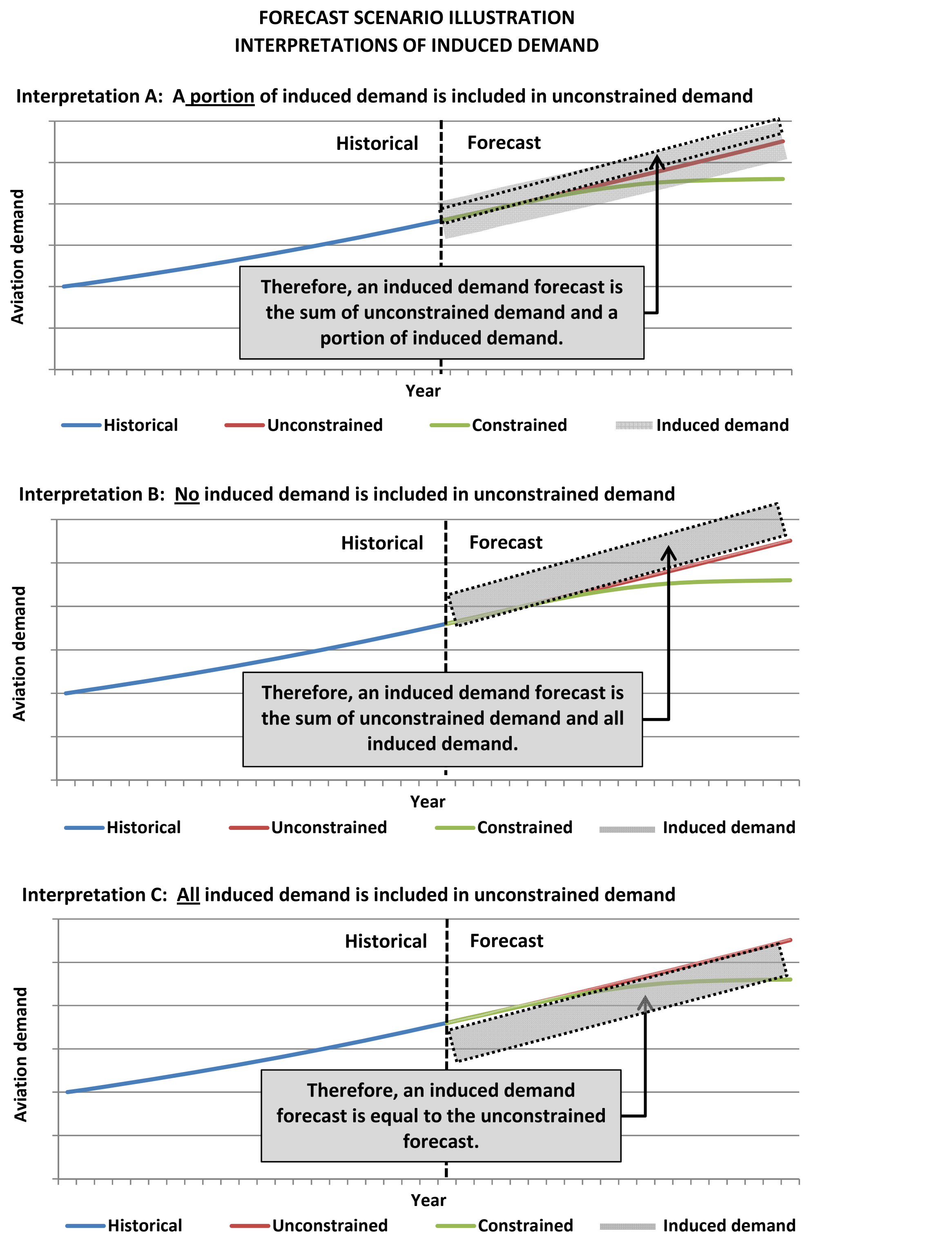
1 Riley Research Associates, *Port of Portland General Aviation Survey*, February 2012. Respondents included pilots, Port of Portland properties and tenants (Hillsboro Airport, Portland-Troutdale Airport, Portland International Airport), Non-Port aviation related businesses throughout Oregon and Washington, and regional airport representatives.

2 Consistent with FAA's standard methodology, which represents a conservative approach, the Unconstrained Forecast in the Final Supplemental Environmental Assessment assumed no artificial or physical constraints at the airport. As such, the Unconstrained Forecast inherently included a portion of the demand that would be attracted to the airport because of the availability of the new runway. However, the 9th Circuit required clearer evidence that induced demand, if any, was considered in the analysis. Out of an abundance of caution and to specifically address the court's decision, the FAA prepared a Remand Forecast that incorporated additional activity attributable to the new runway based on the results of a pilots' survey into the Unconstrained Forecast.



*Interpretation B was used for the estimate of HIO induced demand.

Figure D-1

a. Survey of General Aviation Users

This section summarizes the review of the surveys of general aviation users[3] and provides a summary of the key inputs that are used to estimate the induced demand related to the new parallel runway at Hillsboro. The potential for induced activity is related to the likelihood of changes in general aviation user behavior as a result of the existence and availability of the new runway. Based on the survey of aviation users, an estimate is developed of the induced demand that could result from both a potential reallocation of demand in the Portland region and the potential for growth exceeding the market-driven growth forecast in the Unconstrained Forecasts.

As shown in **Table D-1**, data from the survey are compared with published data for based aircraft and aircraft monthly operations. A total of 348 responses to the survey were received, including 100 respondents with based aircraft at Hillsboro and 248 respondents with based aircraft at other airports in the Portland region.

Based Aircraft

- The number of based aircraft owned by the respondents to the general aviation user survey is compared with FAA published data for the number of based aircraft at Hillsboro and the other airports in the Portland region. The key findings are: The 100 respondents with based aircraft at Hillsboro together accounted for 302 based aircraft, compared with a published estimate of 257 in 2011 from the FAA 2011 TAF. Although the number of based aircraft from the survey is greater than the published estimate, the difference is most likely related to duplication in responses by aviation students and businesses.

- The 248 respondents with based aircraft at other airports in the Portland region together accounted for 497 based aircraft, compared with a published estimate of 1,202 in 2011 from the FAA 2011 TAF. In 2011, the FAA estimates a total of 1,459 based aircraft at airports in the Portland region, including 257 aircraft at Hillsboro and 1,202 aircraft at the nine other airports in the region with an FAA TAF.

As a result of these key findings, it was concluded that:

- For Hillsboro Airport, the general aviation user survey sample was representative of actual based aircraft owners at the Airport, effectively accounting for all based aircraft owners based on published data.
- For the other airports in the Portland region, the general aviation user survey sample was less representative than the sample for Hillsboro, accounting for about 41% all based aircraft owners based on published data.

3 Riley Research Associates, *Port of Portland General Aviation Survey*, March 2012. Respondents included pilots, Port of Portland properties and tenants (Hillsboro Airport, Portland-Troutdale Airport, Portland International Airport), Non-Port aviation-related businesses throughout Oregon and Washington, and regional airport representatives.

Table D-1
EVALUATION OF GENERAL AVIATION SURVEY USER SAMPLE

	Total (pilots and businesses)		
	Hillsboro	Other airports in the Portland region	Total
Based aircraft			
Total based aircraft in 2011	257	1,202	1,459
Survey sample *(a)*			
Number of respondents	100	248	348
Number of based aircraft represented in sample	302	497	799
Percent of total	118%	41%	55%
General aviation aircraft operations			
2011	207,592	397,000	604,592
Average per month	17,299	33,083	50,383
Monthly general aviation operations per based aircraft			
2011	67	28	35
Survey sample *(b)*	68	27	39

(a) (Q3.) (If you own/operate aircraft) What type(s) of aircraft do you, your company, or your organization currently operate? Please indicate all that apply.

(b) (Q5.) Approximately how may operations (landings and take-offs) per month do you average at: (a) Hillsboro Airport and (b) Other airports in the Portland region?

Sources: U.S. Department of Transportation, Air Traffic Activity System (ATADS) and Terminal Area Forecasts, www.faa.gov, accessed January 2012 and Riley Research Associates, *Port of Portland General Aviation Survey*, February 2012.

General Aviation Operations per Based Aircraft

The average monthly number of general aviation operations per based aircraft by the respondents to the general aviation user survey is also compared with FAA published data for Hillsboro and the other airports in the Portland region. As shown in **Table D-1**, the key findings are:

- The 100 respondents with based aircraft at Hillsboro together performed an average of 68 monthly operations per based aircraft, compared with published data of 67 monthly operations per based aircraft in 2011;
- The 248 respondents with based aircraft at other airports in the Portland region together performed an average of 27 monthly operations per based aircraft, compared with a published data of 28 monthly operations per based aircraft in 2011.

Using these two metrics—based aircraft and the number of monthly general aviation operations per based aircraft, it was concluded that the survey sample was representative of overall aviation activity at Hillsboro and the other airports in the Portland region.

Interpretation of the Survey Sample

As shown in **Table D-1**, the survey respondents with based aircraft at Hillsboro effectively account for all based aircraft at Hillsboro and, as a result, the survey responses are assumed to represent all HIO based aircraft owners. For example, if 10 HIO based aircraft owners indicated in the survey that their annual operations (each with an average of 100 annual operations) would increase by 10% as a result of the new runway, the estimate would be for an additional 100 operations per year (e.g., 10 x 100 x 10%).

The sample of general aviation users with based aircraft at other airports in the Portland region accounted for approximately 41% of total based aircraft in the region according to published data. The survey data for based aircraft owners at other airports in the Portland region are used to estimate (1) the potential increase in activity related to the new runway and (2) the potential for based aircraft relocations to Hillsboro.

- The potential increase in activity related to the new runway is estimated for based aircraft owners at other airports in the Portland region based on the survey responses and extrapolated to represent the entire number of based aircraft owners at other airports. As noted earlier, the number of general aviation operations per based aircraft in the sample is consistent with published data for all based aircraft owners at other airports.
- The potential number of based aircraft relocations to Hillsboro from other airports in the Portland region is estimated based only on the survey responses. The decision to relocate an aircraft can be based on a variety of factors (e.g., proximity to an airport, costs, personal preferences) for which there are no available published data. As a result, the survey responses are assumed to represent the total number of based aircraft owners at other airports who would be interested in relocating to HIO. For example, if only one respondent with on based aircraft at another airport in the Portland region indicated interest in relocating to Hillsboro when the new runway is commissioned, the estimate would be for one based aircraft relocation.

Estimated Based Aircraft Relocations to Hillsboro Airport

As shown in **Table D-2**, of the 195 respondents (to Question 10 in the survey) with based aircraft at other airports in the Portland region, a total of 44 respondents (or 22% of the total) indicated that they would be likely (very and somewhat likely) to relocate to Hillsboro assuming the new runway is built. The 195 respondents accounted for 466 based aircraft at other airports in the Portland region, with 75 of those aircraft owned by respondents who indicated that they would be likely to relocate to Hillsboro (or 17% of the total).

For the purposes of this study, it is assumed that 80% of the aircraft owned by respondents who indicated that they would be "very likely" to relocate to Hillsboro are counted in the based aircraft relocation estimate. For those respondents who indicated that they would be "somewhat likely" to relocate to Hillsboro, 40% of their aircraft are counted in the estimate.

Table D-2
ESTIMATION OF POTENTIAL RELOCATIONS TO HILLSBORO FROM OTHER AIRPORTS IN THE PORTLAND REGION

	Number	Percent
Survey respondents likely to relocate to HIO *(a)*		
Very likely	6	3%
Somewhat likely	38	19
Somewhat unlikely	35	18
Very unlikely	104	53
Depends	12	6
Total	195	100%
Based aircraft owned by survey respondents		
Very likely	7	2%
Somewhat likely	68	15
Somewhat unlikely	33	7
Very unlikely	198	42
Depends	160	34
Total	466	100%
Estimate of based aircraft relocated to HIO		
Very likely	6	
Somewhat likely	27	
Estimated total	33	
Average monthly aircraft operations per based aircraft of survey respondents		
Very likely	3	
Somewhat likely	10	
Estimated additional annual operations		
Very likely	200	
Somewhat likely	3,260	
Estimated total	3,460	

Note: It is assumed that 80% of very likely responses and 40% of somewhat responses would result in based aircraft relocations to HIO.

(a) Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Source: General Aviation User Survey: Riley Research Associates, *Port of Portland General Aviation Survey*, February 2012.
Potential increase in activity: LeighFisher, October 2012 (Appendix B).

These assumptions are based, in part, on research regarding the effectiveness of stated preference data. Stated preferences, such as those provided in the general aviation user survey, are responses to hypothetical questions in which respondents indicate what they would do (their preference) if certain conditions are present. However, the actions that people take in real world conditions, such as relocating to another general aviation airport, may be affected by variables not considered in the hypothetical case and, therefore, a respondent's real world action may differ from their stated preference. For example, the decision to relocate to Hillsboro may be affected by the availability of hangar or tie-down space and the cost of Airport facilities compared with other alternatives.

As shown in **Table D-2**, based on the results from the General Aviation user survey and assumptions regarding the likelihood of relocations, it is estimated that 33 based aircraft are likely to be relocated to Hillsboro when the new runway is completed. Based on the average number of monthly operations of survey respondents indicating that they would relocate to Hillsboro, it is estimated that an additional 3,460 annual aircraft operations would occur as a result of based aircraft relocations to Hillsboro when the new runway is completed.

A review of literature on the interpretation of stated preference data for aviation and non-aviation purposes did not provide a defined formula for translating very likely and somewhat likely responses into exact probabilities. However, if alternatively, it is assumed that 100% of the "very likely" responses and 50% of the "somewhat likely" responses are counted in the based aircraft relocation estimate, the alternative estimate would not differ significantly from the estimates reported in **Table D-2**. Based on these alternative assumptions, the estimate would be for a total of 41 relocated based aircraft (compared with 33 based aircraft in **Table D-2**) and an additional 4,330 annual aircraft operations (compared with 3,460 operations in **Table D-2**).

Estimated Increase in Existing Operations Related to the New Runway

As shown in **Table D-3**, of the 91 respondents (to Question 15 in the survey) with based aircraft at Hillsboro, a total of 34 respondents (or 37% of the total) indicated that their existing operations (takeoffs and landings) at Hillsboro would be likely (very and somewhat likely) to increase assuming the new runway is built. Of the 201 respondents (to Question 15 in the survey) with based aircraft at other airports in the Portland region, a total of 78 respondents (or 39% of the total) indicated that their existing operations (takeoffs and landings) at Hillsboro would be likely (very and somewhat likely) to increase assuming the new runway is built.

- The 34 respondents with based aircraft at Hillsboro indicated average increases in existing operations at Hillsboro of 44% and 27%, respectively, for "very likely" and "somewhat likely" responses. These 34 Hillsboro respondents reported average monthly operations at Hillsboro of 50 and 32, respectively, for "very likely" and "somewhat likely" responses.
- The 78 respondents with based aircraft at other airports in the Portland region indicated average increases in existing operations at Hillsboro of 83% and 32%, respectively, for "very likely" and "somewhat likely" responses. These 78 respondents from other airports in the Portland region reported average monthly operations at Hillsboro of 5 and 3, respectively, for "very likely" and "somewhat likely" responses.

Similar to the estimates of based aircraft relocations presented earlier, it is assumed that 80% of the increase in existing operations reported in "very likely" responses would occur and is counted in the estimate of additional operations. For those respondents who indicated that they would be "somewhat likely" to increase existing operations, it is assumed that 40% of their increase would occur and is counted in the estimate.

Table D-3
POTENTIAL INCREASE IN ACTIVITY RELATED TO NEW RUNWAY

	Total (pilots and businesses)		
	Hillsboro	Other airports in the Portland region	Total
Number of survey respondents likely to increase existing operations *(a)*			
Very likely	15	25	40
Somewhat likely	19	53	72
Somewhat unlikely	15	18	33
Very unlikely	33	94	127
Depends	9	11	20
Total	91	201	292
Stated percent increase in existing operations of respondents *(b)*			
Very likely	44%	83%	
Somewhat likely	27	32	
Average monthly aircraft operations of survey respondents *(c)*			
Very likely	50	5	
Somewhat likely	32	3	
Estimated additional operations per month			
Very likely	264	248 *(d)*	
Somewhat likely	66	79 *(d)*	
Estimated additional annual operations			
Very likely	3,170	2,980	6,150
Somewhat likely	790	950	1,740
Estimated total	3,960	3,930	7,890

Note: It is assumed that 80% of very likely responses and 40% of somewhat responses would result in increased operations at HIO.

(a) (Q15.) If we build a new parallel runway at HIO, how likely would it be to result in an increase in your existing operations (take-offs and landings)?

(b) (Q16.) If the answer is "somewhat" or "very" likely, what would you estimate the percentage of increase?

(c) (Q5.) Approximately how may operations (landings and take-offs) per month do you average at: (a) Hillsboro Airport?

(d) Extrapolated to reflect all based aircraft owners at other airports in the Portland region.

Sources: General Aviation User Survey: Riley Research Associates, *Port of Portland General Aviation Survey*, March 2012.
Potential increase in activity: LeighFisher, October 2012 (Appendix B).

As shown in **Table D-3**, it is estimated that an additional 7,890 annual operations at Hillsboro would occur when the new runway is completed, based on the average number of monthly operations of survey respondents. Based aircraft owners at Hillsboro are estimated to account for 50.2% of the total, with 3,960 additional annual operations. Based aircraft owners at other airports in the Portland region are estimated to account for the remaining 49.8% of the total, with 3,930 additional annual operations, extrapolated to represent all based aircraft owners at other airports.

Similar to the discussion above regarding the interpretation of stated preference data, if alternatively, it is assumed that 100% of the "very likely" responses and 50% of the "somewhat likely" responses are counted in the estimate of additional annual aircraft operations, the alternative estimate would not differ significantly from the estimates reported in **Table D-3**. Based on these alternative assumptions, the estimate would be for an additional 4,940 annual aircraft operations by Hillsboro users (compared with 3,960 operations noted above) and an additional 4,900 annual aircraft operations by users at other airports in the Portland region (compared with 3,930 operations noted above)

a. Remand – Induced Demand Forecasts

The approach for developing remand induced demand forecasts included consideration of:

- The unconstrained aviation demand forecasts presented in Appendix B.
- An estimate of the potential for based aircraft relocations to Hillsboro from other airports in the Portland region and additional annual aircraft operations as discussed earlier in "a. Survey of General Aviation Users".

As noted earlier, Interpretation B (no induced demand is included in the unconstrained demand) is used to estimate Hillsboro Remand Forecasts demand and represents a conservative approach that potentially overestimates operations at the Airport related to the existence and availability of the new runway. [4]

In addition, it was assumed that:

- Induced demand related to based aircraft relocations to Hillsboro would begin in 2015, one year after the new runway is commissioned, and remains unchanged through 2031. A one year lag in based aircraft relocations is assumed to allow sufficient time to arrange and negotiate new leased hangar space at HIO and to physically relocate aircraft from other airports in the Portland region to HIO.
- Induced demand related to increased operations by existing based aircraft owners at Hillsboro and users from other airports in the Portland region would begin in 2014, the year that the new runway is commissioned, and remain unchanged through 2021. It is assumed that general aviation users would immediately make use of the new runway.
- Between 2021 and 2031, the estimated number of additional operations per based aircraft will decrease gradually, by approximately 3 operations per year, reflecting the aging of the HIO runway, the potential for new facilities to be constructed at other airports in the Portland region, and changes in the composition of based aircraft users in the future.

4 Consistent with FAA's standard methodology, which represents a conservative approach, the Unconstrained Forecast in the Final Supplemental Environmental Assessment assumed no artificial or physical constraints at the airport. As such, the Unconstrained Forecast inherently included a portion of the demand that would be attracted to the airport because of the availability of the new runway. However, the 9th Circuit required clearer evidence that induced demand, if any, was considered in the analysis. Out of an abundance of caution and to specifically address the court's decision, the FAA prepared a Remand Forecast that incorporated additional activity attributable to the new runway based on the results of a pilots' survey into the Unconstrained Forecast.

- In 2031, there is no induced demand resulting from increased operations (other than the activity by based aircraft owners who relocated to HIO in 2015).

Table D-4 presents the conservative induced demand using the Interpretation B noted earlier.

Table D-4

INTERPRETATION OF REMAND DEMAND FOR TOTAL AIRCRAFT OPERATIONS

Portland Hillsboro Airport

		Estimated induced demand (a)			
	Unconstrained Forecasts (baseline)	Based aircraft relocations to HIO	Additional operations	Total additional aircraft operations	Induced demand forecast
Historical					
2011	214,243	N/A	N/A	N/A	N/A
Forecast					
2014	220,140	N/A	7,890	7,890	228,030
2015	222,190	3,460	7,890	11,350	233,540
2016	224,260	3,460	7,890	11,350	235,610
2021	242,680	3,460	7,890	11,350	254,030
2026	257,730	3,460	4,110	7,570	265,300
2031	270,380	3,460	0	3,460	273,840

N/A = Not Applicable

Note: Total aircraft operations include corporate and charter, general aviation, and military operations for fixed-wing aircraft and helicopters.

(a) General Aviation User Survey: Riley Research Associates, *Port of Portland General Aviation Survey*, February 2012. Potential increase in activity: Forecasts: LeighFisher, October 2012.

Aircraft Operations

In the induced demand forecast, total aircraft operations at the Airport are forecast to increase an average of 1.2% per year between 2011 and 2031 as shown in Table D-5, with faster growth in the near-term (an average increase of 2.1% per year between 2011 and 2016), reflecting the commissioning of the new runway in 2014 and the increase in operations related to based aircraft relocations and induced demand. Local general aviation operations are forecast to increase an average of 1.4% per year between 2011 and 2031, with fixed-wing operations increasing at a slightly faster rate (1.6% per year) than helicopter training operations (1.2% per year). Itinerant general aviation operations are forecast to increase an average of 0.6% per year between 2011 and 2031.

Corporate and charter operations are forecast to increase an average of 3.6% per year between 2011 and 2031. The forecasts of military aircraft operations are based on data for the base year of the forecasts and carried forward through the forecast period. Military operations typically increase and decrease with geopolitical trends and therefore this activity may vary in a given year.

Based Aircraft

As shown in Table D-5, total based aircraft at the Airport are forecast to increase an average of 1.5% per year between 2011 and 2031. Single engine aircraft are forecast to increase an average of 0.9% per year between 2011 and 2031. As shown in **Table D-2**, approximately 33 based aircraft might relocate to Hillsboro from other airports in the Portland region as a result of the new runway based on stated preferences from the general aviation user survey. It is assumed that these 33 aircraft would remain based at the Airport throughout the forecast period. Multi-engine (non-jet) aircraft are forecast to increase an average of 2.3% per year between 2011 and 2031. Jet aircraft and helicopters are forecast to increase an average of 2.1% per year between 2011 and 2031.

Table D-5

REMAND FORECASTS

Portland Hillsboro Airport

2011-2031

	Historical	Remand Forecasts				Compound average annual percent increase (decrease)			
	2011	2016	2021	2026	2031	2011-2016	2016-2021	2021-2026	2026-2031
BASED AIRCRAFT									
Single Engine (Nonjet)	147	169	170	173	176	2.8%	0.3%	0.3%	0.3%
Multi Engine (Nonjet)	31	38	41	45	49	4.2	1.7	1.7	1.6
Jet Engine	39	47	51	55	59	4.0	1.5	1.5	1.5
Helicopter	40	49	52	57	61	4.0	1.5	1.5	1.5
Total based aircraft	257	303	317	331	346	3.3%	0.9%	0.9%	0.9%
AIRCRAFT OPERATIONS									
Corporate and charter	6,239	7,480	9,010	10,700	12,710	3.7%	3.8%	3.5%	3.5%
General aviation									
Itinerant	69,770	75,930	76,910	77,500	78,130	1.5	0.4	0.2	0.2
Local									
Fixed-wing	71,301	83,260	91,120	96,520	99,240	3.1%	2.0%	0.9%	0.6%
Helicopter training	66,521	69,190	75,590	80,180	83,360	0.8	1.8	1.2	0.8
Subtotal—local	137,822	152,450	167,710	176,700	182,600	2.0%	1.9%	1.0%	0.7%
Subtotal--general aviation	207,592	227,730	244,620	254,200	260,730	1.9%	1.4%	0.8%	0.5%
Military	412	400	400	400	400	(0.6)%	0.0%	0.0%	0.0%
Total aircraft operations	214,243	235,610	254,030	265,300	273,840	1.9%	1.5%	0.9%	0.6%
GENERAL AVIATION OPERATIONS PER BASED AIRCRAFT									
Itinerant	271	249	243	234	226	(1.8)%	(0.5)%	(0.7)%	(0.7)%
Local									
Fixed wing	277	275	291	291	286	(0.2)	1.1	0.0	(0.3)
Helicopter training	259	228	239	242	241	(2.5)	0.9	0.3	(0.1)
Total local	536	503	534	534	527	(1.3)	1.0	0.2	(0.2)
FIXED WING/ITINERANT HELICOPTER AIRCRAFT OPERATIONS	147,722	166,420	178,440	185,120	190,480	2.4%	1.4%	0.7%	0.6%
Percent of ASV									
2003 (ASV = 169,000)	--	98%	106%	110%	113%				
2011 (ASV = 178,000)	83%	93%	100%	104%	107%				
New runway (ASV = 315,000)	--	53%	57%	59%	60%				

The forecasts presented in this table were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Note: Aircraft operations include departures and arrivals.

ASV = Annual Service Volume, in terms of annual operations by fixed-wing and itinerant helicopters, as reported in the Hillsboro Master Plan, 2005. 2011 ASV reflects the addition of high-speed taxiways.

Corporate and charter activity includes air carrier and air taxi operations.

Sources: Historical: Port of Portland records and U.S. Department of Transportation, Federal Aviation Administration, ATADS online database.

Forecasts: LeighFisher, October 2012.

RILEY RESEARCH ASSOCIATES
Research for Marketing, Public Relations, and Planning

PORT OF PORTLAND

GENERAL AVIATION SURVEY

REPORT SUMMARY

FEBRUARY, 2012

Michael J Riley & Crystal Bolyard
Riley Research Associates

RESEARCH | INSIGHT | KNOWLEDGE

www.rileyresearch.com
10200 SW Eastridge St, Suite 120, Portland, OR 97225
phone [503] 222-4179 *fax* [503] 222-4313

TABLE OF CONTENTS

INTRODUCTION

Port of Portland is considering adding an additional runway to the Hillsboro Airport, and was interested in hearing from local pilots, aviation contacts, and other invested parties on their feedback regarding the proposed runway. In order to hear from these audiences, Riley Research Associates (RRA) conducted an online survey.

METHODOLOGY

Port of Portland and FAA designed a questionnaire to be used in an online survey, and RRA helped to refine the questions.

Port of Portland provided contact email addresses for HIO/TTD/PDX contacts and additional aviation contacts, which RRA used to email survey invitations. RRA programmed, executed, and managed the online survey. Reminders were sent to the HIO/TTD/PDX contacts and additional aviation contacts who did not respond to the survey initially.

Port of Portland additionally sent 2,500 letters to pilots with a link to the online survey. Of these, 96 postcards were returned due to invalid/outdated addresses, leaving a total of 2,404 postcard invitations. The list of pilots was chosen randomly by RRA from a greater list of approximately 5,100 names. The random sample was chosen by assigning each contact a random number through excel, and selecting the top 2,500 numbers.

All responses were collected through the online survey.

The audiences included:

- ✓ Pilots: Representative of general aviation pilots in the six-county area (Multnomah, Clark, Clackamas, Columbia, Washington, and Yamhill Counties)
- ✓ HIO/TTD/PDX contacts: Port of Portland properties and tenants (Hillsboro Airport, Portland-Troutdale Airport, Portland International Airport) (Please see complete list of respondents in Verbatim Appendix)
- ✓ Aviation contacts: Non-Port aviation-related businesses throughout Oregon and Washington (Please see complete list of respondents in Verbatim Appendix)
- ✓ Airports: regional airport representatives (Please see complete list of respondents in Verbatim Appendix)

Audience	Responses	Sent	Response rate
Pilots	323	2,404	13%
HIO/TTD/PDX contacts	15	35	43
Aviation contacts	7	10	70
Airports	3	11	27
Totals:	348	2,460	14%

Following is a question-by-question summary of results by each of the three audiences. Not all responses add to 100% due to multiple response questions and/or rounding. Not all respondents answered each question.

RESULTS

Q1. At which area airport(s) do you currently base your aircraft (includes both fixed wing and helicopters)? (Multiple Responses)

The *Portland-Hillsboro Airport* is the most utilized in the area (30%), followed by *Stark's Twin Oaks Airport* (13%), *Aurora State Airport* (11%), and *Portland Troutdale airport* (9%). Of those who responded to the question, 87% indicated only one airport at which they base their aircraft, while 13% indicated two or more airports.

	Audience[1]				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	335	311	14	7	3
Portland- Hillsboro Airport	30%	29%	71%	14%	-
Stark's Twin Oaks Airport	13	14	-	-	-
Aurora State Airport	11	11	7	43	-
Portland Troutdale Airport	9	9	14	-	-
Pearson Field Airport	6	6	-	14	-
Portland International Airport	5	5	7	-	-
Lenhardt Airpark	3	3	-	-	-
Grove Field Airport	3	3	-	-	-
McMinnville Municipal Airport	3	3	-	14	-
Mulino State Airport	3	3	-	-	-
Scappoose Industrial Airpark	3	2	-	29	-
Sportsman Airpark	1	2	-	-	-
Chehelam Airpark	1	1	-	-	-
Valley View Airport	1	1	-	-	33
Evergreen Field Airpark	0	0	-	-	-
Fly for Fun Airport	0	0	-	-	-
Sandy River Airport	0	0	-	-	33
Skyport Airport	0	0	-	-	-
Vernonia Municipal Airport	0	0	-	-	-
Woodland State Airport	0	-	-	-	33
Miscellaneous	10	10	7	-	67
Not applicable / Don't own	13	13	21	-	33

[1] The audience labels refer to the following for this survey:
Pilots: General aviation pilots throughout the five-county area (Clark, Clackamas, Columbia, Washington, and Yamhill counties)
HIO/TTD/PDX: Port of Portland properties and tenants (Hillsboro Airport, Portland-Troutdale Airport, Portland International Airport)
Aviation contacts: Non-Port aviation-related businesses throughout Oregon and Washington
Airports: Regional airports

Q1. At which area airport(s) do you currently base your aircraft (includes both fixed wing and helicopters)? (Multiple Responses) (Continued)

Airport at which respondent is located, based on the county of their business (Categorized from zip code)

	Washington	Multnomah	Clackamas	Clark	Yamhill	Marion	Columbia	Thurston	Other
Total Participants	57	34	13	11	8	5	4	1	1
Portland-Hillsboro Airport	61%	26%	23%	-	-	20%	-	100%	-
Stark's Twin Oaks Airpark	23	-	8	9	-	-	-	-	-
Aurora State Airport	9	9	69	-	13	80	-	-	-
Portland Troutdale Airport	7	18	15	-	-	-	-	-	-
McMinnville Municipal Airport	4	-	8	-	50	-	-	-	-
Scappoose Industrial Airpark	4	3	-	9	-	-	75	-	-
Portland International Airport	2	15	8	-	-	20	-	-	100
Grove Field Airport	2	-	-	36	-	-	-	-	-
Skyport Airport	2	-	-	-	-	-	-	-	-
Pearson Field Airport	-	12	-	27	-	-	-	-	-
Lenhardt Airpark	-	3	15	-	-	-	-	-	-
Mulino State Airport	-	9	15	-	-	-	-	-	-
Sportsman Airpark	-	-	-	-	50	-	-	-	-
Valley View Airport	-	3	8	-	-	-	-	-	-
Sandy River Airport	-	-	8	-	-	-	-	-	-
Fly for Fun Airport	-	-	-	9	-	-	-	-	-
Vernonia Municipal Airport	-	-	-	-	-	-	25	-	-
Miscellaneous	7	3	8	27	-	-	25	100	-
Not applicable/Don't own	12	6	-	-	-	-	-	-	-

Q1. At which area airport(s) do you currently base your aircraft (includes both fixed wing and helicopters)? (Multiple Responses) (Continued)

Airport at which respondent is located, based on the county of their residence (Categorized from zip code)

	Washington	Multnomah	Clark	Clackamas	Yamhill	Columbia
Total Participants	108	63	43	36	11	6
Portland-Hillsboro Airport	56%	25%	12%	3%	9%	17%
Stark's Twin Oaks Airpark	21	14	2	14	18	-
Portland Troutdale Airport	7	21	12	3	-	-
Aurora State Airport	4	10	5	36	18	-
Portland International Airport	4	5	14	-	-	-
Lenhardt Airpark	2	2	-	14	-	-
Chehelam Airpark	2	-	-	-	-	-
Pearson Field Airport	1	8	23	3	-	-
Scappoose Industrial Airpark	1	2	2	-	-	50
Skyport Airport	1	-	-	-	-	-
Grove Field Airport	-	-	16	-	-	-
Mulino State Airport	-	2	-	22	-	-
McMinnville Municipal Airport	-	2	2	-	45	-
Sportsman Airpark	-	-	-	-	27	-
Valley View Airport	-	2	-	3	-	-
Sandy River Airport	-	-	-	3	-	-
Fly for Fun Airport	-	-	2	-	-	-
Vernonia Municipal Airport	-	-	-	-	-	17
Miscellaneous	6	10	16	8	-	33
Not applicable/Don't own	6	14	19	11	-	-

Q2. (If you use an airport) What is the zip code of your business or residence?

Business Zip Codes:

Washington County	# of ppl	Multnomah County	# of ppl	Clackamas County	# of ppl	Clark County	# of ppl	Marion County	# of ppl
97005	6	97024	1	97013	1	98604	1	97002	4
97006	3	97030	1	97015	2	98607	2	97308	1
97007	1	97060	1	97034	2	98661	2	**Columbia County**	**# of ppl**
97008	1	97201	5	97035	2	98662	1	97053	1
97062	1	97202	1	97045	1	98664	1	97056	2
97113	1	97203	1	97055	1	98671	1	97064	1
97116	1	97204	2	97068	1	98684	1	**Thurston County**	**# of ppl**
97123	4	97207	1	97070	1	98685	1	98052	1
97124	31	97210	4	97086	1	98686	1	**Yamhill County**	**# of ppl**
97126	1	97212	2	97267	1			97101	1
97133	1	97214	2					97127	1
97223	2	97215	1					97128	3
97224	3	97218	4					97132	3
97225	2	97219	1					**Other**	**# of ppl**
		97220	1					75235	1
		97221	1						
		97227	1						
		97230	2						
		97238	1						
		97266	1						

Q2. (If you use an airport) What is the zip code of your business or residence? (Continued)

Residence Zip Codes:

Washington County	# of ppl	Multnomah County	# of ppl	Clackamas County	# of ppl	Clark County	# of ppl	Columbia County	# of ppl
97005	2	97024	1	97013	3	98604	5	97051	1
97006	12	97030	2	97015	4	98607	6	97053	2
97007	11	97060	2	97017	1	98642	1	97056	2
97008	2	97080	4	97034	4	98660	1	97064	1
97062	8	97201	6	97035	5	98661	1	**Yamhill County**	**# of ppl**
97113	2	97202	2	97038	2	98662	2	97101	1
97116	1	97203	1	97045	5	98663	2	97111	1
97123	17	97205	1	97055	1	98664	3	97115	1
97124	18	97206	1	97068	6	98671	1	97128	3
97133	3	97209	1	97070	5	98682	7	97132	5
97223	5	97210	2	97086	2	98683	3		
97224	5	97211	2	97268	1	98684	4		
97225	7	97212	3			98685	6		
97229	17	97213	5			98686	2		
		97214	3			98687	1		
		97215	1						
		97217	2						
		97219	11						
		97220	3						
		97221	4						
		97222	1						
		97230	1						
		97231	2						
		97239	3						
		97266	1						

Q3. (If you own/operate an aircraft) What type(s) of aircraft do you, your company, or your organization currently operate? (Multiple Responses)

Please see page 45 for full list of aircraft indicated by respondents.

Q4. Which best describes your primary use of Hillsboro Airport? Please select the one answer that best applies. (Single Response)

About half of respondents primarily use the Hillsboro Airport for *personal use* (46%), and many also use the airport for *flight instruction* (19%).

	Audience				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	326	301	15	7	2
Personal use (pilots flying their own aircraft)	46%	48%	13%	29%	-
Flight instruction	19	19	20	57	-
Corporate/Business (owned/business leased)	8	8	20	14	-
Non-aviation office space	0	-	7	-	-
Miscellaneous	6	6	20	-	-
Do not utilize Hillsboro Airport	20	20	20	-	100

Q5. Approximately how may operations (landings and take-offs) per month do you average:

a. At Hillsboro Airport:

Respondents average a mean of 67 operations at Hillsboro Airport, with Pilots averaging the most (70 operations), compared to HIO/TTD/PDX contacts (36) and additional aviation contacts (13).

	Audience				
Hillsboro Airport	**Total**	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	270	255	7	7	1
0 operations/month	19%	19%	-	14%	100%
1-5 operations/month	47	48	43	29	-
6-10 operations/month	14	13	14	29	-
11-20 operations/month	7	7	-	14	-
21-50 operations/month	8	7	29	-	-
51+ operations/month	6	5	14	14	-
Mean operations per month	**68**	**70**	**36**	**13**	**0**

b. At other airports in the Portland region:

Respondents average a mean of 27 operations at other airports in the Portland region, with Pilots averaging the least (21), compared to HIO/TTD/PDX contacts (60) and additional aviation contacts (253).

	Audience				
Other Airports	**Total**	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	254	243	4	6	1
0 operations/month	5%	5%	-	-	100%
1-5 operations/month	29	29	50	-	-
6-10 operations/month	23	23	-	17	-
11-20 operations/month	22	23	-	-	-
21-50 operations/month	14	14	25	17	-
51+ operations/month	8	7	25	67	-
Mean operations per month	**27**	**21**	**60**	**253**	**0**

Q6. What percentage of your total operations are touch-and-go operations at:

a. Hillsboro Airport (Categorized)

Respondents indicated a mean of 18% of their touch-and-go operations are at Hillsboro Airport. HIO/TTD/PDX contacts averaged the least (1%) while pilots and additional aviation contacts had comparable touch-and-go operations (19% and 20%, respectively).

	Audience				
Hillsboro Airport	**Total**	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	265	250	7	7	1
0%	44%	42%	57%	71%	100%
1-5%	18	18	43	-	-
6-10%	8	8	-	-	-
11-20%	5	5	-	-	-
21-50%	11	11	-	14	-
51+%	14	14	-	14	-
Unsure/Depends	0				-
Mean total operations at Hillsboro Airport	**19%**	**19%**	**1%**	**20%**	**0%**

b. Other airports in the Portland region (Categorized)

Respondents indicated a mean of 30% of their touch-and-go operations are at other airports in the Portland region. HIO/TTD/PDX contacts and additional aviation contacts averaged the most (53 each), while pilots averaged the least (29).

	Audience				
Hillsboro Airport	**Total**	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	246	234	4	7	1
0%	24%	24%	-	14%	100%
1-5%	22	22	50	-	-
6-10%	8	7	25	14	-
11-20%	7	7	-	14	-
21-50%	16	16	-	14	-
51+%	23	22	25	43	-
Unsure/Depends	1	1	-	-	-
Mean total operations at other airports	**30%**	**29%**	**53%**	**53%**	**0%**

Q7. Using a scale of 1-5 (1 = minimal importance, 5 = maximum importance) please rate the importance of the following, when selecting an airport at which to base your aircraft. Please select "N/A" if the aspect is not applicable.

The most important aspects to respondents were *convenience* (4.4), *aircraft storage costs* (4.1), and *aircraft hangar facilities* (4.0). The least important aspects were *available runway length* (2.8) and *separate runways for smaller aircraft* (2.8).

Fewer delays and *hangar facilities* were among the most important aspects for those on the HIO/TTD/PDX contacts list (4.7 and 34.0, respectively). *Convenience* and *hangar facilities* were the most important aspects for aviation contacts (4.7 each), and airport respondents rated many aspects a 5.0.

Mean Importance Ratings: All Audiences	Total	Pilots	HIO/ TTD/ PDX	Aviation Contacts	Airports
a. Convenience	4.4	4.4	3.5	4.7	5.0
b. Aircraft Hangar Facilities	4.0	4.0	4.7	4.7	5.0
c. FBO/Executive Terminal Services	3.1	3.1	3.7	3.7	5.0
d. Aircraft Storage Costs	4.1	4.1	3.7	3.8	5.0
e. Available Runway Length	2.8	2.8	3.7	1.8	n/a
f. Navigational Aids	3.2	3.1	3.8	2.5	5.0
g. Separate Runway for Smaller Aircraft	2.8	2.8	3.1	1.7	1.0
h. Fewer Delays	3.7	3.7	4.0	3.3	3.0

Key	
Highest importance	
Lowest importance	

Q7. Please rate the importance of the following to you when selecting an airport at which to base your aircraft. (Continued: Ratings distribution for each audience)

Mean Importance Ratings: All Audiences	Partic-ipants	Mean	Minimal 1	2	3	Maximum 4	5	N/A
a. Convenience	307	4.4	3%	1%	10%	24%	53%	8%
b. Aircraft Hangar Facilities	304	4.0	3	4	13	30	34	15
c. FBO/Executive Terminal Services	301	3.1	13	15	22	22	14	15
d. Aircraft Storage Costs	304	4.1	4	3	13	26	39	16
e. Available Runway Length	302	2.8	19	18	24	17	12	10
f. Navigational Aids	303	3.2	16	15	18	23	19	8
g. Separate Runway for Smaller Aircraft	301	2.8	24	17	17	15	17	11
h. Fewer Delays	297	3.7	7	9	19	24	31	10

Q7. Please rate the importance of the following to you when selecting an airport at which to base your aircraft. (Continued: Ratings distribution for each audience)

Mean Importance Ratings: Pilots	Partic-ipants	Mean	Minimal 1	2	3	Maximum 4	5	N/A
a. Convenience	287	4.4	2%	1%	10%	25%	53%	8%
b. Aircraft Hangar Facilities	285	4.0	3	5	14	31	32	15
c. FBO/Executive Terminal Services	282	3.1	13	15	22	22	12	15
d. Aircraft Storage Costs	285	4.1	4	2	12	27	39	16
e. Available Runway Length	283	2.8	19	18	25	17	11	10
f. Navigational Aids	284	3.1	16	15	19	24	19	8
g. Separate Runway for Smaller Aircraft	282	2.8	23	18	17	16	16	11
h. Fewer Delays	279	3.7	8	9	19	24	31	9

Mean Importance Ratings: HIO/TTD/PDX	Partic-ipants	Mean	Minimal 1	2	3	Maximum 4	5	N/A
a. Convenience	11	3.5	18%	9%	18%	-	45%	9%
b. Aircraft Hangar Facilities	10	4.7	-	-	10	10	70	10
c. FBO/Executive Terminal Services	10	3.7	20	-	20	-	50	10
d. Aircraft Storage Costs	10	3.7	-	20	30	-	40	10
e. Available Runway Length	10	3.7	-	20	20	20	30	10
f. Navigational Aids	10	3.8	10	-	20	30	30	10
g. Separate Runway for Smaller Aircraft	10	3.1	30	-	20	10	30	10
h. Fewer Delays	9	4.0	-	-	33	22	33	11

Mean Importance Ratings: Aviation	Partic-ipants	Mean	Minimal 1	2	3	Maximum 4	5	N/A
a. Convenience	7	4.7	-	-	-	29%	57%	14%
b. Aircraft Hangar Facilities	7	4.7	-	-	-	29	57	14
c. FBO/Executive Terminal Services	7	3.7	-	29	-	29	29	14
d. Aircraft Storage Costs	7	3.8	14	-	14	14	43	14
e. Available Runway Length	7	1.8	57	17	-	-	14	17
f. Navigational Aids	7	2.5	29	29	-	14	14	14
g. Separate Runway for Smaller Aircraft	7	1.7	71	-	-	-	14	14
h. Fewer Delays	7	3.3	14	14	14	14	29	14

Mean Importance Ratings: Airports	Partic-ipants	Mean	Minimal 1	2	3	Maximum 4	5	N/A
a. Convenience	2	5.0	-	-	-	-	50%	50%
b. Aircraft Hangar Facilities	2	5.0	-	-	-	-	50	50
c. FBO/Executive Terminal Services	2	5.0	-	-	-	-	50	50
d. Aircraft Storage Costs	2	5.0	-	-	-	-	50	50
e. Available Runway Length	2	-	-	-	-	-	-	100
f. Navigational Aids	2	5.0	-	-	-	-	50	50
g. Separate Runway for Smaller Aircraft	2	1.0	50	-	-	-	-	50
h. Fewer Delays	2	3.0	-	-	50	-	-	50

Q8. Miscellaneous issues of maximum importance:

Please see verbatim appendix for full list of responses.

Q9. The Hillsboro Airport Master Plan (2005) identified the improvements listed above for future consideration. Please rate the importance of these improvements to your operations at HIO on a scale of 1 to 5 (1 = minimal importance, 5 = maximum importance). Please select "N/A" if the aspect is not applicable.

The most important consideration to all respondents was *fewer delays* (3.8). The remaining factors were rated comparably in terms of importance, ranging from 3.1 to 3.5, with *aircraft hangars* rated the least important.

Additional aviation contacts rated the importance lower than other respondents for many considerations. In addition to *fewer delays*, HIO/TTD/PDX contacts also rated *aircraft hangars* highest.

Mean Importance Ratings: All Audiences	Total	Pilots	HIO/ TTD/ PDX	Aviation Contacts	Airports
a. Taxiway Improvements	3.2	3.2	2.8	2.3	5.0
b. Aircraft Hangars	3.1	3.1	3.2	2.3	5.0
c. Separate Runway for Smaller Aircraft	3.5	3.5	2.9	2.7	1.0
d. Navigation Aids	3.3	3.3	3.1	2.5	5.0
e. Fewer Delays	3.8	3.8	3.2	3.4	1.0

Key	
Highest importance	
Lowest importance	

Q9. The Hillsboro Airport Master Plan (2005) identified the improvements listed above for future consideration. Please rate the importance of these improvements to your operations at HIO on a scale of 1 to 5 (1 = minimal importance, 5 = maximum importance).
(Continued: Ratings distribution for each audience)

Mean Importance Ratings: All Audiences	Partic-ipants	Mean	Minimal 1	2	3	4	Maximum 5	N/A
a. Taxiway Improvements	304	3.2	10%	13%	29%	21%	13%	14%
b. Aircraft Hangars	303	3.1	13	11	20	22	13	21
c. Separate Runway for Smaller Aircraft	305	3.4	15	9	17	23	26	11
d. Navigation Aids	303	3.3	13	11	20	23	21	13
e. Fewer Delays	302	3.8	8	6	18	25	32	13

Mean Importance Ratings: Pilots	Partic-ipants	Mean	Minimal 1	2	3	4	Maximum 5	N/A
a. Taxiway Improvements	284	3.2	10%	12%	28%	23%	13%	14%
b. Aircraft Hangars	283	3.1	12	12	20	22	12	22
c. Separate Runway for Smaller Aircraft	285	3.5	14	8	17	24	26	11
d. Navigation Aids	283	3.3	13	11	20	23	21	13
e. Fewer Delays	283	3.8	7	6	17	25	33	12

Mean Importance Ratings: HIO/TTD/PDX	Partic-ipants	Mean	Minimal 1	2	3	4	Maximum 5	N/A
a. Taxiway Improvements	11	2.8	9%	18%	55%	-	9%	9%
b. Aircraft Hangars	11	3.2	18	9	18	27	18	9
c. Separate Runway for Smaller Aircraft	11	2.9	27	9	18	18	18	9
d. Navigation Aids	11	3.1	18	9	18	36	9	9
e. Fewer Delays	11	3.2	18	9	27	9	27	9

Mean Importance Ratings: Aviation	Partic-ipants	Mean	Minimal 1	2	3	4	Maximum 5	N/A
a. Taxiway Improvements	7	2.3	14%	29%	43%	-	-	14
b. Aircraft Hangars	7	2.3	43	-	14	29	-	14
c. Separate Runway for Smaller Aircraft	7	2.7	29	14	14	14	14	14
d. Navigation Aids	7	2.5	29	14	29	-	14	14
e. Fewer Delays	6	3.4	-	17	33	17	17	17

Mean Importance Ratings: Airports	Partic-ipants	Mean	Minimal 1	2	3	4	Maximum 5	N/A
a. Taxiway Improvements	2	5.0	-	-	-	-	50%	50%
b. Aircraft Hangars	2	5.0	-	-	-	-	50	50
c. Separate Runway for Smaller Aircraft	2	1.0	50%	-	-	-	-	50
d. Navigation Aids	2	5.0	-	-	-	-	50	50
e. Fewer Delays	2	1.0	50%	-	-	-	-	50

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

With 20% of respondents already located at HIO, 24% are likely to consider locating there, 51% are *unlikely*, and 5% say it *depends*. Aviation contacts are the least likely to consider relocating to HIO if a new runway is built (83%). The majority of HIO/TTD/PDX contacts who responded are already located at HIO, and additional respondents would be likely to consider relocating.

	Audience				
Including all respondents	**Total**	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	276	260	8	6	2
Likely	**24%**	**25%**	**13%**	**17%**	**-**
Very likely	8	8	13	17	-
Somewhat likely	16	17	-	-	-
Unlikely	**51%**	**51%**	**25%**	**83%**	**100%**
Somewhat unlikely	13	14	13	-	
Very unlikely	38	37	13	83	100
Already located	**20%**	**19%**	**63%**	**-**	**-**
Already located at HIO	20	19	63	-	-
Depends	**5%**	**5%**	**-**	**-**	**-**
Depends	5	5	-	-	-

Looking at just those who are not already located at HIO, 29% would be likely to consider locating at HIO, and 64% would be unlikely.

	Audience				
Including only respondents not currently located at HIO	**Total**	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	221	210	3	6	2
Likely	**29%**	**30%**	**33%**	**17%**	**-**
Very likely	10	10	33	17	-
Somewhat likely	19	20	-	-	-
Unlikely	**64%**	**63%**	**67%**	**83%**	**100%**
Somewhat unlikely	17	17	33	-	
Very unlikely	48	46	33	83	100
Depends	**6%**	**7%**	**-**	**-**	**-**
Depends	6	7	-	-	-

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)? (Continued)

Likelihood to locate at HIO based on the airport at which respondents are currently based.

All respondents	Very likely to locate at HIO	Somewhat likely to locate at HIO
Participants this question	22	42
Portland-Hillsboro Airport	73%	12%
Portland Troutdale Airport	14	12
Stark's Twin Oaks Airpark	5	19
Pearson Field Airport	5	12
Grove Field Airport	5	2
McMinnville Municipal Airport	5	2
Sandy River Airport	5	-
Aurora State Airport	-	14
Portland International Airport	-	7
Lenhardt Airpark	-	7
Mulino State Airport	-	2
Scappoose Industrial Airpark	-	2
Sportsman Airpark	-	2
Vernonia Municipal Airport	-	2
Miscellaneous	18	7
Not applicable/Don't own/	14	17

Q11. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)? **Why is that? (Open-ended)**

Please see verbatim appendix for full list of responses.

Q12. If the answer is "somewhat" or "very" likely, or you are already located there, what would you estimate the number of your operations (take-offs and landings) to be at HIO? (Categorized per month)

Those who are likely to relocate to HIO or are already located there estimate 39 operations at HIO. HIO/TTD/PDX contacts estimate their number of operations would be 97.

	Audience				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	89	83	5	0	1
0	4%	2%	20%	-	100%
1-5	12	12	20	-	-
6-10	28	30	-	-	-
11-20	15	16	-	-	-
21-50	10	10	20	-	-
51+	17	17	20	-	-
Unsure/Depends	13	13	20	-	-
Mean	**39**	**36**	**97**	**-**	**-**

Q13. If a new parallel runway is not built at HIO, how likely would it be to result in a <u>reduction</u> of your existing operations?

If a new parallel runway is not built at HIO, the vast majority of respondents feel it will be *unlikely* to result in a reduction of their current operations (80%), while only 13% think it will be *likely*, and 6% say it *depends*. The vast majority of aviation contacts and HIO/TTD/PDX contacts think a reduction in operations would be unlikely if a new runway was not built, and the remainder says it "depends."

	Audience				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	287	269	10	6	2
Likely	**13%**	**14%**	**-**	**-**	**-**
Very likely	4	4	-	-	-
Somewhat likely	9	10	-	-	-
Unlikely	**80%**	**80%**	**90%**	**83%**	**100%**
Somewhat unlikely	14	15	-	-	-
Very unlikely	67	65	90	83	100
Depends	**6%**	**6%**	**10%**	**17%**	**-**
Depends	6	6	10	17	-

Q14. If the answer is "somewhat" or "very" likely, what would be the percentage of <u>decrease</u>? (Categorized per month)

Those who think their operations are likely to decrease if a new runway is not built at HIO estimate a drop of 49% in operations.

	Audience				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	38	38	0	0	0
0%	3%	3%	-	-	-
6-10%	3	3	-	-	-
11-20%	16	16	-	-	-
21-50%	50	50	-	-	-
51%+	26	26	-	-	-
Unsure/Depends	3	3	-	-	-
Mean	**49%**	**49%**	**-**	**-**	**-**

Q15. If we build a new parallel runway at HIO, how likely would it be to result in an <u>increase</u> in your existing operations (take-offs and landings)?

With 38% of participants indicating an increase in operations is *likely* if a parallel runway is built at HIO, about half feel an increase in existing operations is *unlikely* (55%), and 7% say it *depends*.

Aviation contacts and HIO/TTD/PDX contacts are more likely than pilots to indicate a new parallel runway would be unlikely to result in an increase of their current operations.

	Audience				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	292	274	10	6	2
Likely	**38%**	**41%**	**10%**	**-**	**-**
Very likely	14	14	10	-	-
Somewhat likely	25	26	-	-	-
Unlikely	**55%**	**53%**	**70%**	**83%**	**100%**
Somewhat unlikely	11	11	10	50	-
Very unlikely	43	43	60	33	100
Depends	**7%**	**6%**	**20%**	**17%**	**-**
Depends	7	6	20	17	-

Q15. If we build a new parallel runway at HIO, how likely would it be to result in an increase in your existing operations (take-offs and landings)? (Continued)

Likelihood to result in an increase of operations, by area airport(s) respondent currently bases their aircraft (includes both fixed wing and helicopters)

More than one-third of pilots who indicated a new parallel runway at HIO would be “very likely” to result in an increase of their operations are based at Portland-Hillsboro airport (37%), and about one-quarter are based at Stark’s Twin Oaks Airport (24%) and Portland Troutdale Airport (24%).

Of the 14 pilots (37%) based at Portland-Hillsboro Airport who think an increase in existing operations are “very likely,” nine indicated they are only based at Portland-Hillsboro Airport.

Pilots		
	Very Likely	Somewhat Likely
Participants this question	38	72
Portland-Hillsboro Airport	37%	26%
Portland Troutdale Airport	24	8
Stark's Twin Oaks Airpark	24	18
Aurora State Airport	13	11
McMinnville Municipal Airport	8	3
Pearson Field Airport	5	8
Portland International Airport	5	7
Mulino State Airport	5	3
Scappoose Industrial Airpark	3	6
Lenhardt Airpark	3	3
Chehelam Airpark	3	-
Sandy River Airport	3	-
Grove Field Airport	-	3
Sportsman Airpark	-	3
Fly for Fun Airport	-	1
Vernonia Municipal Airport	-	1
Miscellaneous	3	11
Not applicable/Don't own/operate aircraft	5	8

Q15. If we build a new parallel runway at HIO, how likely would it be to result in an increase in your existing operations (take-offs and landings)? (Continued)

Aircraft owned by pilots who indicated a new parallel runway at HIO would be “very likely” to result in an increase of their operations

Respondents	Aircraft Type and number
1	172 C (1)
2*	Beechcraft G36 (1)
3	C152 (25), C172 (8), PA44 (8), BE90 (2)
4	c152 (15), c172p (7), c172s (3), c172rg (2), c160 (3), Piper Seminole (8)
5*	C152 –(10), C172P (5), C172S (2), C172RG (1), PA-44-180 (4)
6*	C-152 (12), C-172 (4)
7*	C-180 (1)
8	C182 (1)
9	C182 (1)
10	Cessna 152 (1), Cessna 172 (2), Cessna 182 (2)
11	Cessna 152 (1)
12*	Cessna 152 (1)
13*	Cessna 152II (1)
14	cessna 172 (1), cessna 150 (1)
15	Cessna 172 – 3 (1)
16	Cessna 172 (1)
17	Cessna 172 (1)
18	Cessna 172 (1)
19	Cessna 172 (1)
20	Cessna 172 (1)
21	Cessna 182 (1)
22	Cessna T182T (1)
23*	Cirrus SR22 (1)
24	Diamond DA-20 (1), Cessna 172 – 1, (1)
25	Ellis Melvin RV9A (1)
26	Experimental RV6A (1)
27	Grumman AA1B (1), Piper PA 22/20 (1)
28	PA-28 (1)
29	piper (1)
30	Piper Cherokee PA-28-235 (1)
31	Robinson R-22 (1), Robinson R-44 (1), PA-28-161 (1), Cessna 172 Skyhawk (1)
32	s-61 (1)
33	Vans RV-12 (1)
34	Vans RV-4 (1), Miller Tern (Glider) (1)

*Pilots indicated in Q1 they were only based at Portland-Hillsboro Airport

Q16. If the answer is "somewhat" or "very" likely, what would you estimate the percentage of increase? (Categorized per month)

Those who think their operations are likely to increase if a new runway is built at HIO estimate a boost of 44% in operations.

	Audience				
	Total	**Pilots**	**HIO/ TTD/ PDX**	**Aviation Contacts**	**Airports**
Participants this Question	104	103	1	0	0
0%	2%	2%	-	-	-
1-5%	6	6	-	-	-
6-10%	15	16	-	-	-
11-20%	13	13	-	-	-
21-50%	43	43	100	-	-
51%+	18	20	-	-	-
Unsure/Depends	3	3	-	-	-
Mean	**44%**	**44%**	**50%**	**-**	**-**

The mean increase of pilots who indicated a new parallel runway at HIO would be “very likely” to result in an increase of their operations is 71%, and 31% for those who think a new runway would be “somewhat likely” to result in an increase of their operations.

The mean increase of pilots currently based at Portland Hillsboro airport who indicated a new parallel runway at HIO would be “very likely” to result in an increase of their operations is 44%, and 27% for those who think a new runway would be “somewhat likely” to result in an increase of their operations.

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	Pilots			
	Very Likely		**Somewhat Likely**	
	All Pilots	**Based at Portland-Hillsboro**	**All Pilots**	**Based at Portland-Hillsboro**
Participants this question	36	11	64	18
0	-	-	-	-
1-5	-	-	9%	11%
6-10	6%	9%	20	11
11-20	3	-	19	22
21-50	56	73	38	44
51+	33	18	11	6
Unsure/Depends	3	-	3	6
Mean	**71%**	**44%**	**31%**	**27%**

Q1b. Miscellaneous airport:

Pilots
North Plains/North Plains Glider Port (4)
Parkside Airpark (WA87) (2)
Sunset Air Strip 1or3 (2)
30OR
9OR7
Eagle's Nest (private)
Glider Port / 10R4
Green Mt
Have no aircraft
I am the executive director at the Port of Camas-Washougal
In training
Jernsteadt Field Hood River, OR
K6K5 Sisters
Kelso-Longview Airport (KKLS)
KDLS
KTDO
Mechanic (HIO)
Multnomah Channel 2mi south of Scappoose Industrial
OG63 Gilbert Airfield, 7NM West of HIO
OL05
OR41
Private
Rent Airplane out of Pearson
Renton, WA: KRNT
Wiley's Seaplane Base

HIO, TTD, PDX Contacts
I managed the Woodland State Airport we have two aircraft tiedown tenants.

Airports
I am an air traffic controller at Hillsboro Tower.

Q4b. Miscellaneous use:

Pilots
Air shows, glider flying
Aircraft Rental
AV gas
Charity flights (Angel Flight)
EAA B-17 Tour Stop
Hillsboro Classic Aviation Museum
Hillsboro Flying Club (Currently 31 members)
I use it on rare occasions
Law enforcement
Maintenance
Maintenance and parts at Aero Air
Personal use (pilot flying club aircraft)
Planning on doing instructing there
Socializing
Some small maintenance and practice approaches
Student
Support Aviation improvements
Work

HIO, TTD, PDX Contacts
Car rental
Hillsboro Tower
We rent NE 'T' hangars from Port of Portland

Additional Aviation Contacts
Flight instruction

Q8. Miscellaneous issues of maximum importance:

Pilots
Tower/safety (2)
100LL fuel price
Ability to initiate radio communications (i.e. a frequency with actual empty slots in it)
Aircraft rental availability and maintenance facilities
Aircraft rentals not requiring personal hull insurance policy
An FBO that still caters to GA even though servicing jet traffic
Availability of FAA-approved maintenance facilities and availability of other pilots
Avgas availability and price
Competitive fuel pricing
Congestion
Cost of fuel, availability of services- maintenance, tie down fees, safety, airport management
Costs: fuel, hangar, tie-down, delays (burning fuel, putting more time on the Hobbs).
Courtesy of staff, nearby restaurants and entertainment
Driving time for principal passengers
Ease of getting to and from the airport on the ground. Some airports a bit farther away but an easier commute
FAA Tower
Flight training
Fuel available
Fuel on Field, Maintenance on Field
Grass runway
Helicopter Friendly
I rent my aircraft
I've found that delays are minimal and seasonal
Less Congestion
Less garbage jet traffic on GA runways
Low cost aircraft storage
Maintenance / fuel
Maintenance on field / Control tower
Minimize chance of mid-air collisions
Minimizing Noise Impact on Nearby Residents
No Users Fees (Already paid in my higher tax rates)
Opportunity to own land and hangar instead of lease
Pattern/runway congestion
Prefer non-towered with grass runway available
Price and Availability of Rental Aircraft
Radar Service - Operational Tower Hours until 2230
Safety of aircraft and pilots/less congestion/minimal delay due to traffic congestion
Security of hanger facilities, availability of instrument approaches
Separate runway will cause less delay
That where the business is domiciled
Unencumbered access and good security
Would like to see another runway available to GA

Q8. Miscellaneous issues of maximum importance: (Continued)

HIO, TTD, PDX Contacts
No landing or other usage fees
Security

Additional Aviation Contacts
What the Port does is mismanage funds. Airport fees go up and people stop patronizing the airport. It's a great idea to have another runway, meaning the runway is there to stay. Driving too far to Portland is a joke. If they played their cards right, they could make HIO a hub for UPS or other carrier. They should go to those companies and solicit them. Could also have a warehouse there.

Airports
Isn't it a shame that the FAA makes it so hard to get in and out of an airport because it's a pain in the butt? Too much hassle in it. Like to see streamlined procedures in and out of the airport -- shouldn't need a co-pilot with a single plane.

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that?

Pilots: Very Likely

A secondary runway for smaller aircraft would improve flow and make operations safer and more efficient

Additional runway will reduce the training congestion substantially and would allow much easier/better access to the airport

Close to home, IFR, affordable hangers

Currently can experience horrible delays, e.g. from too many Hillsboro Aviation students

Ease of congestion

HIO is a great airport and a busy airport that runway improvements will only help make a better airport.

I find a new runway would make flight in and out of HIO to be more efficient. I would move my company to HIO if it had another runway for primarily light aircraft

Increased safety by separating training from business aircraft operations

It is closer to my residence and business

Less delays and better suited to small aircraft

Less traffic congestion

Location

No more delays for both arrivals and departures

Safety; The Hillsboro Airport is extremely busy. The airspace surrounding the airport is also very busy as it's the host to flight training operations from numerous airports nearby. The operations in and out of Hillsboro far exceed the capacity and capability of Hillsboro's one main runway (30-12). Having seen first-hand the amount of traffic during peak hours, it would be foolish to forego building a new runway. If something is not done to increase the capacity of the Hillsboro airport, operators have options outside of the PoP's operation

The Hillsboro Airport (KHIO) is a desirable and easily accessible secondary airport. KHIO is a well-constructed centrally co-located airport that has easy access to desirable locations throughout Oregon. I feel that the KHIO airport is a vital airport that greatly expands business into the Portland metropolitan area

Training now, but on my way

With a runway for smaller aircraft, there would be very few delays and the training environment would be even better

Pilots: Somewhat Likely

Convenience (2)

Avoiding PDX

Better access

Better areas to operate in and around

Better flow of traffic. Less interference from large aircraft.

Better operational and handling capabilities

Closer, safer

Closest to home

Control Tower Operation

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that? (Continued)

Pilots: Somewhat Likely (Continued)
Convenience and facilities
Distance to commute
Easier to get in and out of, new hangers available
Fewer delays
Good facilities
Hangars are kind of expensive
HIO already has a lot of traffic, and most of that traffic practice takeoff and landings. So if new RWY is built, somewhat there is fewer delay for landings
I haven't flown for about a year, but I received all my ratings in Utah and appreciate a separate runway for smaller aircraft to help with delays, especially as a paying student. But time and experience with a towered airport are invaluable
I stopped having anything to do with HIO about 12 years ago. Got tired of waiting on the ground, sometimes up to half an hour because of IFR practice on clear VFR days or waiting for larger aircraft on approach; if HIO changes resulted in less delays on ground or in the pattern, I'd give it another look
If hangar space is cheaper than PDX, I'll go to HIO
If more hangar space is made available
I'm attracted to Hillsboro for its all-hours infrastructure, its all-weather navaids, and a dedicated runway would enhance the convenience of my operations
In general, a runway for small aircraft would make the airport more appealing for sport aviation
Less delays
Less takeoff/landing delays
Moved aircraft already to K6K5; will use HIO for commuting purposes or will choose Starks Twin Oaks depending on Hangar cost and availability
Presently don't own an Aircraft in the area, but may consider purchasing in future so reduced engine time idling is important (fewer taxi/runway delays) and in favor if the extra runway provides that
Safer operation
Short regional flights are taken on by small aircraft and flights of 1000 miles or more are taken with larger faster aircraft. There needs to be an interface airport that handles both
The biggest problem with HIO is the time it takes from engine-start to getting off the ground. A training runway would make it a lot easier to take off without delay.
Was at HIO (A6-Tower Ts) 25 years; when I had to wait for 20 minutes to takeoff, I moved to 7S3

Pilots: Somewhat Unlikely
Distance from home (2)
Aircraft is currently hangared at Pearson for the convenience of co-owners
Already based at 7S3
Already established at PDX, but things could change
Company is based in TTD

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that? (Continued)

Pilots: Somewhat Unlikely (Continued)
Cost is higher than my current location (KTTD); traffic congestion (student training congestion), shared ownership of the aircraft would require moving two owners away from current location
Costs
Distance to residence makes it a less likely choice than many others
Do not have an aircraft yet
HIO has been adequate
HIO is not near my home or business
I am not convinced that a parallel runway would reduce the congestion that exists at HIO on weekends. In addition, the use of trainee tower personnel makes flying at HIO aggravating
I like McMinnville, it is closer to where I live, and I don't know much about the community of HIO. Honestly, if there were a good community of young pilots at HIO that would be a bigger draw than a new runway
I live on a private airport
I live on an airstrip with a hangar in my backyard
It is not close to my home
Live in Troutdale
More likely to locate at KSPB because of proximity, KHIO would be second choice.
Not a request from the aircraft owner
Not as convenient
Not my decision
Only moving for cheaper hangar rent
Our hangar costs at 4S9 are much less than HIO. Again, cost for me is of extreme importance and that includes reducing delays as these lengthy delays cost fuel and put time on the Hobbs meter, thus shortening the effective interval between scheduled maintenance.
Our Scout is based on our family farm, if we need to fly the Comanche; we just fly over to Twin Oaks in our Scout. The fuel and hangar ret is cheaper there
Partners live far away from HIO
Professional Pilot and Company is based at KUAO
Proximity to business and residence
Surface traffic getting to/from airport
Too far from home
Too far from home and business

Pilots: Very unlikely
Too far away / Too far from where I live / Distance from home/office/commute (22)
Not convenient for me / Convenience (3)
Costs (2)
Don't own an airplane (2)
Aircraft based at other area airport
Airport is not convenient to my home location. Already have a hangar for my aircraft at convenient airport

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that? (Continued)

Pilots: Very Unlikely (Continued)

Already based out of Chehalem
As a Vancouver resident and if I owned an aircraft I'd try focusing on locating it most likely in Clark County
Aurora and Mulino are much closer to my residence in Canby
Based at TTD
Belong to club based at TTD
Driving time and automobile traffic to and from my residence in Vancouver, WA wouldn't make it advantageous for me to move my aircraft
Flight Training currently at Pearson, live in North Vancouver; distance is prohibitive
For the kind of flight instruction I have done, the smaller the field, the better. No air traffic hassles. No car traffic hassles getting to the field, or parking hassles at the field. No security hassles and/or fencing to prevent me or my student from showing up early and getting to the aircraft
For VFR flights, it is easier to not have to deal with the tower
From both, my place of work and residence, access to Hillsboro is impractical due to traffic on Hwy 217 and especially on Hwy 26
Further from home
Glider operation
Happy at Twin Oaks
High cost of hanger rent
Hillsboro too far away, too big, too expensive
HIO further vs. current location; happy where I'm at
HIO is just too far out of the way relative to the rest of my life
Home of the aircraft is S17
I am a Captain for Southwest Airlines
I am happy with Aurora State. Hillsboro is further away
I base my helicopter at my private heliport 9OR7
I don’t like flying out to HIO because of all the student traffic, but more importantly the lack of qualified student pilots. It seems that Hillsboro is a pilot mill when it comes to cranking out overseas pilots who are very hard to understand on the radio and have a track record for hard landings and crashes
I don't own an airplane. How does anyone afford one now days? Everything costs so much
I like Twin Oaks. The People are great; small and easy to operate out of. My EAA chapter is located there
I like where I am at
I like where I am at Lenhardt due to the tight aviation community that exists there
I live in Gresham
I live in Vancouver
I live in Vancouver, WA and am based at Pearson which is <5 min from my home
I live on a very nice Airpark
I rent aircraft from an FBO
I rent my aircraft
I work for an airline

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that? (Continued)

Pilots: Very Unlikely (Continued)

It would be nice to have the additional runway so we can operate in a more coordinated fashion. Would be nice to be able to visit more often
It's not close enough to the home
It's on the far side of the Portland Metro Area from my home/business. The drive is prohibitive
Live closer to Aurora and have business there
Live on east side
Long distance from work or residence
Long drive from where I live, and auto traffic is terrible between home are and KHIO
MMV is much closer
My residence and my business are both only 4 miles from SPB
Never thought HIO was a busy airport where it required a separate piston runway
New runway would not be a factor in a move
Nice airport though
No aircraft of my own to locate
No plans or desire to relocate from my current base
Not signed off for towered airports
Now based at KUAO and very happy there; no reason to relocate
Operate at Pearson
Operate our own airport
Our business is located in Scappoose. Not interested in moving it
Pain in the butt to operate out of
Road access to Aurora better; also less flight traffic
Satisfied with my current airport/FBO, additional runway at HIO has no attraction for me
Several other airports are closer to me
The Port of Portland operates this facility and tends to force small operators away with high lease rates, etc. At HIO we cannot own our land or even our facility in time. Remember Mulino? Is Troutdale thriving? Now look at UAO
This addition isn't needed in the aviation community. It's a way to make money for the contractors and government cronies involved and with the high cost of fuel, smaller aircraft usage will decrease over time, not increase to the point you can justify the growth
Twin Oaks is more convenient
We are happy at UAO
We don't need to spend the money
When I have landed there, if IFR, I usually get delayed due to traffic. A second runway will not help this aspect. Valley radar so coverage from the west to southeast quadrants would speed IFR arrivals up more than a runway
Where my current aircraft are based is the most cost effective in combination with my proximity to the airport and the amount of traffic at the airport I have found in the tri-county area
Work for Southwest Airlines at PDX
Would have to buy an airplane

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that? (Continued)

<u>Pilots: Already located at HIO</u>

I am a CFI at HIO

I considered Aurora, but like being at a tower controlled airport. However, I have been reconsidering this decision due to frequent delays due to all the student traffic

Personally, I think with the economy as it is and our national debt a very serious problem, an additional runway is a colossal waste of taxpayers' money and unnecessary. I love to fly and I think it's going to be another repeat of what happened in Eugene - underutilized runway at a huge expense

<u>Pilots: Depends</u>

Cost (2)

Convenience - close to home or work - depends on home or work location. FBO and fuel prices also of interest

Depends largely on costs and other personal factors, including possible aviation club membership; new runway will have almost no bearing upon my decision to relocate there

Do not own an aircraft

Hangar and fuel expense

I am looking for a job as a flight instructor or A&P mechanic

I like my small family owned airport (7S3). The flight training operations at HIO make it a little bit hectic to want to conduct the type of flying I do which is that of a GA pilot who goes out on $100 hamburger runs. HIO is a very nice airport, has great runways and definitely has its place with GA just usually do not have a reason to go there. Make a shuttle service to the Thai Princess or one of the other restaurants and maybe I will make it a stop, but living in the area and happy with 7S3 I am not sure I would anyway. I say depends because I wonder how close the taxi would be from a hangar I could rent. 7S3 is only a minute of taxi time, versus HIO which could be a bit more; a new runway would cut down on wait times, so depends

I use Hillsboro primarily for flight training and aircraft rental services. I decreased my operations out of HIO because of increased traffic and delays. If I rent aircraft from Hillsboro or need to stop in there while flying out of other airports, I try to do so when there is less flight instruction or commercial traffic. A new runway might persuade me to use to increase my use of the airport and facilities. Also I'm looking to purchase an aircraft in near future and I would consider a hanger at HIO if it could handle the increased traffic that it has seen in recent years

I used to fly out of HIO and Starks Twin Oaks. One of the main reasons I shifted my business away from HIO is that there were often long delays to take off or land the airplane. Since I was paying for Hobbs time this was a substantial cost to me with no benefit. However I have stopped flying since them due to the high costs of flying for recreation/sightseeing so this construction will not impact me in the short term

Q10. Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

Q11. Why is that? (Continued)

<u>HIO, TTD, PDX Contacts: Very Likely</u>
Base of operations at TTD

<u>HIO, TTD, PDX Contacts: Somewhat Likely</u>
Not important

<u>HIO, TTD, PDX Contacts: Very Unlikely</u>
Location works for business

<u>Additional aviation contacts: Very Unlikely</u>
Current operation is at MMV
My business and hangar are at UAO, and HIO is owned by the Port of Portland
We are at the airport now in Scappoose.
We operate off UAO and only use HIO for training and passenger pick-up/drop-off

<u>Airport: Very unlikely</u>
Let me speak for everyone out here: The 30 people that are customers at my airport, no one would be willing to relocate there. Hillsboro would charge more for hangers, maybe 1/3 more than we charge. Our airport serves a different purpose, strategically located. We're just over Mt. Hood and had an emergency-type landing recently. We have several of them when it fogs in. Once you fly into the fog you have two minutes to live.
Live in Washington

Q14. Comments:

Pilots

Amount of traffic

Current delays

Too much traffic for the existing runway/taxiway system

Q17. Additional comments:

Pilots

A new runway just makes sense. There aren't many options west of Portland and HIO has the infrastructure necessary for GA as well as business operations. HIO does need more capacity for the GA aircraft being the business operations are taking over the existing runway/taxiway system

A new runway would help smooth out the flow of operations at HIO and building a new runway would reduce delays on the tarmac due to traffic if there was a dedicated runway for smaller aircraft operations; saving everyone involved time and money

A parallel runway is necessary to accommodate the large training load at HIO. The impact is small as it will accommodate smaller planes only, allowing better access for business traffic

Adding the additional runway will make for safer operations for all aircraft operating within the KHIO airspace

Additional RW equates to fewer delays, fuel savings, less noise, and more safety of operations at HIO

Aircraft safety on the ground and in the air are of increasing importance and are receiving emphasis from the pilot population of small and large planes. Congestion and competition for space is always a concern for pilots of small, single engine aircraft, and additional runway availability for VFR pilots would be very helpful

Airports with control towers usually waste time and are inconvenient unless renting a car

An additional runway at Hillsboro would be nice, but I'm not sure how it would be financed

An additional runway would be a big benefit to HIO. As a pilot who flew there prior to the increased corporate (Intel) and student (HAI) traffic, the need for another runway is evident on the ground and in the pattern. Parking is also an issue and I hope it will be addressed soon

An additional runway would make HIO much more convenient for me to practice on than MMV, and better for my flying since it is a towered airport

Any additional users' fees for small aircraft (besides fuel surcharges) would restrict my ability to fly and support our local aviation and business community

As law enforcement, fixed wing aircraft, there are times when the success of our mission demands an expedited departure from Hillsboro. Over the last year, we have been delayed by as much as 5 minutes in departing, despite the tower's best attempts to get us out quickly. The foreign student pilots do not always follow instructions and have created hazards on the ground and within the traffic pattern. Upon our return to Hillsboro the congestion to land at runway 31 (clear day) and runway 20 (wind and rain from the south) force us to remain outside the Class D airspace until the controller can get things sorted out

Q17. Additional comments: (Continued)

Pilots (Continued)

As a student who learned to fly at Hillsboro Aviation, I believe a smaller parallel runway would be extremely beneficial to everyone. It will aid in traffic separation and help make the airport even safer

At present, due to other traffic, I tend to fly to nearby airports to perform recurrent training. If a separate light aircraft runway is built I would hope that it would allow me to do some of the recurrent training/practice of touch and go's at HIO

Basing my aircraft at HIO would increase my operating expenses for fuel, hanger and maintenance. I fly into HIO once or twice a year for practice in a higher traffic density, ATC tower environment. Adding a runway will have little or no impact for me

Being a recent recipient of a private pilot's certificate, I still use HIO mostly for training for towered Class D operations. During the busy summer months, it would be a huge benefit to have a secondary runway for small piston aircraft to train on. It can be a challenge for students to be dodging larger faster commercial, corporate, and medevac flights when the skies are busy enough with a swarm of Cessna's in the pattern along with the always prevalent helicopter training flights as well. I think a second runway would increase safety, and increase training activity as there would be fewer delays in between landings. The more landing practice young pilots can get, the safer they fly

Can't imagine justifying the cost of a new runway in Hillsboro at this time

Consider future expansion. Population growth is exploding on the West Side of Willamette. Eventually, we need PDX and HIO for airlines. Long term planning is essential.

Currently building a Van's RV-9, when complete I would prefer to base it at HIO, second choice 7S3, because of proximity to home and navaids. I would also give more flight instruction at HIO if another runway was available

Currently my use of KHIO is limited; as we are currently based at KUAO however I live within 5 miles of the airport and was a flight instructor there for many years. I believe an additional runway would enhance safety and efficiency while not affecting the noise impact to the surrounding area. The Airport was here long before the homes that now surround it

Do people really own airplanes anymore? What line of work are they in, because I would like to do what they are doing to make enough money to have an airplane. Who is getting delayed at HIO? Students? Have them go to Aurora or Scappoose; seems like a waste to me to build another runway for a dying hobby and a career path that has no hope of improving. GA will continue to die as long as prices stay out of reach for the common citizen. I want to fly more GA, but I choose to not spend my money on airplanes. How do I justify costs of greater than $100 an hour? I can't. Even with the LSAs coming on the market, I can't afford a $100k aircraft. The current airports and runways we have in the region should well cover the future of GA as it continues to decline

Have doubts that this survey is going to result in any valid information. Appears it was sent to registered pilots; little opportunity to get input from residents around the airport. Seemed designed to support construction of a third runway

Hillsboro mostly used for IFR approach practice and as an alternate

HIO is a great airport; however, I have experienced takeoff delays of up to 20 minutes. I am an active volunteer pilot for Angel Flight West. These delays are especially unfortunate when transporting passengers for Angel Flight

Q17. Additional comments: (Continued)

Pilots (Continued)

HIO is an extremely busy airport, an additional runway will do nothing but improve traffic flow, increase the safety margin and improve the quality the GA traffic has experienced already there. A lot of people in the HIO area that do not use the airport at all and are not involved in aviation do not understand the needs for improvement and expansion at busy GA airports. No HIO is not the same as PDX, it does not have the commercial traffic, and therefore a lot of people do not think additional runway space is needed. However, for those companies that utilize the airport, and the hundreds of students that move to the Hillsboro area, spend their money in this community, any improvement to the layout and operation of the airport are looked at with a great deal of appreciation.

HIO is not part of my daily life. No amount of airport improvements would convince me to use HIO more than 1 time every 2 years or so

HIO is very overcrowded, especially with student pattern traffic. I avoid the airport unless I must make a landing there for business reasons or use the Navaids for IFR or night currency flights. A separate runway for small craft will hopefully relieve some of that congestion

I'm glad Hillsboro Aviation is thriving, but the sheer number of their students is a huge problem, causing traffic jams getting into and out of KHIO. 2. Most of my flights are IFR and getting an IFR release can mean big delays these days. I base at KHIO because of the IFR approaches, but the IFR release delays are getting to be troublesome.

I am a helicopter pilot and I look forward to reconstruction of the Charlie pattern helicopter practice area.

I am generally in favor of small aircraft facilities at larger airports. I think it benefits operations of small aircraft as well as larger aircraft

I am indifferent to a new runway at HIO

I appreciate being a part of this survey. GA costs are rising to a point where it is very difficult to justify flying. Increased capacities at airports (fuel, storage, runways) will only serve to reduce these costs, so I am very much in support of this additional runway, despite my current low usage of HIO

I avoid landing at HIO with students on weekdays because of the possible long delays for takeoffs. I've waited over 10 minutes for takeoff clearance in the past

I believe an additional parallel runway for GA aircraft is an excellent idea both for the reduction of delays and for the economic boost it would bring to the area

I believe it is a good investment as we are losing too many airports, which in my opinion will lead to a decrease in commerce. It is cost effective to fly and not use the highway system with its increased congestion. There are many uses to which smaller aircraft can be used in increasing the bottom line. I for one use it to travel in a consultation business

I believe it would be a very desirable consideration to build a new runway so as to cut down on delays and also to make HIO a first class general aviation airport

I believe that the addition of a new runway will greatly help the traffic flow at HIO. During peak times planes can wait 10-15 minutes just circling trying to get clearance into the HIO airspace. This is due to multiple aircraft flying the pattern as well as IFR and VFR traffic moving in and out of the area. Planes can/are sent on 8 mile down winds in the pattern, well outside the Class D airspace, to make room for all the aircraft trying to do touch-and-go's. By making it more efficient to get in and out of HIO will greatly help overall flying businesses

Pilots (Continued)

I can't see that a new runway will attract more HIO traffic. Pilots fly in and out of airports based on need not how many runways exist. Anything that improves the flow of traffic will reduce congestion and get aircraft on the ground (out of the air) more quickly. It will have no effect on which airports I fly to/from, but another HIO runway appears to be a positive thing for everyone

I care about delays, and if a second runway is the answer, then fine, but this strikes me as a want, not a need for the airport, and probably not the best use of taxpayer money

I don’t foresee a significant increase in the number of operations with the addition of a parallel runway, but rather a significant increase in the safety of operations by building a parallel runway. As the population continues to expand the use of local airports and highways will likewise require expansion and improvement. Not improving highways doesn’t decrease their use, but increases congestion and accidents; same is true for airports

I don't own an airplane, but if I do rent. HIO will be on the short list of airports to utilize. Therefore, I feel an additional runway will be advantageous especially if it saves 30 minutes of waiting to depart from an arriving aircraft on an approach. Lastly, thank you for the opportunity for participating in this survey

I fly for Civil Air Patrol and use their aircraft. I would like to also use the airport for private use sometime in the future

I have very little need to visit HIO. I get my maintenance done at fields closer to my home; the fuel there is too expensive; the location is inconvenient

I just use HIO as a different place to land, probably 1-2 times a year. One time I decided to overnight there because of weather

I marked “unlikely” to increase or decrease operations, which would change if the new runway or lack thereof caused gas prices to go up/down or caused FBO services to improve/worsen

I prefer the smaller airports around PDX. Tend to stay away from the towered airports if I can

I say depends, because I usually am up during peak hours flying, and there are tons of people using the pattern and runways for practice. Because of this it makes getting a landing take longer and uses more fuel. I have been told by controllers they will call my base on runway 31 and end up flying over Bull Mountain sometimes, the patterns are huge at HIO! If a second parallel runway were put in, it would alleviate some of the strain on the traffic and make patterns a more reasonable size

I see the benefit to the extra runway as a way to expedite the current traffic rather than having one runway and having planes extend downwind or hold outside of the airspace as well as dwell time on the ground. My opinion is that traffic will not increase much over what it is now with the extra runway

I support the addition of a parallel runway at HIO

I support the construction of another runway. Congestion at HIO is pretty high due to flight training. Having another runway that can take some of the workload off of the main runway would be beneficial

I think that the new runway will be a good improvement for the community. Washington County is growing. There is lots of training going on at HIO and an additional runway would really help. I am 100% for it

I tried to land at Hillsboro several days ago for touch and goes, but was not able to due to heavy traffic. I circled for about 20 minutes but could not receive permission to land at the airport because it was non-stop busy...so we flew to PDX

I use HIO basically for IFR currency

Q17. Additional comments: (Continued)

<u>Pilots (Continued)</u>

I use HIO sometimes for flight instruction when a pilot has his AC based there. I never use HIO for training (landing or takeoff) other than to leave the area or to return because of congestion (we waste too much time waiting for clearance to land or take off)

I would like to fly into HIO to pick up friends that live close to there and less congestion would make that possible

I would rather see the funds go to adding a GA piston runway at PDX

If a new runway is built, there is a chance some existing hangar tenants may be forced to relocate and/or pay higher rental prices

If I want to fly, I fly. It doesn't have anything to do with the number of runways at HIO. It totally depends on availability and affordability of hangaring my plane there; period. Save the money and spend it on hangar upkeep. The pilot population is decreasing at a large rate, and especially with economic trends. I don't see aviation as a viable future activity for many existing pilots - of which, myself included. Fuel prices are the number one major influence in general aviation (hobby) activities. Not a 2nd runway for some minor delays here and there

If I were based at KHIO, I definitely would strongly support this improvement

If the additional runway is added, and the airport airspace becomes class-C, then I will probably avoid the Hillsboro Airport

"If you build it they will come"

If you guys build new parallel runway, there should be more traffic over there. So I just want to recommend you guys have to set one more tower frequency. Thanks

I'm a flight instructor based at Hillsboro, so my operations per year are higher than average. The parallel runway would be a welcome addition to flight operations and perhaps ensure safer separation between business aircraft and light training planes. Its main benefit is reduced delays for takeoffs and landings of smaller aircraft, which directly benefit students by minimizing delays on the ground

I'm an independent CFI and don't own an airplane. I make sure my students are proficient dealing with ATC. Flying at HIO is part of training for all my students. A new runway will benefit them greatly. It will decrease delays and make training more efficient. My use of HIO increases or decreases with my student load; it's not dependent on number of runways. Many questions in this survey are poorly worded. You ask for an estimate of the number of operations, but fail to give a time frame. Do you want operations per year, month or day

I'm glad to see that an additional runway is being considered at HIO. Back in the day, I used to do a lot of flight instructing. The additional runway, I believe, would attract some more flight training operations at the airport. Instructors do want to see their students gain valuable radio communication skills and division-of-attention skills while flight training. When transient traffic is heavy, it tends to discourage touch-and-goes and flight training operations in the pattern with only one non-intersecting runway. A parallel runway might encourage more flight training in the pattern, while still allowing transient and business traffic unimpeded access

I'm primarily an aircraft renter and seasonal (fair weather) pilot. I love HIO and learned to fly there, after my initial flight training I started flying out of other airports because of the increased traffic from Hillsboro Aviation, Intel, and Global Aviation. I would definitely consider returning to Hillsboro more regularly for both personal and training flights if the delays were less and the traffic more fluid. I am concerned about user fees and if the new runway increased or added user fees/taxes that I would have to weigh out the cost-benefit ratio

Pilots (Continued)

In 12,000 hours of commercial flying in small general aviation aircraft I have chosen a policy for myself and my line pilots concerning airports with a long and a short runway. The policy is to almost always request the long runway. With a fully loaded aircraft on a hot day it is a company rule to refuse a short runway as it is always safer to have excess runway in front of the aircraft for stopping safely after a problem. Such guidelines have contributed to our 30+ year accident and incident free record. Our lives are just as important as the suits in the Gulfstream G-5 on 10 mile final for runway 30

In the past, when I worked for Ameriflight, it was very difficult to conduct realistic IFR training to minimums when Tower gives me an MDA of 1,000 feet when on an ILS approach. The added runway would greatly increase realistic IFR training and cut down training costs

Increasing safety at HIO is very important considering the amount of pilot training conducted there. Conducting parallel simultaneous take-offs and landings I think would be detrimental to improving safety. If constructing a parallel runway would allow more airplanes to be in the air in the vicinity of the airport, especially in the traffic pattern, at any given time I think the increase in traffic flow, both in the air and on the ground, would increase the likelihood of loss of separation incidents. Keep in mind that many of the students flying out there have less than a secure grasp of the English language and find it challenging to follow simple instruction from Ground or Tower control, let alone more complex clearances that increased runway and taxiway traffic would probably necessitate. Many of these students had enough trouble keeping track of which runway was which, when we had runways 30/12 and 02/20. Since the change in the long runway designation to 31/13, that challenge has intensified. If they had to distinguish between runways 02/20, 31R/L and 13R/L, I think the confusion factor would increase dramatically due to the lack of English proficiency and overall experience.

It is a good idea to expand the airport and allow additional flight, particularly since the flight pattern will not impact additional residences. This is due to the standard pattern already being a right pattern. Also, this may cause the tower to route aircraft differently avoiding the problematic neighborhood west of the airport

It seems that the additional runway will make operations safer by separating traffic. The other perceived benefit would be reduced wait times on the ground and shorter traffic patterns. This could reduce the amount of gas burned and the amount of time planes have to spend in the air waiting for clearance

It would be unlikely for me to move back to HIO, but with the new runway I certainly would start again to use HIO

It's much safer to land and takeoff in a small single engine plane when there are no heavy aircraft landing and taking off behind or ahead of you, pushing you in the pattern, and exposing you to wake turbulence. So safety is my primary issue

More pavements allows corporate users to be segregated from school aircraft

More runways anywhere is always a better idea

Pilots (Continued)

Most IFR delays going in and out of HIO is due to a lack of radar coverage. Over HIO the coverage is around 2,500 and it gets worse to the west through southeast. Therefore, you have typically a 1-in-1-out scenario. The departure procedures extremely limit the traffic. (Example: HIO aviation aircraft doing a missed approach on the ILS not only ties up the scapo departure-NW, but also the Farmington departure-South. A Canby departure might work depending on the runway, but in low IFR where the tower can't provide visual separation, the IFR departure may wind up waiting up to 8-12 minutes due to FAA rules.) Since my aircraft can't keep up with Nike's G5s and certainly there's a ton of C172 and Seminoles IFR approach training from HIO, I avoid HIO airport unless necessary or flying VFR. Never really experience delays going VFR

My operations are not likely to increase or decrease due to new runway, or increase or decrease if there is no new runway, in other words I will continue to operate much the same as I have, with or without change to KHIO. The only reason my operations would change at KHIO is if GA operations were to become restricted at KHIO

Needs to be cost justified

On several occasions I have prematurely terminated my flight at HIO because of congestion in the traffic pattern. I have operated at other airports with parallel runways and this has helped to alleviate congestion and to create flexibility in the pattern

Operations at HIO will be safer with a new parallel runway, which will increase the likelihood that I will conduct operations there

Parallel runway is a good thing; hangar costs, fuel taxes, and other considerations much more important. You are focusing on the wrong things

Please support general aviation

Please excuse my anger. This country is on its ass economically; we are 15 Trillion dollars in debt and you self serving bureaucrats want to build a runway to nowhere. For what purpose? Government expenditures bring about $1.00 into the economy for every $4.00 spent of public tax dollars. Your promotion of this project is like asking the welfare folks if they would like a cafeteria installed in the unemployment offices. I would ask you to pass on this construction project and be patriotic enough to save on wasting this money no matter how much jeopardizes your positions.

Since HIO is a regional, I would not recommend having commercial 135 traffic operations due to training FBOs, traffic mix, and surrounding neighborhoods who are already complaining about light jet traffic; such as Nike, Intel, Global - I'm currently in southerly approach end of 30 and would not particularly appreciate additional Commercial operations / overflow from PDX, even with noise abatement procedures

Small aircraft congestion is a major problem at HIO

Some answers here might be skewed incorrectly regarding “the Portland region” since that was not defined. Is that City of Portland, Tri-county area or a certain radius from Portland Intl? I am based at Aurora in Marion county, but it would not fall into the first two categories, although it is, I think the highest used, non-tower airport in the state

Someone is going to get killed at HIO as it is way too busy and controllers are not able to keep up. Recently I have had to wait outside the airspace for more than 20 minutes before being allowed to enter the airspace (5 miles). That means there are several aircraft circling around waiting for clearance to land. It is scary

Sorry I couldn't be more help, I don't use Hillsboro. I am however always interested in safety, and it would seem that a designated runway for smaller aircraft would be safer

Pilots (Continued)

Tend to take instrument students to other airports due to the high percentage of approaches that can't be flown to completion due to VFR student pattern activities. Excessive radio congestion requires many repeat calls frequently for pilots in the patterns as well as approaching and departing the airport

Thanks for allowing me to comment

The addition would be a smart move as traffic increases at PDX and HIO over the decades

The building of another runway will speed up our departures and arrivals. Being delayed increases fuel burn, costs, noise, and increased exhaust into the air

The construction of the extra runway surface would reduce the interference by the educational traffic which is significant. The flight school is a huge contributor to the economy of the Hillsboro area and the profession of aviation

The Hillsboro Airport was constructed long before residential neighborhoods (est.1952) were established in the area. Local businesses utilized KHIO for its intended purpose - to increase business accessibility and revenue. I feel that KHIO does a wonderful job at that and that the capacity to handle an increase in business aviation would be wonderful for the Hillsboro/Beaverton area(s). From a corporate standpoint, I think an additional runway would be excellent. As a previous resident (closer than 1 mile to the airport) for a sustained time in excess of 12 years, I did not feel like the noise generated from the airport had any negative effect on my conditions of living. I saw the airport as a great way to increase local business and corporate business revenue in the area. I feel Hillsboro and Beaverton's micro-economies have been wonderfully expanded due to the airport

The importance of building another runway (for me) is to deconflict my small/slower/pattern work aircraft from faster/heavier/itinerant aircraft on the long runway. The complexity of operating both types of aircraft/operations on the same runway leads to increase safety risk

The key problem at KHIO right now is that the HAI School consumes a huge chunk of operations and frequency. There is a continual loop of fixed-wing HAI students in RH traffic doing T&G and almost as much HAI rotor traffic running on the taxiways. As HAI has grown over the last five years, the rest of us are spending more and more time and energy dodging the school traffic. This is going to get much worse when the recession ends. Frankly, the lack of any serious aircraft to aircraft accident in the pattern is simply amazing, and due to great ATC folks, care/experience on the part of the locals, and no small amount of luck. The recent fatality near KUAO involving an HAI Seminole is a case-in-point of what happens if any of these factors are missing. At some point, we are going to have a fatality in the pattern, and that (in combination with the overfull field and overfull frequencies) is likely to trigger locals and operators other than HAI to leave. Now, having the locals leave because of too much traffic may not affect the statistic much because the locals don't dominate the operations statistics. However, while we locals don't have a lot of operations, we live here and are the ones who influence the communities “sense” on the airport. If we are happy and telling other taxpayers we are happy, everybody wins. If we are grumbling and dissing HAI and talking about moving to another airport because “All the Chinese students in the pattern make it impossible to fly,” I'm not sure anybody wins. While I am very supportive of another runway to put the HAI planes on, it isn't my #1 desire for the airport (it is #2). My #1 desire is to get the tower frequency cleared up, with the first step being to get the helicopters on their own frequency. As I mentioned my #2 desire is to get the other runway built, and get HAI over on that runway. #3 would be to put the other runway on its own frequency as well

Pilots (Continued)

The new parallel would be a safety improvement from my perspective, and would probably increase my likelihood to fly there as a destination for lunch or other services. At present, I don't have a compelling reason to fly to HIO, so I have not been there for several years

The new runway will probably encourage me to use other airports for primary training. I would use HIO and PDX for training in a higher traffic area. Having two (parallel) runways does not cut down on radio work or aeronautical decision making. Second point - as a government entity, I expect that the Port of Portland will abide by the applicable laws regarding notice and comment periods. The rules are not hard to understand, it's simple "admin law." What's surprising is that the Port makes unlawful decisions and it requires a lawsuit to force compliance. Even small decisions, like where the port puts a fence or a gate, are not delegated to the Port's sole discretion although they (you) act as if entitled

The new runway would be advantageous in reducing delays for IFR traffic. Due to the heavy student traffic I am often delayed when departing or arriving

The new runway would make it easier to train in larger rotorcraft both VFR and IFR

The only use I make of KHIO is for an occasional landing to disembark Angel Flight passengers for transport to OHSU hospital. I have always been granted first landing privileges in this capacity

The parallel runway will greatly increase safety and reduce emissions due to more efficient operations on both the ground and in the air

The parallel runway would be considered for additional safety to separate larger planes from smaller planes. It would, also, reduce ground and air delays for takeoff and landings

The Port of Portland has already spent huge amounts of money at PDX on new port offices and a new parking facility that will never get filled. A new runway at HIO isn't needed in this economic environment. You can't justify the growth

The primary factor for increase/decrease in general aviation air traffic is cost in my opinion. The cost of fuel, insurance, and maintenance makes it prohibitive for most, would be pilots. With rental rates in the 100-150 per hour range for small aircraft and much more for larger aircraft there is little chance that flying will increase because of a new runway at HIO

The runway is probably needed due to large queuing times out of the airport because of training and recreational uses of the airport. However these uses could probably be shifted to nearby airports instead of creating a mega-hub at the Hillsboro hub. Perhaps the center of an urban area isn't the best place for a huge training school? The airport is a huge barrier to folks using the land area for active transportation and increases the demand for auto-trips. Enlarging the airport will only increase the barrier and increase auto trips around the airport

The shorter runway would have minimal direct impact on my flight operations with the Columbia because I need the runway length and utilize instrument approaches

There are services at HIO and close to the airport that we would use more often if it was not for the delays in takeoffs and landings. Also very important, both our planes and many of my friends' planes are licensed to burn the lower cost unleaded mogas. We and many that I know would come there much more often if that gas were available at HIO

There needs to be an interface airport for commercial, private, and business traffic

This is a good project. Let's get it done

This is ridiculous with all of the other important things we should be resolving the need for the Port to add a parallel runway at HIO is absurd. Look at EUG where I fly there frequently as an airline pilot ...the additional runway is hardly ever used yet probably costs tens of millions of taxpayer money

Q17. Additional comments: (Continued)

Pilots (Continued)

This opposition to the new runway is illogical. I don't see the construction of the runway doing much to increase traffic. What it will do is take much of the existing small aircraft traffic and move it farther north of the airport, further away from residential areas. It will also reduce delays. This to me would seem to benefit all who live near, or use the airport. I really wish the people who oppose the runway would sit down and have a rational analysis of this matter. I think they then would realize that the new runway in fact will benefit them by reducing the number of aircraft flying over their homes. They should also realize that not building the runway will do little to nothing to slow airport growth. There is major, vibrant economic activity occurring at this airport, and it will continue to grow, regardless of their objections

Though it would not have any direct impact on my usage of HIO, I think the establishment of a runway more or less dedicated to training ops would be a significant safety enhancement by separating training from transient traffic

Transportation is important to all citizens and we must plan for the future

We certainly do not need another runway at HIO

We don't go to HIO often as we fly a variety of old GA aircraft, mostly for pleasure. We might go there more often if we weren't either waiting for jet turbulence to pass or spending more time and fuel in the taxi and holding processes. Or if there was a good restaurant at the field

We use HIO to pick up passengers for corporate travel. It would be beneficial to have training aircraft having the use of a separate runway

HIO, TTD, PDX Contacts

A third runway would not change the number of our operations, but it would reduce traffic delays for both takeoff and landing, resulting in reduced operating costs, but more important would be the safety enhancement brought about by the separation of our operations from slower traffic

Construction of the additional runway will increase safety and efficiency of our operations and reduce noise and aircraft exhaust emissions

Even though it doesn't affect our use, we support the construction of the new runway and taxiway

Increasing the number of operations at HIO is not of great concern. The most important need is safety. Currently we have large aircraft mixed with small which is very dangerous and causes long periods of waiting on takeoff and unsafe number of small aircraft mixed with the larger and faster on landing... Give us a parallel runway to make operations safer

More attention should be given to TTD. TTD seems to be the bastard child of Port of Portland

My company does a large number of operations at the Hillsboro airport and the surrounding airports, but we do not count operations. Instead we count flight hours based from a particular location. Troutdale and Hillsboro airport towers would have more accurate information regarding our operation counts

No airplane

Additional aviation contacts

For Safety, as well as noise and environmental impact reduction and time savings; we believe the addition of another runway is a very important improvement

Organization

HIO, TTD, PDX Contacts
Global Aviation (2)
Avis Car Rental
BHG Hotels in Hillsboro
Boeing
Centers for Airway Science
FAA Hillsboro Control Tower-HIO
Fliteline Condominium Hangar Owners
Gorge Winds Aviation
Hertz Corporation
Hillsboro Aviation
Horizon Airlines
Intel
Storage Management Solutions (SMS)
Tower Park Condo Hangar

Additional aviation contacts
Aero Maintenance
Aurora Aviation
Jerry Trimble Helicopters
Pacific Coast Avionics
Sherpa Aircraft Company
Sportcopter
Willamette Air

Airport
County Squire Airpark
Woodland-State-Airport
Pearson Field

Q3. (If you own/operate an aircraft) What type(s) of aircraft do you, your company, or your organization currently operate? Please indicate all that apply.

172 C	1	Cessna 182Q	1
2003 Cessna Skyhawk C172S	1	Cessna 182R	1
2004 Piper Arrow P28R201	1	Cessna 310	1
737	1	Cessna 310	1
A-330/200	1	Cessna 340	1
A-330/300	1	Cessna 421C	1
Aero Commander 680V	1	Cessna C172	1
Aeronca 7AC	1	Cessna C-188	1
Aeronca Champ	1	Cessna Citation 560	1
Aeronca S11CC floatplane	1	Cessna Citation CJ3	1
AEST-702P	1	Cessna Skycatcher	1
Airbus/330	50	Cessna Skyhawk	1
AS350B3	10	Cessna Skyhawk 172	1
AS350B3 2b1	1	Cessna skyhawk 172 s	1
B737-400,-700,-800,-900	110+ company-wide	Cessna Skyhawk 172F	1
B747-400	1	Cessna Skylane	1
Bbeechcraft F33A Bonanza	1	Cessna T182T	1
BE-1900	1	Cessna T210	1
BE90	2	Cessna T-210	1
BE-99	5	Cessna/182	1
BE9L	2	Cessna/C177RGII	1
Beachcraft Kingair	2	Cessna/Citation CJ3	1
Beech B200	1	Cessnas	10
Beech Bonanza K-35	1	Cirrus	1
Beech C24R - BE24	1	Cirrus SR-20-G2	1
Beech C33	1	Cirrus SR22	1
Beech Debonair	1	CL-65	270
Beech King Air 200	3	Columbia 400	1
Beech King Air 90	2	Commander 690	1
Beechcraft 35	1	Commander 690	1
Beechcraft BE35-C33 Debonair	1	Commander 690	1
Beechcraft Bonanza	1	Commander 690A	1
Beechcraft G36	1	Commander 690A	1
Beechcraft K-35		COMPAIR 6	1
Beechcraft K-35	1	Dash-8 400	48
Beechcraft King Air C90	2	DH-8 Q400	47

Beechcraft N35	1	DHC8-Q400	
Beechcraft S35		Diamond DA-20	1
Bell 205	1	Diamond DA40	1
Bell 206 JetRanger	2	Diamond DA40	1
Bell 206B/L	7	Diamond DA-40	1
Bell 407	2	Diamond DA40/XL	1
Bellanca 8GCBC	1	EC135	25
Bellanca Cruisair 14-13-3	1	EC145	10
Benua / Vans RV-10	1	Ellis Melvin RV9A	1
Benua / Vans RV-3B	1	EMB-120	45
Boeing 737	600	EMB-135	1
Boeing PT-17	1	Embraer 135	
Boeing Stearmann	1	Embraer 135	
Bombadier/Q400	48	Experimental	2
Bombardier / Q400	48	Experimental Krueger KK1	1
Bombardier Challenger 604	1	Experimental RV6A	1
Bombardier Challenger 604	1	Experimental RV8-A	1
Bombardier Challenger 604	1	Experimental Vans/RV-10	1
Bombardier Global Express	1	F-15 C/D	
Bombardier Global Express XRS	1	Fairchild 24W-46	1
Bombardier Global XRS	1	Falcon 2000EXE	1
Bombardier Lear 45	2	G-4	1
Bombardier Q400	48	GA-1159	1
Bombardier Q400	48	Glasair	1
Bucker-Jungmann	1	Glassflugel Libelle 201B	1
C 152	1	Glastar GS1	1
C 172	1	Grob 102	1
C-140	1	Grob 103	1
C150	1	Grumman A50	1
C-150	1	Grumman AA1B	1
C-150	2	Grumman American AA5 Traveler	1
C152	25	Grumman Tiger	1
C152	15	Grumman Tiger	1
C152	10	Grumman Tiger AA-5B	1
C152	22	Grumman Tiger AA-5B	1
C152		Grumman Widgeon	1
C152	1	Homebuilt Sonex	1
C-152	15	Hughes 269	1
C-152	1	Hughes 500	1
C-152	1	IAI Westwind 1124	1
C-152	1	IAR Brasov IS28-B2	1

C-152	1	King Air C-90	2
C-152	12	LAK-12	1
C160	2	Lambada / UFM-13	1
C162	2	Lambada Motorglider	1
C-162	1	Lear 31	3
C172	1	Lear 31A	1
C172	1	Lear 35	3
C172	1	Lear 35A	1
C172	8	Learjet 24	1
C172	8	Learjet 35	1
C-172	3	Learjet 35A	1
C-172	1	Learjet 35A	1
C-172	rental fleet	Learjet 36	1
C-172	2	Learjet 36	1
C-172	1	Learjet 36	1
C-172	2	Learjet 45	2
C-172	4	Learjet 45	2
C-172	11	LET L-23	2
C-172	3	Luscombe 8A	1
C-172	3	Manufacture Gyroplanes	3
C172N	1	Maule 260C	1
C172P	1	MD902	1
C172P	1	Micco SP26	1
c172p	7	Miller Tern (Glider)	1
C172P	5	Mooney	1
C172rg	2	Mooney M-10 Cadet	1
C172RG	1	Mooney M20-F	1
C172s	3	Mooney M20G	1
C172S	2	Mooney M20J	1
C177B	1	Mooney M20T	1
C-180	1	Mooney/M20K	N4087
C182	1	Mooney-M20J	1
C182	1	P28R	1
C182	1	PA 22/20	1
C182		PA-22	1
C-182	1	PA22/20	1
C-182	1	Pa-22-150	
C-182	2	PA-24-250	1
C-182	1	PA-28	
C206		PA28-140	1
C-206	1	PA28-161	1

C310	1	PA28-161	1
C-310	1	PA-28-161	1
C-310B	1	PA-28-161	1
Cessna	1	PA-28180	1
Cessna	152	PA28-181	1
Cessna	1	PA-28-181	1
Cessna 172	1	PA-28-181	1
Cessna 140	1	PA-28R	1
Cessna 150	1	PA28R-200	1
Cessna 150	1	PA-31-350	10
Cessna 150	1	PA32R301	1
Cessna 150	2	PA-32R-301	1
Cessna 150	1	PA44	8
Cessna 150		PA44	1
Cessna 150	1	PA-44	7
Cessna 150	2	PA-44	6
Cessna 150F	1	PA-44-180	4
CESSNA 152	1	Pilatus PC-12	1
Cessna 152	16	Piper	1
Cessna 152	1	Piper 4 place	1
Cessna 152	1	Piper Archer	1
Cessna 152		Piper Archer	1
Cessna 152	23	Piper Archer	1
Cessna 152	1	Piper Arrow	1
Cessna 152	12	Piper Cherokee 180D 1968	1
Cessna 152		Piper Cherokee PA 28A	1
Cessna 152	5	Piper Cherokee PA-28-235	1
Cessna 152	5+	Piper J-3	1
Cessna 152	1	Piper J-3 Cub	1
Cessna 152II	1	Piper J-3 Cub	1
Cessna 162	2	Piper J-3 Cub	1
Cessna 162	1	Piper j5 cub	1
Cessna 170A	1	Piper Malibu Mirage	1
Cessna 172		Piper PA 22/20	1
Cessna 172	1	Piper PA 28-180 Cherokee	1
Cessna 172	1	Piper PA18	
Cessna 172	1	Piper PA-18	1
Cessna 172	1	Piper PA-22	1
Cessna 172	1	Piper PA-22-150	1
Cessna 172	1	Piper PA-24-250	1
Cessna 172	1	Piper PA-25	1

Cessna 172	5	Piper PA-28	1
Cessna 172	1	Piper pa28-161	1
Cessna 172	1	Piper PA-28-201	1
cessna 172	1	Piper PA-32-300	1
Cessna 172	1	Piper pa-44	7
Cessna 172	1	Piper PA-44-180	7
Cessna 172	1	Piper Seminole	5
Cessna 172	5+	Piper Seminole	5
Cessna 172	1	Piper Seminole	8
Cessna 172	1	Piper Turbo Arrow IV	1
Cessna 172	1	Pitts S-2B	
Cessna 172	8	Pitts S-2B	1
Cessna 172	1	PZL Bielsko SZD51-1	1
Cessna 172		R22	1
Cessna 172	2	R-22	1
Cessna 172	1	R44	1
Cessna 172	3	Raytheon Hawker 800	1
Cessna 172	2	Raytheon Hawker 800	1
Cessna 172	1	Raython-Hawker	1
Cessna 172	1	Recip Sherpa	3
Cessna 172	1	Robin Sport	1
Cessna 172	1	Robinson R22	1
Cessna 172	3	Robinson R22	5+
Cessna 172	1	Robinson R-22	1
Cessna 172	1	Robinson R-22	3
Cessna 172	1	Robinson R-22	15
Cessna 172	1	Robinson R-22	18
Cessna 172	1	Robinson R-22	11
Cessna 172	1	Robinson R44	1
Cessna 172	1	Robinson R-44	2
Cessna 172	1	Robinson R-44	1
Cessna 172	1	Robinson R-44	1
Cessna 172 - Model M		Robinson R-44	1
Cessna 172 F	1	Rockwell Commander 112TC/A	1
Cessna 172 rg	1	Rockwell Turbo Commander	6
Cessna 172 Skyhawk	1	RV-12	2
Cessna 172m	1	RV4	1
Cessna 172m	1	RV-7	1
Cessna 172N		RV-7	1
Cessna 172P	6	RV7 Experimental	1
Cessna 172P	1	RV-8	

Cessna 172P	1	RV-8	1
Cessna 172P/S/RG	14	RV-8	1
Cessna 172SP	1	RV-8	1
Cessna 172SP	1	S269c	1
Cessna 174		S-61	1
Cessna 177B	1	Schweizer 1-26	1
Cessna 180		Schweizer 2-33	1
Cessna 180		Schweizer 333	1
Cessna 180	1	Schwietzer 300CB	1
Cessna 180	1	Schwiezer 300cb	1
Cessna 180	1	Sherpa	3
Cessna 180 K	1	Single engine Moonies, piper Cubs, Cessna, Bonanza, Stearma, Cessna Skymaster 337, Comanche 260, lot of helicopters, mostly from Troutdale and Hillsboro	30
cessna 182	1	Single engine propeller	1
Cessna 182	1	SportCubS2	1
Cessna 182	1	Stinson 108-3	1
Cessna 182		Taylorcraft BC-12S	1
Cessna 182	1	Titan Tornado	1
Cessna 182	1	Turbine Sherpa	1
Cessna 182	1	Vans RV-12	1
Cessna 182		Vans RV-12 Experimental	1
Cessna 182		Vans RV-4	1
CESSNA 182	1	Vans RV-4	1
Cessna 182	1	Vans RV6	1
Cessna 182	1	Vans RV6A	1
Cessna 182	1	Vans RV7	1
Cessna 182	1	Vans RV-8	1
Cessna 182	1	Van's RV-8	1
Cessna 182	2	Van's RV-8	1
Cessna 182	2	Vans RV9A	1
Cessna 182/g	1	Van's RV-9A	1
Cessna 182A	1	Vans/RV-6	1
Cessna 182P Skylane	1	Vivat l13 SW	1

The Port of Portland owns and operates Hillsboro Airport (HIO), located in Washington County, Oregon. The Port and FAA are currently conducting an environmental review of proposed improvements at HIO, which would include (if approved) construction of a new 3,600 foot long, 60 foot wide, visual flight rules, parallel runway, primarily for small, single-engine propeller aircraft; associated taxiways; future helipad relocation; and associated infrastructure.

The purpose of this questionnaire is to assist the FAA in evaluating the impact resulting from the HIO expansion project, and whether or not it changes the nature or magnitude of aviation demand at HIO.

Please take about 5 minutes to complete the following survey. If you have any questions, you may contact our independent research partner, Riley Research, by phone: 503-222-4179, or by email: cbolyard@rileyresearch.com.

This survey is designed for a variety of audiences, including pilots and operators. If a question does not apply to you, please leave it blank.

Thank you in advance for your participation.

At which area airport(s) do you currently base your aircraft (includes both fixed wing and helicopters)? Please select all that apply.

- ☐ Aurora State Airport
- ☐ Cedars North Airpark
- ☐ Chehalem Airpark
- ☐ Country Squire Airpark
- ☐ Evergreen Field Airport
- ☐ Fly For Fun Airport
- ☐ Goheen Airport
- ☐ Grove Field Airport
- ☐ Lenhardt Airpark
- ☐ McMinnville Municipal Airport
- ☐ Mulino State Airport
- ☐ Pearson Field Airport
- ☐ Portland International Airport
- ☐ Portland-Hillsboro Airport
- ☐ Portland-Troutdale Airport
- ☐ Sandy River Airport
- ☐ Scappoose Industrial Airpark
- ☐ Skyport Airport
- ☐ Sportsman Airpark
- ☐ Stark's Twin Oaks Airpark
- ☐ Valley View Airport
- ☐ Vernonia Municipal Airport
- ☐ Woodland State Airport
- ☐ Not applicable / Don't own/operate aircraft
- ☐ Other (please specify) ____________

(If you use an airport) What is the zip code of your business or residence? (If applicable)

Business ______

Residence ______

(If you own/operate an aircraft) What type(s) of aircraft do you, your company, or your organization currently operate? Please indicate all that apply.

Aircraft type:

Aircraft make/model: ____________

Number of aircraft: ____________

Aircraft type:

Aircraft make/model:

Number of aircraft:

Aircraft type:

Aircraft make/model:

Number of aircraft:

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Aircraft type:

Aircraft make/model:

Number of aircraft:

Aircraft type:

Aircraft make/model:

Number of aircraft:

All additional aircrafts:

Which best describes your primary use of Hillsboro Airport? Please select the one answer that best applies.

- ◯ I do not utilize Hillsboro Airport
- ◯ Flight Instruction
- ◯ Personal use (pilots flying their own aircraft)
- ◯ Corporate/business (owned/leased aircraft/business travel)
- ◯ Non-aviation office space
- ◯ Other use (please specify)

Approximately how many operations (landings and take-offs) per month do you average at:

Hillsboro Airport

Other airports in the Portland region

What percentage of your total operations are touch- and-go operations at:

Hillsboro Airport

Other airports in the Portland region

Using a scale of 1 to 5 (1 = minimal importance, 5 = maximum importance) please rate the importance of the following to you when selecting an airport at which to base your aircraft. Please select "N/A" if the aspect is not applicable.

	1 - minimal importance	2	3	4	5 - maximum importance	N/A
Convenience (closer to where I live or work)	◯	◯	◯	◯	◯	◯
Aircraft Hangar Facilities	◯	◯	◯	◯	◯	◯
FBO/Executive Terminal Services	◯	◯	◯	◯	◯	◯
Aircraft Storage Costs	◯	◯	◯	◯	◯	◯
Available Runway Length	◯	◯	◯	◯	◯	◯
Navigational Aids	◯	◯	◯	◯	◯	◯
Airport has separate Runway for Smaller Aircraft	◯	◯	◯	◯	◯	◯
Fewer delays	◯	◯	◯	◯	◯	◯

Other aspects of maximum importance (please specify)

The Hillsboro Airport Master Plan (2005) identified the improvements listed above for future construction.

Please rate the importance of these improvements to your operations at HIO on a scale of 1 to 5 (1 = minimal importance, 5 = maximum importance). Please select "N/A" if the aspect is not applicable.

	1 - minimal importance	2	3	4	5 - maximum importance	N/A
Taxiway Improvements	◯	◯	◯	◯	◯	◯
Aircraft Hangars	◯	◯	◯	◯	◯	◯
Airport has separate runway for smaller aircraft	◯	◯	◯	◯	◯	◯
Navigation Aids	◯	◯	◯	◯	◯	◯
Fewer delays	◯	◯	◯	◯	◯	◯

Assuming the new runway was to be built, how likely would you be to consider locating at HIO (if you are not already located there)?

◯ Very likely
◯ Somewhat likely
◯ Somewhat unlikely
◯ Very unlikely
◯ Already located at HIO
◯ Depends

Why is that?

If the answer is "somewhat" or "very" likely, or you are already located there, what would you estimate the number of your operations (take-offs & landings) to be at HIO?

If a new parallel runway is not built at HIO, how likely would it be to result in a REDUCTION of your existing operations?

◯ Very likely
◯ Somewhat likely
◯ Somewhat unlikely
◯ Very unlikely
◯ Depends

If the answer is "somewhat" or "very" likely, what would be the percentage of DECREASE?

If we build the new parallel runway at HIO, how likely would it be to result in an INCREASE in your existing operations (take-offs & landings)?

- ◯ Very likely
- ◯ Somewhat likely
- ◯ Somewhat unlikely
- ◯ Very unlikely
- ◯ Depends

If the answer is "somewhat" or "very" likely, what would be the percentage of INCREASE?

Additional comments:

Thank you for your time and opinions! Please select "Done" to submit your responses.

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Appendix E – Air Quality Technical Memo

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Memorandum

To: *Renee Dowlin, Port of Portland Aviation Division*

From: *John Pehrson, CDM Smith*
Gwen Pelletier, CDM Smith

Date: *January 2, 2013*

Subject: *Aircraft Air Emission Calculations for Parallel Runway Supplemental EA*

Overview

This technical memorandum summarizes the assumptions and methods used for aircraft air emission calculations used for the Parallel Runway Supplemental Environmental Assessment (EA) for Hillsboro Airport (HIO). Emissions inventories were calculated for three different new forecasts: 1) Constrained Forecast (which represents the No Action), 2) Unconstrained Forecast, which represents one With Project forecast, and 3) Remand Forecast. Emissions for each forecast were calculated for 2016 and 2021. Separate Port of Portland documentation discusses how these forecasts differ from one another and the purpose of having alternative forecasts.

Figure 1 illustrates the trend in operational emissions for the three forecasts by horizon year. As shown, the Unconstrained and Constrained Forecasts have identical operations for 2016 and 2021, but Unconstrained Forecast operations are higher than Constrained Forecast operations in future years. Operations for the Remand Forecast are higher than the unconstrained and constrained operations in all future horizon years.

Emission inventories were created to report annual emissions (tons per year) of carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur dioxide (SO_2), inhalable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb). Although not reported in this memorandum, emissions were also created for carbon dioxide and hazardous air pollutants. Emissions were estimated for five aircraft modes (start-up[1], taxi-in/out, takeoff, climbout, and approach), auxiliary power units (APUs), and ground support equipment (GSE).

Table 1 summarizes the annual emissions estimated for each forecast.

1 Aircraft main engine startup occurs at the gate. The aircraft engine startup process begins with fuel flowing into the annular combustor. Some emissions of unburned, raw fuel vapor may occur during this process. As a result, the start-up emissions discussed in this memorandum are only associated with VOC emissions that occur during this process and are estimated directly by EDMS.

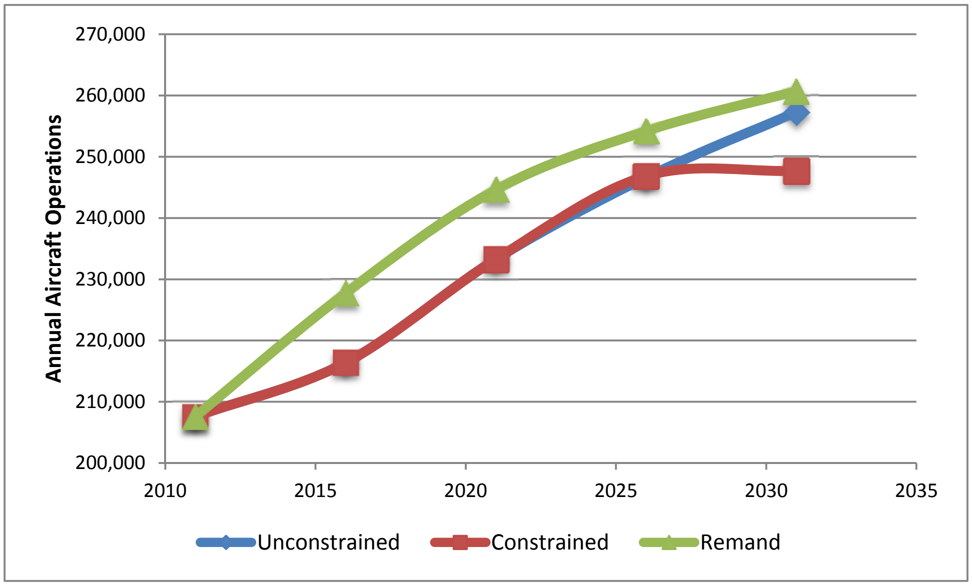

Figure 1
Annual General Aviation Operations by Forecast and Horizon Year

Table 1. Comparative Operational Emissions Inventories

Forecast	Annual Emissions (tons per year)						
	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$	Pb
2016 Constrained	1,208.32	41.59	37.50	6.66	1.18	1.17	0.83
2016 Unconstrained	1,179.20	39.23	36.89	6.41	1.15	1.14	0.81
2016 Remand	1,249.29	42.14	39.27	6.85	1.22	1.21	0.86
2021 Constrained	1,289.45	45.81	39.87	7.48	1.26	1.26	0.90
2021 Unconstrained	1,245.22	42.19	38.90	7.10	1.22	1.22	0.87
2021 Remand	1,316.39	45.11	41.01	7.54	1.29	1.29	0.92

Source: CDM Smith, 2012
Key:
CO= carbon monoxide
PM_{10} = inhalable particulate matter
VOC = volatile organic compound
NOx = nitrogen oxides
$PM_{2.5}$ = fine particulate matter
Pb = lead
SOx = sulfur oxides

Table 2 summarizes the project-related emissions for the various new forecasts, defined as the Constrained emissions subtracted from the Unconstrained or Remand emissions. As shown in the table, emissions for the Unconstrained Forecast would decrease for all pollutants in both horizon years. All pollutants would increase in 2016 for the Remand Forecast; however, VOC emissions would decrease (while other pollutants would increase) in 2021. Figure 2 illustrates the VOC emissions by mode for the Constrained and Remand Forecast emission inventories in 2021. Emissions increase in the Remand

Forecast as compared to the Constrained Forecast for all modes except for taxi-in and taxi-out. This apparent discrepancy occurs because of the reduced taxi/idle time in the Remand Forecast as compared to the Constrained Forecast compounded by the increased aircraft operations (see Methodology for more information). In 2016, while aircraft operations increase, the difference in taxi/idle times between the Unconstrained Forecast and the Remand Forecast is less than that assumed in 2021.

Table 2. Project-Related Emissions

Forecast Comparison	Annual Emissions (tons per year)[1]						
	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$	Pb
2016 Unconstrained – Constrained	(29.12)	(2.36)	(0.62)	(0.25)	(0.03)	(0.03)	(0.02)
2016 Remand – Constrained	40.97	0.55	1.76	0.19	0.04	0.04	0.03
2021 Unconstrained - Constrained	(44.23)	(3.62)	(0.96)	(0.38)	(0.04)	(0.04)	(0.03)
2021 Remand – Constrained	26.94	(0.71)	1.15	0.05	0.03	0.03	0.02

Notes:
[1] Beneficial impacts (emissions reductions) are shown in parentheses.
Key:
CO = carbon monoxide
NOx = nitrogen oxides
Pb = lead
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

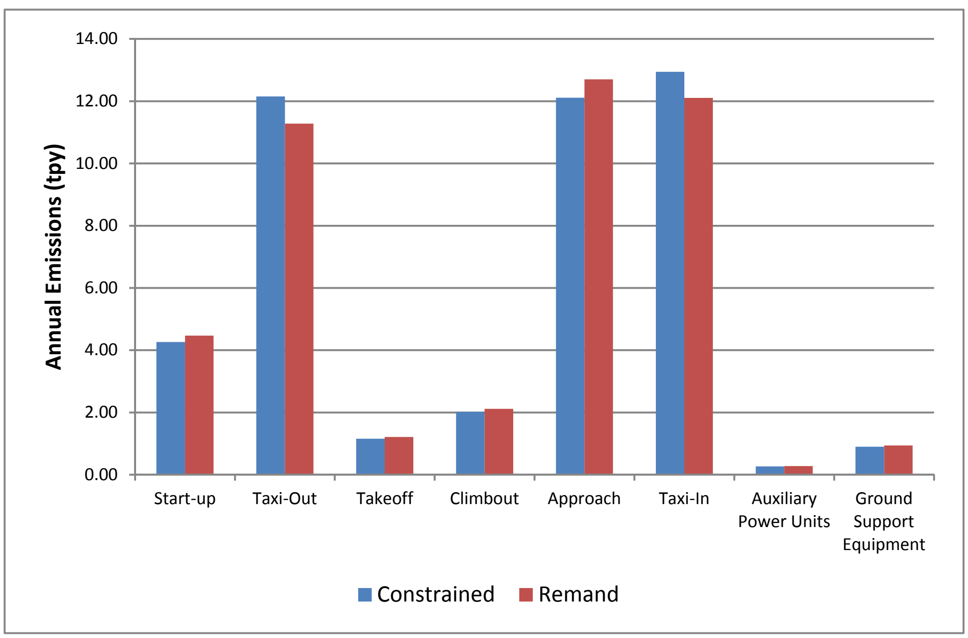

Figure 2
Summary of VOC Emissions by Mode (2021)

Methodology

This section describes the methodology used to complete the emissions inventory for HIO.

Model Inputs

The Federal Aviation Administration's (FAA's) Emissions and Dispersion Modeling System (EDMS), Version 5.1.3, was used to estimate emissions for all pollutants except Pb and for all source categories (i.e., aircraft, APUs, and GSE). EDMS does not directly calculate Pb emissions and so it was necessary to calculate these emissions separately using the Pb content of aviation gasoline (avgas). The aircraft fleet mix and operations for each forecast were derived from the new aviation demand forecasts produced by LeighFisher Management Consultants.

All aircraft operations were entered into EDMS as annual landing/takeoff operations (LTOs) without touch-n-go (TGO) operations. The average taxi/idle time varies for each year and forecast based on the percentage of annual service volume (ASV)[6], in terms of annual operations by fixed-wing and itinerant helicopters, as reported in the Hillsboro Master Plan (2005), that would occur for each forecast. Table 3 summarizes the taxi/idle times used in EDMS.

Table 3. Taxi/Idle Times Used in EDMS

Year	Alternative	Forecast	Total Delay (minutes)[1]
2016	1 (No Action)	Constrained	11.25
2016	2 (With Project	Unconstrained	10.00
2016	3 (Remand With Project)	Remand	10.40
2021	1 (No Action)	Constrained	11.75
2021	2 (With Project)	Unconstrained	10.00
2021	3 (Remand With Project)	Remand	10.40

Source: Port of Portland, and Synergy Consultants for delay based on AC 150/5060
Note:
[1] The taxi/idle time shown represents the total taxi/idle time predicted by EDMS. As a result, the times were split equally between the taxi-in and taxi-out times in mode.

The general aviation aircraft fleet mix identified in the aviation demand forecasts was used to develop the EDMS inputs. A two-pronged approach was used to determine the representative airframe/engine combination to be used in EDMS for each aircraft type identified in the forecast demands. For aircraft originally identified in the Draft HIO Parallel Runway 12L/30R EA (CH2M HILL 2009), the same aircraft/engine combinations were used in this update. If an aircraft was not identified in the Draft EA, then EDMS defaults were used. Several aircraft, such as the Vans RV, are not used by EDMS. For these aircraft, a representative aircraft with a comparable configuration was used to estimate emissions from the specific aircraft.

Table 5, and Table 6 summarize the aircraft fleet mix and annual operations for each forecast and year.

6 The ASV is an estimate of an airport's annual capacity that accounts for differences in runway use, aircraft mix, weather conditions, and other factors that would be encountered in a year.

Table 4. Aircraft Fleet Mix for Unconstrained Forecast

Aircraft Class	Aircraft Type	Representative Aircraft (EDMS 5.1.3)	Representative Engine (EDMS 5.1.3)	Annual Operations 2016	Annual Operations 2021
Single Engine	Cessna 172	Cessna 172 Skyhawk	O-320	28,346	29,810
	Cessna 152	Cessna 150 Series	O-200	19,258	20,160
	Cessna 182	Cessna 182	IO-360-B	5,194	5,400
	Cirrus SR22	Cirrus SR22	TIO-540-J2B2	3,678	3,770
	Cessna 162	Rans S7S	O-200	3,462	3,640
	Cessna 206	Cessna 206	IO-360-B	3,462	3,620
	Diamond DA-40	Piper PA-28 Cherokee Series	0-320SERIES	3,030	3,070
	Other	Cessna 210 Centurion	TIO-540-J2B2	13,632	14,250
Multi-engine	Piper 44	Cessna 310	TIO-540-J2B2	13,416	14,700
	Beech King Air	Raytheon Super King Air 200	PT6A-42	6,276	6,820
	Rockwell Turbo Commander	Rockwell Commander 690	TPE331-10	4,760	5,180
	Other	Cessna 337 Skymaster	IO-360SER	7,356	8,060
Business Jet	Learjet 35	Bombardier Learjet 35	TFE 731-2-2B	6,276	7,020
	IAI Westwind 1124/1125	Israel IAI-1124 Westwind I	TFE731-3-1G	2,596	2,980
	Learjet 31	Bombardier Learjet 31	TFE731-2-3B	2,596	2,840
	Bombardier Challenger 600	Bombardier Challenger 601	CF34-3A LEC II	2,596	2,840
	Gulfstream IV	Gulfstream G400	TAYMK.611-8	2,596	2,840
	Grumman Gulfstream II	Gulfstream II	SPEYMK511-8	2,596	2,840
	Learjet 45	Bombardier Learjet 45	TFE731-20AR	2,380	2,760
	Raytheon Hawker 800	Raytheon Hawker 800	TFE731-5BR	2,380	2,760
	Bombardier Global Express	Bombardier Global Express	BR700-710A2-20	2,380	2,760
	Other	Embraer ERJ135	AE3007A1/3 Type 2	4,976	5,580
Helicopter	Robinson R22	Robinson R22	IO-360-B	26,398	28,440
	Robinson R44	Robinson R44 Raven	TIO-540-J2B2	25,100	27,180
	Schwiezer 269/300/333	Bell 206 JetRanger	250B17B	19,258	20,910
Other	Vans RV	Cirrus SR20	IO-360-B	2,164	2,700
	Other	Raytheon Beech Bonanza 36	TIO-540-J2B2	216	340
			Total	**216,378**	**233,270**

Source: CDM Smith based on LeighFisher forecasts.

Table 5. Aircraft Fleet Mix for Constrained Forecast

Aircraft Class	Aircraft Type	Representative Aircraft (EDMS 5.1.3)	Representative Engine (EDMS 5.1.3)	Annual Operations 2016	Annual Operations 2021
Single Engine	Cessna 172	Cessna 172 Skyhawk	O-320	28,346	29,810
	Cessna 152	Cessna 150 Series	O-200	19,258	20,160
	Cessna 182	Cessna 182	IO-360-B	5,194	5,400
	Cirrus SR22	Cirrus SR22	TIO-540-J2B2	3,678	3,770
	Cessna 162	Rans S7S	O-200	3,462	3,640
	Cessna 206	Cessna 206	IO-360-B	3,462	3,620
	Diamond DA-40	Piper PA-28 Cherokee Series	0-320SERIES	3,030	3,070
	Other	Cessna 210 Centurion	TIO-540-J2B2	13,632	14,250
Multi-engine	Piper 44	Cessna 310	TIO-540-J2B2	13,416	14,700
	Beech King Air	Raytheon Super King Air 200	PT6A-42	6,276	6,820
	Rockwell Turbo Commander	Rockwell Commander 690	TPE331-10	4,760	5,180
	Other	Cessna 337 Skymaster	IO-360SER	7,356	8,060
Business Jet	Learjet 35	Bombardier Learjet 35	TFE 731-2-2B	6,276	7,020
	IAI Westwind 1124/1125	Israel IAI-1124 Westwind I	TFE731-3-1G	2,596	2,980
	Learjet 31	Bombardier Learjet 31	TFE731-2-3B	2,596	2,840
	Bombardier Challenger 600	Bombardier Challenger 601	CF34-3A LEC II	2,596	2,840
	Gulfstream IV	Gulfstream G400	TAYMK.611-8	2,596	2,840
	Grumman Gulfstream II	Gulfstream II	SPEYMK511-8	2,596	2,840
	Learjet 45	Bombardier Learjet 45	TFE731-20AR	2,380	2,760
	Raytheon Hawker 800	Raytheon Hawker 800	TFE731-5BR	2,380	2,760
	Bombardier Global Express	Bombardier Global Express	BR700-710A2-20	2,380	2,760
	Other	Embraer ERJ135	AE3007A1/3 Type 2	4,976	5,580
Helicopter	Robinson R22	Robinson R22	IO-360-B	26,398	28,440
	Robinson R44	Robinson R44 Raven	TIO-540-J2B2	25,100	27,180
	Schwiezer 269/300/333	Bell 206 JetRanger	250B17B	19,258	20,910
Other	Vans RV	Cirrus SR20	IO-360-B	2,164	2,700
	Other	Raytheon Beech Bonanza 36	TIO-540-J2B2	216	340
			Total	**216,378**	**233,270**

Source: CDM Smith based on LeighFisher forecasts.

Table 6. Aircraft Fleet Mix for Remand Forecast

Aircraft Class	Aircraft Type	Representative Aircraft (EDMS 5.1.3)	Representative Engine (EDMS 5.1.3)	Annual Operations 2016	Annual Operations 2021
Single Engine	Cessna 172	Cessna 172 Skyhawk	O-320	29,910	31,260
	Cessna 152	Cessna 150 Series	O-200	20,230	21,140
	Cessna 182	Cessna 182	IO-360-B	5,420	5,660
	Cirrus SR22	Cirrus SR22	TIO-540-J2B2	3,790	3,950
	Cessna 162	Rans S7S	O-200	3,660	3,820
	Cessna 206	Cessna 206	IO-360-B	3,630	3,800
	Diamond DA-40	Piper PA-28 Cherokee Series	0-320SERIES	3,070	3,220
	Other	Cessna 210 Centurion	TIO-540-J2B2	14,300	14,940
Multi-engine	Piper 44	Cessna 310	TIO-540-J2B2	14,160	15,420
	Beech King Air	Raytheon Super King Air 200	PT6A-42	6,570	7,150
	Rockwell Turbo Commander	Rockwell Commander 690	TPE331-10	4,990	5,430
	Other	Cessna 337 Skymaster	IO-360SER	7,770	8,450
Business Jet	Learjet 35	Bombardier Learjet 35	TFE 731-2-2B	6,630	7,360
	IAI Westwind 1124/1125	Israel IAI-1124 Westwind I	TFE731-3-1G	2,820	3,120
	Learjet 31	Bombardier Learjet 31	TFE731-2-3B	2,680	2,980
	Bombardier Challenger 600	Bombardier Challenger 601	CF34-3A LEC II	2,680	2,980
	Gulfstream IV	Gulfstream G400	TAYMK.611-8	2,680	2,980
	Grumman Gulfstream II	Gulfstream II	SPEYMK511-8	2,680	2,980
	Learjet 45	Bombardier Learjet 45	TFE731-20AR	2,600	2,890
	Raytheon Hawker 800	Raytheon Hawker 800	TFE731-5BR	2,600	2,890
	Bombardier Global Express	Bombardier Global Express	BR700-710A2-20	2,600	2,890
	Other	Embraer ERJ135	AE3007A1/3 Type 2	5,270	5,850
Helicopter	Robinson R22	Robinson R22	IO-360-B	27,680	29,820
	Robinson R44	Robinson R44 Raven	TIO-540-J2B2	26,460	28,500
	Schwiezer 269/300/333	Bell 206 JetRanger	250B17B	20,350	21,930
Other	Vans RV	Cirrus SR20	IO-360-B	2,230	2,830
	Other	Raytheon Beech Bonanza 36	TIO-540-J2B2	270	360
			Total	**227,730**	**244,600**

Source: CDM Smith based on LeighFisher forecasts.

No changes were made to the EDMS default assumptions for APUs. Additionally, default assumptions were generally used for the GSE. Helicopters are not assigned default GSE in EDMS. As a result, diesel fuel trucks were added for all helicopters with an operating time of 10 minutes per departure. This assumption is consistent with data provided by the Port on previous projects.

To estimate emissions of Pb, it was necessary to calculate a Pb emissions index (EI). The EI was calculated using the maximum lead content allowed in avgas (0.56 grams per liter) and the average density of avgas (6 pounds per gallon). The EI was estimated at 0.00078 tons of Pb per ton of avgas. Using the fuel consumption calculated by EDMS for all piston engines, the Pb content was then estimated using the EI.

Results

Emissions inventories were created for aircraft, APU, and GSE emissions. As described previously, CO, VOC, NOx, SOx, PM_{10}, and $PM_{2.5}$ emissions are estimated directly by EDMS, while Pb emissions were estimated separately based on avgas consumption in piston aircraft. Table 7, Table 8, and Table 9 summarize emissions for the Constrained, Unconstrained, and Remand forecasts, respectively.

As shown in the tables, aircraft operations drive emissions at HIO for all pollutants. For gaseous pollutants (CO, VOC, NOx, and SOx), aircraft emissions account for 79 to 98 percent of the total airport emissions, depending on the forecast and horizon year. For particulate matter, aircraft emissions account for 54 to 63 percent of total airport emissions with APU emissions representing 25 to 29 percent of total airport emissions.

Table 7. Emissions Inventory –No Action Alternative (Constrained Forecast)

Emission Sources	Annual Emissions (tons per year)						
	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$	Pb
2016							
Aircraft							
Start-up[1]	--	3.80	--	--	--	--	--
Taxi-Out	131.04	10.60	2.77	1.11	0.11	0.11	0.09
Takeoff	99.53	1.08	12.56	1.17	0.20	0.20	0.08
Climbout	177.97	1.89	8.19	1.00	0.16	0.16	0.14
Approach	600.13	11.19	5.29	1.70	0.11	0.11	0.41
Taxi-In	152.68	11.32	3.18	1.21	0.12	0.12	0.11
Aircraft Subtotal	**1,161.35**	**39.89**	**31.98**	**6.18**	**0.71**	**0.71**	**0.83**
APUs	5.69	0.24	1.49	0.30	0.31	0.31	--
GSE	41.29	1.46	4.03	0.17	0.16	0.15	--
Grand Total	**1,208.32**	**41.59**	**37.50**	**6.66**	**1.18**	**1.17**	**0.83**
2021							
Aircraft							
Start-up[1]	--	4.26	--	--	--	--	--
Taxi-Out	148.48	12.15	3.23	1.28	0.13	0.13	0.11
Takeoff	106.44	1.16	14.13	1.31	0.22	0.22	0.08
Climbout	190.08	2.02	9.13	1.10	0.18	0.18	0.15
Approach	641.90	12.11	5.90	1.87	0.12	0.12	0.44
Taxi-In	171.89	12.94	3.68	1.40	0.14	0.14	0.12
Aircraft Subtotal	**1,258.79**	**44.64**	**36.08**	**6.96**	**0.80**	**0.80**	**0.90**
APUs	6.32	0.27	1.67	0.34	0.35	0.35	--
GSE	24.33	0.90	2.12	0.18	0.11	0.11	--
Grand Total	**1,289.45**	**45.81**	**39.87**	**7.48**	**1.26**	**1.26**	**0.90**

Source: CDM Smith, 2012

Note:

[1] Aircraft main engine startup occurs at the gate. The aircraft engine startup process begins with fuel flowing into the annular combustor. Some emissions of unburned, raw fuel vapor may occur during this process. As a result, the start-up emissions discussed in this memorandum are only associated with VOC emissions that occur during this process and are estimated directly by EDMS.

Key:

-- = zero emissions
GSE = ground support equipment
PM_{10} = inhalable particulate matter
VOC = volatile organic compound
APUs = auxiliary power units
NOx = nitrogen oxides
$PM_{2.5}$ = fine particulate matter
CO = carbon monoxide
Pb = lead
SOx = sulfur oxides

Table 8. Emissions Inventory –With Project Alternative (Unconstrained Forecast)

Emission Sources	Annual Emissions (tons per year)						
	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$	Pb
2016							
Aircraft							
Start-up[1]	--	3.80	--	--	--	--	--
Taxi-Out	116.48	9.42	2.46	0.99	0.10	0.10	0.08
Takeoff	99.53	1.08	12.56	1.17	0.20	0.20	0.08
Climbout	177.97	1.89	8.19	1.00	0.16	0.16	0.14
Approach	600.13	11.19	5.29	1.70	0.11	0.11	0.41
Taxi-In	138.12	10.15	2.87	1.09	0.11	0.11	0.10
Aircraft Subtotal	**1,132.23**	**37.54**	**31.36**	**5.94**	**0.68**	**0.68**	**0.81**
APUs	5.69	0.24	1.49	0.30	0.31	0.31	--
GSE	41.29	1.46	4.03	0.17	0.16	0.15	--
Grand Total	**1,179.20**	**39.23**	**36.89**	**6.41**	**1.15**	**1.14**	**0.81**
2021							
Aircraft							
Start-up[1]	--	4.26	--	--	--	--	--
Taxi-Out	126.36	10.34	2.75	1.09	0.11	0.11	0.09
Takeoff	106.44	1.16	14.13	1.31	0.22	0.22	0.08
Climbout	190.08	2.02	9.13	1.10	0.18	0.18	0.15
Approach	641.90	12.11	5.90	1.87	0.12	0.12	0.44
Taxi-In	149.78	11.13	3.20	1.21	0.12	0.12	0.11
Aircraft Subtotal	**1,214.57**	**41.02**	**35.12**	**6.58**	**0.76**	**0.76**	**0.87**
APUs	6.32	0.27	1.67	0.34	0.35	0.35	--
GSE	24.33	0.90	2.12	0.18	0.11	0.11	--
Grand Total	**1,245.22**	**42.19**	**38.90**	**7.10**	**1.22**	**1.22**	**0.87**

Source: CDM Smith, 2012

Note:

[1] Aircraft main engine startup occurs at the gate. The aircraft engine startup process begins with fuel flowing into the annular combustor. Some emissions of unburned, raw fuel vapor may occur during this process. As a result, the start-up emissions discussed in this memorandum are only associated with VOC emissions that occur during this process and are estimated directly by EDMS.

Key:

-- = zero emissions
APUs = auxiliary power units
CO = carbon monoxide
GSE = ground support equipment
NOx = nitrogen oxides
Pb = lead
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Table 9. Emissions Inventory –Remand With Project Alternative (Remand Forecast)

	Annual Emissions (tons per year)						
Emission Sources	**CO**	**VOC**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
2016							
Aircraft							
Start-up[1]	--	4.02	--	--	--	--	--
Taxi-Out	127.57	10.33	2.70	1.08	0.11	0.11	0.09
Takeoff	104.57	1.14	13.35	1.24	0.21	0.21	0.08
Climbout	186.85	1.99	8.64	1.05	0.17	0.17	0.14
Approach	630.34	11.78	5.61	1.79	0.12	0.12	0.43
Taxi-In	150.37	11.09	3.13	1.19	0.12	0.12	0.11
Aircraft Subtotal	**1,199.70**	**40.35**	**33.44**	**6.35**	**0.72**	**0.72**	**0.86**
APUs	5.97	0.25	1.58	0.32	0.33	0.33	--
GSE	43.62	1.54	4.25	0.18	0.16	0.15	--
Grand Total	**1,249.29**	**42.14**	**39.27**	**6.85**	**1.22**	**1.21**	**0.86**
2021							
Aircraft							
Start-up[1]	--	4.47	--	--	--	--	--
Taxi-Out	137.80	11.28	3.00	1.19	0.12	0.12	0.10
Takeoff	111.62	1.21	14.81	1.37	0.23	0.23	0.09
Climbout	199.33	2.12	9.58	1.16	0.19	0.19	0.15
Approach	673.13	12.70	6.19	1.96	0.13	0.13	0.46
Taxi-In	162.36	12.11	3.47	1.31	0.13	0.13	0.11
Aircraft Subtotal	**1,284.25**	**43.88**	**37.04**	**6.99**	**0.80**	**0.80**	**0.92**
APUs	6.63	0.28	1.75	0.36	0.37	0.37	--
GSE	25.51	0.94	2.22	0.19	0.12	0.11	--
Grand Total	**1,316.39**	**45.11**	**41.01**	**7.54**	**1.29**	**1.29**	**0.92**

Source: CDM Smith, 2012
Note:
[1] Aircraft main engine startup occurs at the gate. The aircraft engine startup process begins with fuel flowing into the annular combustor. Some emissions of unburned, raw fuel vapor may occur during this process. As a result, the start-up emissions discussed in this memorandum are only associated with VOC emissions that occur during this process and are estimated directly by EDMS.

Key:
-- = zero emissions
GSE = ground support equipment
PM_{10} = inhalable particulate matter
VOC = volatile organic compound
APUs = auxiliary power units
NOx = nitrogen oxides
$PM_{2.5}$ = fine particulate matter
CO = carbon monoxide
Pb = lead
SOx = sulfur oxides

cc: Mary Vigilante, Synergy Consultants

Hillsboro Aircraft Using 100LL Fuel

Aircraft Class	Aircraft Type	Representative Aircraft (EDMS 5.1.3)	Representative Engine (EDMS 5.1.3)	Constrained/Unconstrained 2016	2016	Remand Forecast 2016	2021
Single Engine	*Cessna 172*	*Cessna 172 Skyhawk*	*O-320*	28,346	29,910	31,260	29,810
	Cessna 152	*Cessna 150 Series*	*O-200*	19,258	20,230	21,140	20,160
	Cessna 182	*Cessna 182*	*IO-360-B*	5,194	5,420	5,660	5,400
	Cirrus SR22	*Cirrus SR22*	*TIO-540-J2B2*	3,678	3,790	3,950	3,770
	Cessna 162	*Rans S7S*	*O-200*	3,462	3,660	3,820	3,640
	Cessna 206	*Cessna 206*	*IO-360-B*	3,462	3,630	3,800	3,620
	Diamond DA-40	*Piper PA-28 Cherokee Series*	*0-320SERIES*	3,030	3,070	3,220	3,070
	Other	*Cessna 210 Centurion*	*TIO-540-J2B2*	13,632	14,300	14,940	14,250
Multi-engine	*Piper 44*	*Cessna 310*	*TIO-540-J2B2*	13,416	14,160	15,420	14,700
	Beech King Air	Raytheon Super King Air 200	PT6A-42	6,276	6,570	7,150	6,820
	Rockwell Turbo Commander	*Rockwell Commander 690*	*TPE331-10*	4,760	4,990	5,430	5,180
	Other	*Cessna 337 Skymaster*	*IO-360SER*	7,356	7,770	8,450	8,060
Business Jet	Learjet 35	Bombardier Learjet 35	TFE 731-2-2B	6,276	6,630	7,360	7,020
	IAI Westwind 1124/1125	Israel IAI-1124 Westwind I	TFE731-3-1G	2,596	2,820	3,120	2,980
	Learjet 31	Bombardier Learjet 31	TFE731-2-3B	2,596	2,680	2,980	2,840
	Bombardier Challenger 600	Bombardier Challenger 601	CF34-3A LEC II	2,596	2,680	2,980	2,840
	Gulfstream IV	Gulfstream G400	TAYMK.611-8	2,596	2,680	2,980	2,840
	Grumman Gulfstream II	Gulfstream II	SPEYMK511-8	2,596	2,680	2,980	2,840
	Learjet 45	Bombardier Learjet 45	TFE731-20AR	2,380	2,600	2,890	2,760
	Raytheon Hawker 800	Raytheon Hawker 800	TFE731-5BR	2,380	2,600	2,890	2,760
	Bombardier Global Express	Bombardier Global Express	BR700-710A2-20	2,380	2,600	2,890	2,760
	Other	Embraer ERJ135	AE3007A1/3 Type 2	4,976	5,270	5,850	5,580
Helicopter	*Robinson R22*	*Robinson R22*	*IO-360-B*	26,398	27,680	29,820	28,440
	Robinson R44	*Robinson R44 Raven*	*TIO-540-J2B2*	25,100	26,460	28,500	27,180
	Schwiezer 269/300/333	Bell 206 JetRanger	250B17B	19,258	20,350	21,930	20,910
Other	*Vans RV*	*Cirrus SR20*	*IO-360-B*	2,164	2,230	2,830	2,700
	Other	*Raytheon Beech Bonanza 36*	*TIO-540-J2B2*	216	270	360	340
			Total	**216,378**	**227,730**	**244,600**	**233,270**

Note: Aircraft *highlighted* represent aircraft that use 100LL fuel. All other aircraft use JetA.

Source: CDM, 1-2-2013 memo

Appendix F – Port of Portland

Hillsboro Airport Lead Study

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Port of Portland

Hillsboro Airport Lead Study

September 1, 2010

Final Report

Appendix F

Contents

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Executive Summary

The Oregon Department of Environmental Quality (ODEQ) recently completed an analysis of lead emissions from airports located in the state. Dispersion modeling was then completed using the CALPUFF model, a non-steady-state dispersion model that simulates the effects of long distance pollutant transport. The results indicated that a high concentration of lead that could exceed the National Ambient Air Quality Standard (NAAQS) was located over Hillsboro Airport (HIO). As a result, the Port of Portland requested that a parallel study be completed to evaluate lead emissions and dispersion using the Federal Aviation Administration's (FAA's) required model, the Emission & Dispersion Modeling System (EDMS). While EDMS generates emission sources based on the airport layout, EDMS uses the AERMOD modeling system, a steady-state plume model, to complete the dispersion analysis.

An emissions inventory for lead was completed for existing conditions (2007) using aircraft operation information from the Draft Hillsboro Airport Parallel Runway 12L/30R Environmental Assessment. EDMS estimated lead emissions to be approximately 0.632 tons per year for piston aircraft; all turbine aircraft were excluded from the study[1]. Further review of the data indicated that approximately five percent of the airport's emissions are from ground-level sources associated with taxiing and idling at the airport. It would therefore be overly conservative to consolidate all of an airport's emissions into a ground-level source because emissions would disperse differently at a higher release height.

EDMS typically generates several hundred emission sources for a given airport. ODEQ requested that these sources be simplified into no more than ten sources, which could then be imported into the CALPUFF model. Several dispersion analyses were completed to accomplish the following goals:

1. Complete dispersion modeling using EDMS-generated sources directly to serve as a comparison for the simplified AERMOD dispersion.
2. Complete modeling using the simplified sources for eventual use in CALPUFF.
3. Complete sensitivity analyses to evaluate how modifying the sources affects the modeling.
    a. Evaluate the effects of lowering the release heights of the emission sources.
    b. Evaluate the effects of merging all of the emission sources into a ground-level source, equal to the area of the taxiways and runways.

It should be noted that AERMOD version 09292 was used to complete the modeling for all of the emission dispersion scenarios (full EDMS sources, simplified sources, and sensitivity runs). The simplified modeling indicates that the average modeled

[1] The emissions inventory completed by ODEQ estimated lead emissions to be 0.715 tons per year in 2005.

concentration was approximately 17 percent less than the EDMS-source model, whereas the maximum concentration was approximately four percent less than EDMS sources. The maximum concentration from the ODEQ's CALPUFF modeling, however, was found to be approximately 60 times greater than the peak concentration from the EDMS modeling. The results indicate that the original CALPUFF modeling is overly conservative and that the lead emissions from HIO should not exceed the NAAQS level of 0.15 μg/m³, based on a three-month rolling average.

The results of the modeling are provided in Table ES-1.

Table ES-1
Results of AERMOD Air Dispersion Modeling

Scenario	Concentration (μg/m³)	Difference (Compared to EDMS) (μg/m³)	Percentage Difference
Maximum Concentration			
EDMS	0.00405	n/a	n/a
Simplified AERMOD Run	0.00389	-0.00016	-4%
Sensitivity Analyses			
Adjusted Release Height	0.00766	0.00361	89%
Ground-Based Sources	0.06567	0.61620	1,521%
Average Concentrations			
EDMS	0.00082	n/a	n/a
Simplified AERMOD Run	0.00068	-0.00014	-17%
Sensitivity Analyses			
Adjusted Release Height	0.00104	0.00022	26%
Ground-Based Sources	0.01007	0.00925	1,127%

Key:
μg/m³ = micrograms per cubic meter
AERMOD = AMS/EPA Regulatory Model
AMS = American Meteorological Society
EDMS = Emission & Dispersion Modeling System
EPA = Environmental Protection Agency

Section 1
Overview

The ODEQ recently completed an inventory of lead emissions from airports located in the state. Air dispersion modeling was then completed using the CALPUFF modeling system to evaluate if there were any localized concentrations of lead in the state. The dispersion modeling completed by ODEQ suggested that a high concentration of lead could be centered near HIO. Figure 1-1 shows the results of the modeling completed by ODEQ. Although the maximum concentration determined by ODEQ is not explicitly provided, based on the results of the figure, it appears as though the peak concentration of lead near HIO is approximately 0.25 $\mu g/m^3$.

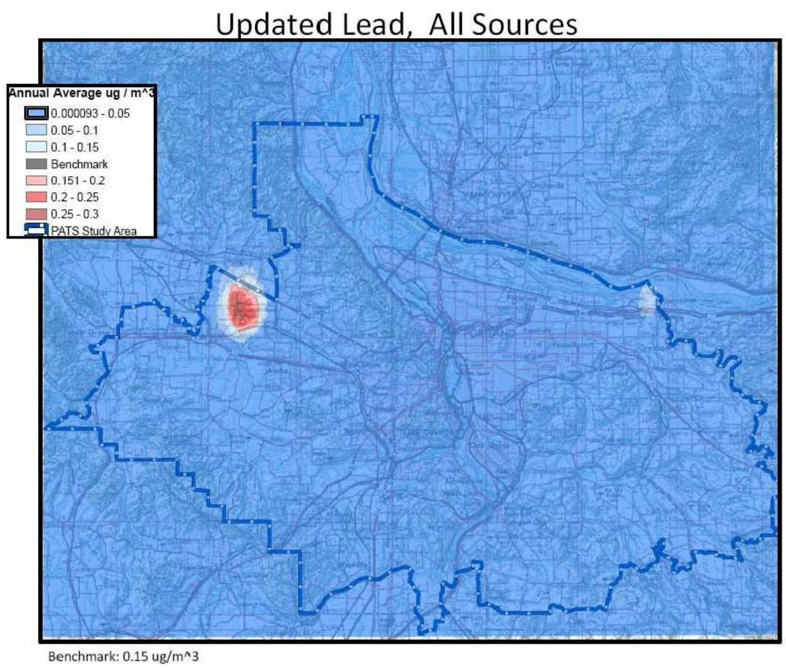


Figure 1-1
Results of ODEQ Modeling (provided by ODEQ)

An updated emissions inventory and refined dispersion modeling was completed using the FAA's EDMS to compare to the ODEQ CALPUFF results. EDMS creates a series of sources from the airport layout information provided in the model. The model then uses the Environmental Protection Agency's (EPA's) preferred refined dispersion model, AERMOD, to complete air dispersion modeling using the generated source information. Since EDMS will typically create several hundred or thousand emission sources for an airport, the emission sources were simplified so that the model would contain no more than ten emission sources. The results of the simplified model were then compared to the full EDMS model to verify the results.

Section 2
Methodology

This section describes the methodology used to complete the lead emissions inventory for the airport and to complete the air dispersion modeling.

2.1 Model Selection

The FAA's EDMS was used to estimate emissions of lead from general aviation aircraft operations at HIO. EDMS is a multi-component software that is capable of completing both an emissions inventory and air dispersion modeling for an airport. If dispersion modeling is enabled in the software, then system aircraft times in mode are performance based while sequence modeling is used to determine the taxi time in the model. In other words, EDMS dynamically determines emissions from the various modes of operation[2] by modeling the aircraft movements, rather than relying on default times-in-mode

EDMS generates a series of point, volume, and area sources suitable for use in AERMOD based on the airport layout specified in the study. For example, airport movements on the taxiways and runways are represented as a series of area sources. EDMS uses the EPA's AERMOD modeling system to complete the air dispersion element of the study. AERMOD is the EPA's recommended refined air dispersion model in 40 CFR 51, Appendix W. EDMS is also the FAA's required model for air quality analyses for aviation sources and was therefore selected for use in this study.

2.2 User-Created Aircraft

By default, EDMS creates emission inventories of criteria pollutants, including carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM_{10} and $PM_{2.5}$). To estimate emissions of lead (Pb) directly in EDMS, it was necessary to define user-created aircraft that specified a lead emissions index (EI).

The lead EI was calculated using the maximum lead content allowed in aviation gas (avgas) (0.56 grams per liter) and the average density of avgas (6 pounds per gallon). The lead EI was then calculated as approximately 0.78 grams of lead per kilogram of avgas (lead content divided by density).

The consolidated aircraft fleet mix for 2007 existing operations contained in Appendix C to the Draft Hillsboro Airport Parallel Runway 12L/30R Environmental Assessment ("Draft EA") was used as a starting point for the creation of user-specific aircraft. Each combination of representative aircraft and engine types was used to define the user-created aircraft; all turbine aircraft (turboprop, turbojet, and helicopter turbine) were

[2] EDMS includes emissions from six modes of operation: 1) start-up, 2), taxi-out, 3) takeoff, 4) climb-out, 5) approach, and 6) taxi-in.

excluded from further analysis. Table 2-1 identifies the user-created aircraft and associated landing/takeoff operations (LTOs) and touch-and-go operations (TGOs).

Table 2-1
Fleet Mix for Hillsboro Airport (HIO) Lead Study

Representative Aircraft	***Representative Engine***	***EDMS User-Created Aircraft Name***	***TGOs***	***LTOs***	***Total***
Cessna 150 Series	O-200	HIO-FP-o 235	5,474	4,259	9,733
Cessna 172 Skyhawk	O-320	HIO-FP-o 320	18,042	14,037	32,079
Cessna 182	IO-360B	HIO-FP-o 360	2,770	2,156	4,926
Cessna 210 Centurion	TIO-540-J2B2	HIO-FP-tio 540	3,759	3,117	6,873
Raytheon Beech Bonanza 36	TIO-540-J2B2	HIO-VP-io 360	2,912	3,348	6,260
Cessna 337 Skymaster	IO-360B	HIO-MEP-o 360	293	1,557	1,850
Cessna 310	TIO-540-J2B2	HIO-MEP-tio 540	238	1,263	1,501
Robinson R22	IO-360-B	HIO-HP-o 360	35,145	10,177	45,322
Robinson R44 Raven	TIO-540-J2B2	HIO-HP-io 540	1,849	536	2,385
Total			**70,479**	**40,450**	**110,929**

The aircraft were created by defining the fuel flow rates and flight profiles as being equivalent to the representative aircraft/engine combinations. The emission indices for the specific engine were zeroed out with the exception of PM, which was changed to be equal to the calculated lead EI. Figure 2-1 shows a typical data entry screen for the user-created aircraft used in the study.

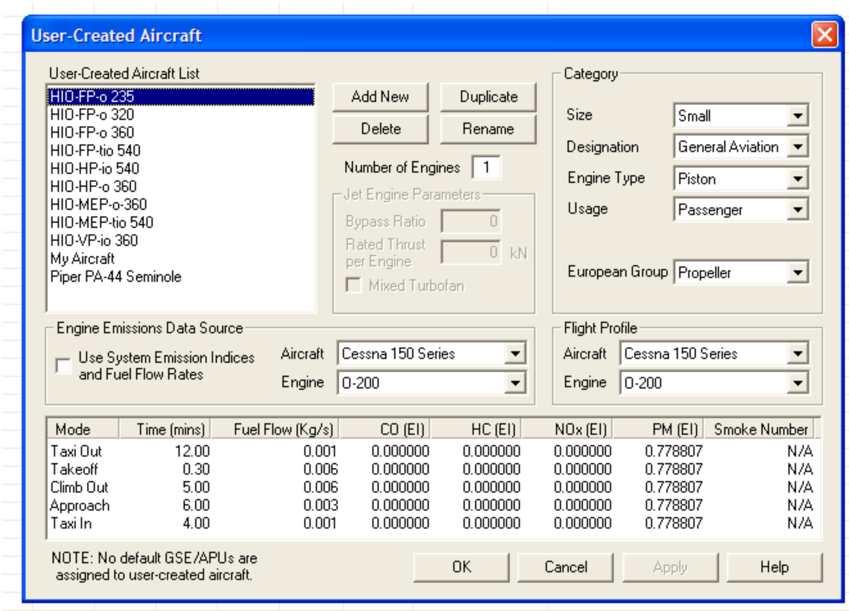


Figure 2-1
Screenshot of Example User-Created Aircraft Data Entry

2.3 Airport Layout and Configuration

A simplified airport layout, adapted from Figure 1-1 of the Draft EA, was developed for EDMS. The airport layout was simplified to only include the Main Apron;

Runway 12/30; Taxiways A, A1, and A8; and Charlie Helipad. The cross-runway 2/20 was not included in the analysis because of its limited use. The runway use percentages were derived from Table 1AA of the HIO Master Plan and were adjusted to reflect runway use assuming that only Runway 12/30 was operational. The runway usage by aircraft type was then averaged for input into the runway assignments section of EDMS. Table 2-2 summarizes the runway use percentages used in the modeling.

Table 2-2
Runway Use Percentages

Aircraft	***Runway Usage***	
	12	***30***
Itinerant Operations		
SEPF (Fixed Propeller)	7.29%	92.71%
SEPV (Variable Pitch Propeller)	7.29%	92.71%
MEP (Multi-Engine Piston)	18.95%	81.05%
Average	*11.18%*	*88.82%*
Local Operations		
SEPF (Fixed Propeller)	2.13%	97.87%
SEPV (Variable Pitch Propeller)	2.13%	97.87%
MEP (Multi-Engine Piston)	40.00%	60.00%
Average	*14.75%*	*85.25%*

EDMS requires the runway configuration to be identified for each size of aircraft (small, large, and heavy). In order to account for the proper runway configuration by aircraft type, it was necessary to complete two individual model runs for aircraft sources and for helicopters. Not doing so would result in an underestimation of emissions from the aircraft. For helicopter emissions on Charlie Helipad, all takeoffs were assumed to occur at the southeastern portion of the landing strip.

2.4 Receptors

Two main types of receptors were used in the modeling: plant boundary receptors and uniform polar grid receptors. A Cartesian plant boundary was placed along the property boundary of HIO. Intermediate receptors were then placed every 100 meters along the property boundary. A uniform polar grid was centered over the airport emission sources and extended approximately 2,000 meters from the airport boundary. Direction radials were spaced in increments of 10 degrees around the airport, while each spoke on the polar grid had 100-meter spacing. All receptors located on the airport property were removed from modeling. Figure 2-2 identifies the receptors that were used in the modeling.

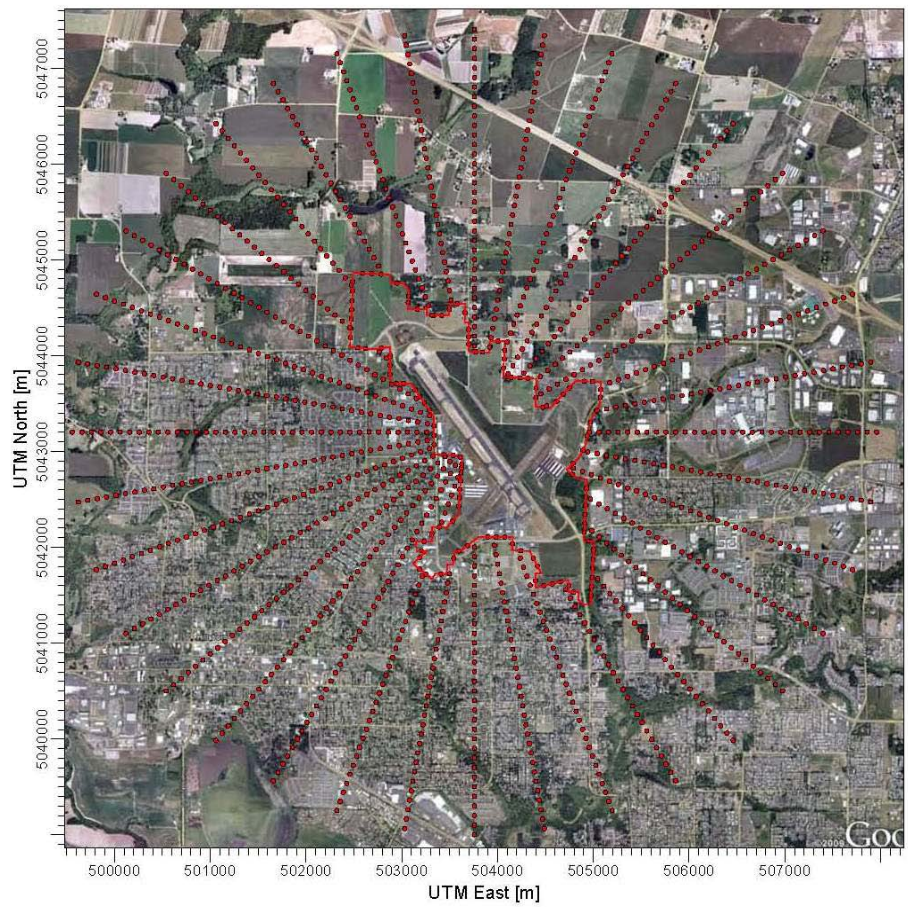


Figure 2-2
Uniform Polar Grid and Cartesian Plant Boundary Receptors Used in Modeling

A review of the 7.5-minute series Hillsboro Quadrangle from the United States Geological Survey (USGS) indicates that the area surrounding the airport is relatively flat. Although there are hills to the northeast of the airport, they are not within the modeled flight path and receptors for the airport and would not affect the modeling. The terrain was therefore modeled as flat and elevation data was not imported into the model.

2.5 Meteorological Data

Representative meteorological data is required to complete the necessary air dispersion modeling. Portland International Airport (ID No. 24229) was determined to be the closest representative surface weather station to HIO and was selected for use in the model. Salem McNary Field (ID No. 24232) was identified as the closest upper air weather station to HIO. Data was downloaded from the WebMET website (http://www.webmet.com), a source of free meteorological data. The most recent year of data available, 1990, was used in the analysis.

2.6 Emission Sources

EDMS models aircraft activity that occurs during six modes of operation. The following modes in an LTO cycle are identified as follows:

- Approach – Airborne segment of an aircraft's arrival extending from the start of the flight profile to touchdown on the runway.
- Taxi-in – The landing roll segment of an arriving aircraft and the taxiing from the runway exit to a gate.
- Startup – Aircraft main engine startup at the gate. Since this mode is only applicable to International Civil Aviation Organization (ICAO) engines, emissions at the gate were not modeled because piston engines are not ICAO certified.
- Taxi-out – Taxiing from the gate to a runway end.
- Takeoff – Segment that extends from the start of the ground roll on the runway through the airborne portion of the ascent during which the aircraft operates at maximum thrust.
- Climb Out – Segment from engine cutback at maximum thrust to the end of the flight profile or mixing height (whichever is lower)

2.6.1 EDMS Sources

EDMS generated over 1,100 sources to represent aircraft activity at the airport. In addition, it creates an hourly emission rate (HRE) that specifies emissions for every source and hour of the day. For the HIO modeling, the HRE file contained over 10 million lines of data and was approximately 500 megabytes.

EDMS creates a series of area sources to represent aircraft emissions. Ground-based emission sources, such as taxiing, have a release height of 12 meters, which is the approximate height of an engine. Airborne sources, such as approach and takeoff operations, are shown as a series of elevated area sources that rise from approximately 22 meters to 619 meters, or the maximum height of the flight profile.

2.6.2 Simplified Sources

To evaluate how to consolidate the EDMS-generated sources to a simplified AERMOD dispersion run, the distance of each source from the runway end was plotted against its height above ground. Release heights of 100 meters, 300 meters, and 500 meters were selected to represent the airborne emissions associated with the airport. The plots of the arrival and departure sources indicated that the airborne sources generally overlap at the same distance from the runway end at these elevations. As a result, the arrival and departure operations were consolidated into a single area source for each release height. The length of each area source was taken as the distance from the runway end for all of the EDMS sources at each of the release heights. The width of the emission source was taken as the distance between Runway 12/30 and Charlie Helipad.

A total of seven source groups were consequentially created to represent the aircraft: three elevated sources from Runway 12, three elevated sources from Runway 30, and one ground-level source to represent aircraft movements on the runway and taxiways. To further simplify the model, aircraft and helicopter emissions were also merged into each of the sources; Charlie Helipad was not explicitly included in the model as a source. Table 2-3 summarizes the AERMOD input sources that were used in the modeling. Figure 2-3 shows a two-dimensional plan view of the AERMOD area sources, whereas Figure 2-4 shows the height above ground-level by the distance from the end of Runway 12 for each of the elevated sources included in the model.

2.6.3 Emission Rates

A goal of the simplified modeling was also to avoid the large HRE file that is created by EDMS; rather, an average annual emission rate was used for each of the sources. Emissions from each source type in the HRE file were converted to emissions of tons per year using a Microsoft Access Query. Emissions were found to be slightly less than the emissions inventory developed directly by EDMS; therefore, emissions for the sources were adjusted to equal the EDMS emission inventory. Emissions were then divided by the total area of all of the sources, as determined by EDMS, to create an average emission rate for entry into the models. The aircraft were assumed to be operating continuously at 8,760 hours to per year to develop an average annual emission rate. The emission rates for each main source category are provided in Table 2-4.

Table 2-3 AERMOD Input Sources									
Source ID	***X Coord. (m)[1]***	***Y Coord. (m)[1]***	***Base Elevation (m)***	***Release Height (m)***	***Emission Rate g/(s-m²)***	***X-Side Length (m)***	***Y-Side Length (m)***	***Angle from North (deg)***	***Initial Vertical Dimension***
NW100	503976.19	5042879.84	62	100	2.93E-09	240	2,000	-36	4.1
NW300	503173.96	5043984.92	62	300	2.93E-09	240	4,400	-36	4.1
NW500	502438.44	5044982.70	62	500	2.93E-09	240	7,000	-36	4.1
SE100	504685.22	5041914.16	62	100	2.38E-09	240	2,000	-36	4.1
SE300	506938.65	5038833.70	62	300	2.38E-09	240	4,600	-36	4.1
SE500	509180.78	5035762.25	62	500	2.38E-09	240	7,000	-36	4.1
TAXIQ	504359.18	5042387.29	62	12	4.15E-09	2,000	120	-126	4.1

Notes:
1. Coordinates shown in Universal Transverse Mercator (UTM) coordinate system, North American Datum 1983 (NAD83).

Key:
g/(s-m^2) = grams per second per square meter
m = meters
NW100 = Takeoff (RW 30) and approach (RW 12) – 100 meters
NW300 = Takeoff (RW 30) and approach (RW 12) – 300 meters
NW500 = Takeoff (RW 30) and approach (RW 12) – 500 meters
SE100 = Takeoff (RW 12) and approach (RW 30) – 100 meters
SE300 = Takeoff (RW 12) and approach (RW 30) – 300 meters
SE500 = Takeoff (RW 12) and approach (RW 30) – 500 meters
TAXIQ = Taxi/idle

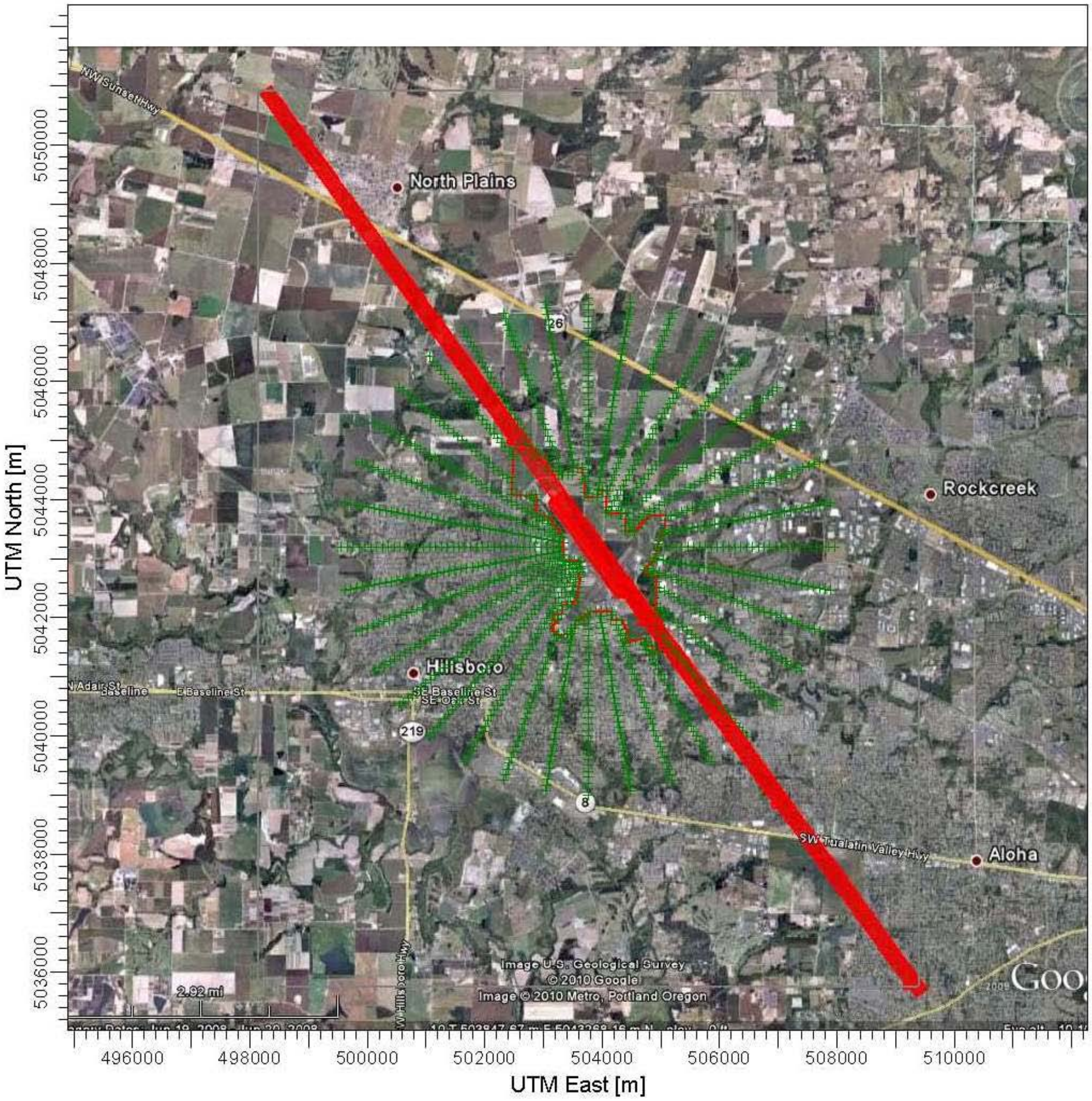


Figure 2-3
Plan View of Simplified Area Sources Used in AERMOD Air Dispersion Modeling

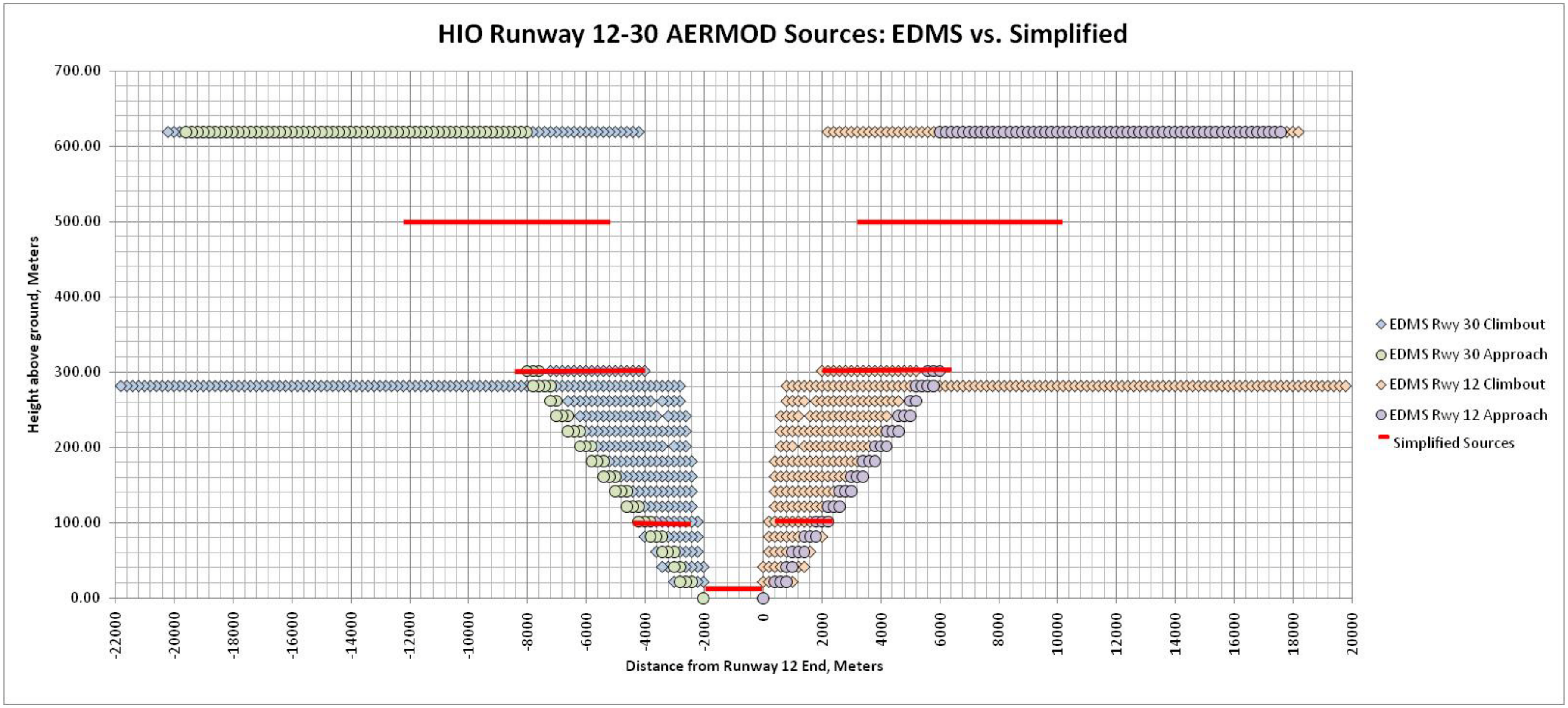


Figure 2-4
Elevation View of Simplified Sources Relative to EDMS Sources Used in AERMOD Air Dispersion Modeling

Table 2-4
Modeled Source Groups and Emission Rates

EDMS Source Group	***Type [a]***	***Emissions (tpy)***	***Consolidated Group***	***Consolidated Emissions (tpy)***	***(g/sec)***	***Area (m^2)***	***Emission Rate (g/(s-m^2))***
Airborne Landing – 12	Aircraft	0.032	Takeoff 30/Approach 12	0.328	9.42E-03	3,216,000	2.93E-09
Airborne Landing – 30L	Helicopter	0.046					
Airborne Takeoff – 30	Aircraft	0.250					
Airborne Landing – 30	Aircraft	0.229	Takeoff 12/Approach 30	0.270	7.75E-03	3,264,000	2.38E-09
Airborne Takeoff – 12	Aircraft	0.040					
Runway Landing – 12	Aircraft	0.005	Taxiways	0.035	9.97E-04	240,000	4.15E-09
Runway Landing – 12R	Helicopter	<0.001					
Runway Takeoff – 12	Aircraft	0.009					
TAXIQ	Both	0.020					
Total [b]		**0.632**		**0.632**	**1.82E-02**	**6,720,000**	**2.70E-09**

Notes:
[a] "Type" specifies the type of aircraft that is included in the source group (i.e., helicopters and aircraft represented by two different EDMS models).
[b] Total emission rate identified for "Model Emission Rate (g/(s-m^2))" is the weighted average of the other modeled emission rates, rather than an additive total.

Key:
EDMS = Emissions and Dispersion Modeling System
g/(s-m^2) = grams per second per square meter
g/sec = grams per second
m^2 = square meters
TAXIQ = taxi/idle sources
tpy = tons per year

Section 3
Emission Inventory Results

An emissions inventory was completed for lead emissions from aviation gas-fueled aircraft (piston engines) at HIO. The user-created aircraft described in Section 2 were entered into EDMS for the number of LTOs and TGOs identified in the Draft EA for existing conditions. Table 3-1 summarizes the lead emissions and fuel consumption that was estimated by EDMS for piston aircraft operations at HIO.

Table 3-1
Summary of Emissions and Fuel Consumption

Mode	***Lead Emissions***		***Fuel Consumption***	
	(kg/yr)	***(tpy)***	***(kg/yr)***	***(tpy)***
Taxi-Out	3.177	0.004	4,079	4
Takeoff	56.969	0.063	73,149	81
Climb out	212.921	0.235	273,393	301
Approach	278.400	0.307	357,470	394
Taxi-In	21.648	0.024	27,796	31
Total	**573.114**	**0.632**	**735,887**	**811**

Key:
kg/yr = kilograms per year
tpy = short tons per year

To verify the lead emissions inventory that was generated by the model, the fuel consumption estimated by EDMS was multiplied by the lead EI that was entered into the model (0.78 grams lead per kilogram fuel). Annual emissions of lead were estimated to be 0.632 tons per year, which is equal to the lead emissions estimated by EDMS. The method used to estimate lead emissions and dispersion in EDMS was therefore confirmed and no further edits to the model were necessary.

3.1 Source Analysis

As is shown in Table 3-1, total emissions from ground-level sources (e.g., taxi-out and taxi-out) are approximately 0.028 tons per year (tpy). Ground-level source therefore represent less than five percent of the total emissions associated with the airport, as calculated by EDMS. Since the ground-based source represents a small percentage of total emissions at the airport, modeling all of the airports emissions at this level would be overly conservative because emissions would be focused on the ground. By concentrating the emissions at the ground, the ground-level concentrations would be higher than if the emissions were to be dispersed at the higher elevations from the airborne sources.

Section 4
Dispersion Results

The following section describes the results of the air dispersion modeling that was completed for HIO. Results from the full EDMS modeling and the simplified approach are both presented.

4.1 EDMS Dispersion Results

Air dispersion modeling was initially completed using the EDMS-generated sources and HRE files. Due to complications with runway assignments, it was necessary to create two files to model aircraft and helicopter emission sources separately. Modeling was completed using the Lakes Environmental graphical user interface (GUI) to AERMOD. Although sources can be modeled in EDMS directly, EDMS uses a local coordinate system. The files were modeled by Lakes in order to shift the sources to a NAD83 UTM coordinate system. The latest version of AERMOD, Version 09292, was used to complete the modeling.

The ground-level concentrations of lead from aircraft and helicopter emissions were added externally for each receptor. The maximum concentration of lead from aircraft was 0.00396 micrograms per cubic meter ($\mu g/m^3$), while the maximum concentration from helicopters was 0.00022 $\mu g/m^3$; however, these concentrations occurred at different receptors. The maximum combined concentration was 0.00405 $\mu g/m^3$, while the average combined concentration from all receptors was 0.00082 $\mu g/m^3$. Figure 4-1 shows the results of the dispersion modeling.

4.2 Simplified AERMOD Dispersion Results

Air dispersion modeling was also completed using the seven simplified area sources described in Section 2 and the average annual emission rates. Since aircraft and helicopter sources and emissions were combined for this study, only one model was created for the simplified approach. The maximum ground-level concentration of lead was estimated at 0.000389 $\mu g/m^3$ from this simplified approach. This value is approximately 0.0002 $\mu g/m^3$ less than the combined results of the EDMS modeling. The ground-level concentration is approximately four percent less than the EDMS modeling. The average lead concentration was 0.00068 $\mu g/m^3$, which is 17 percent less than the EDMS modeling. Figure 4-2 shows the results of the simplified AERMOD dispersion modeling.

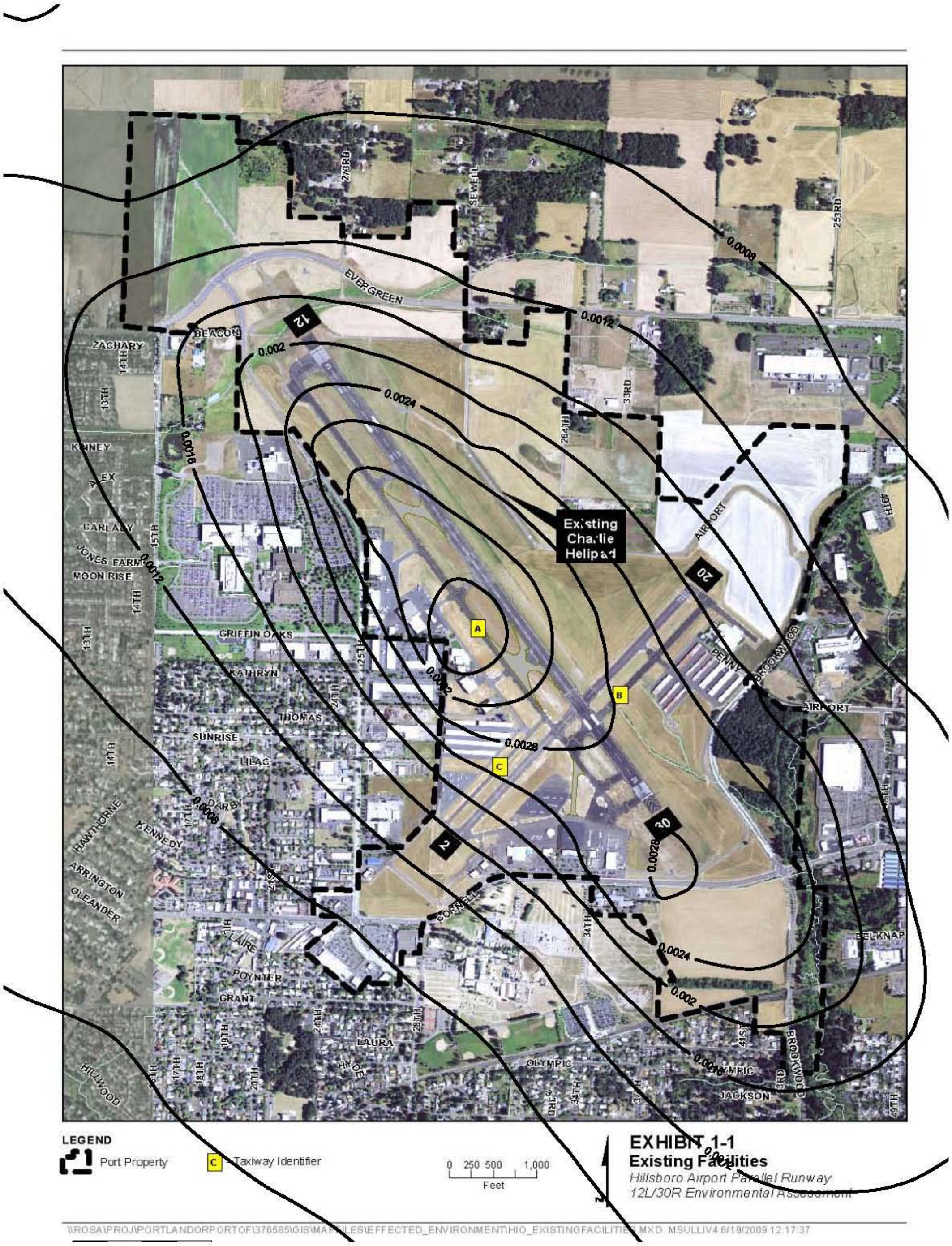


Figure 4-1
Lead Concentrations from Combined (Aircraft + Helicopter) EDMS Modeling

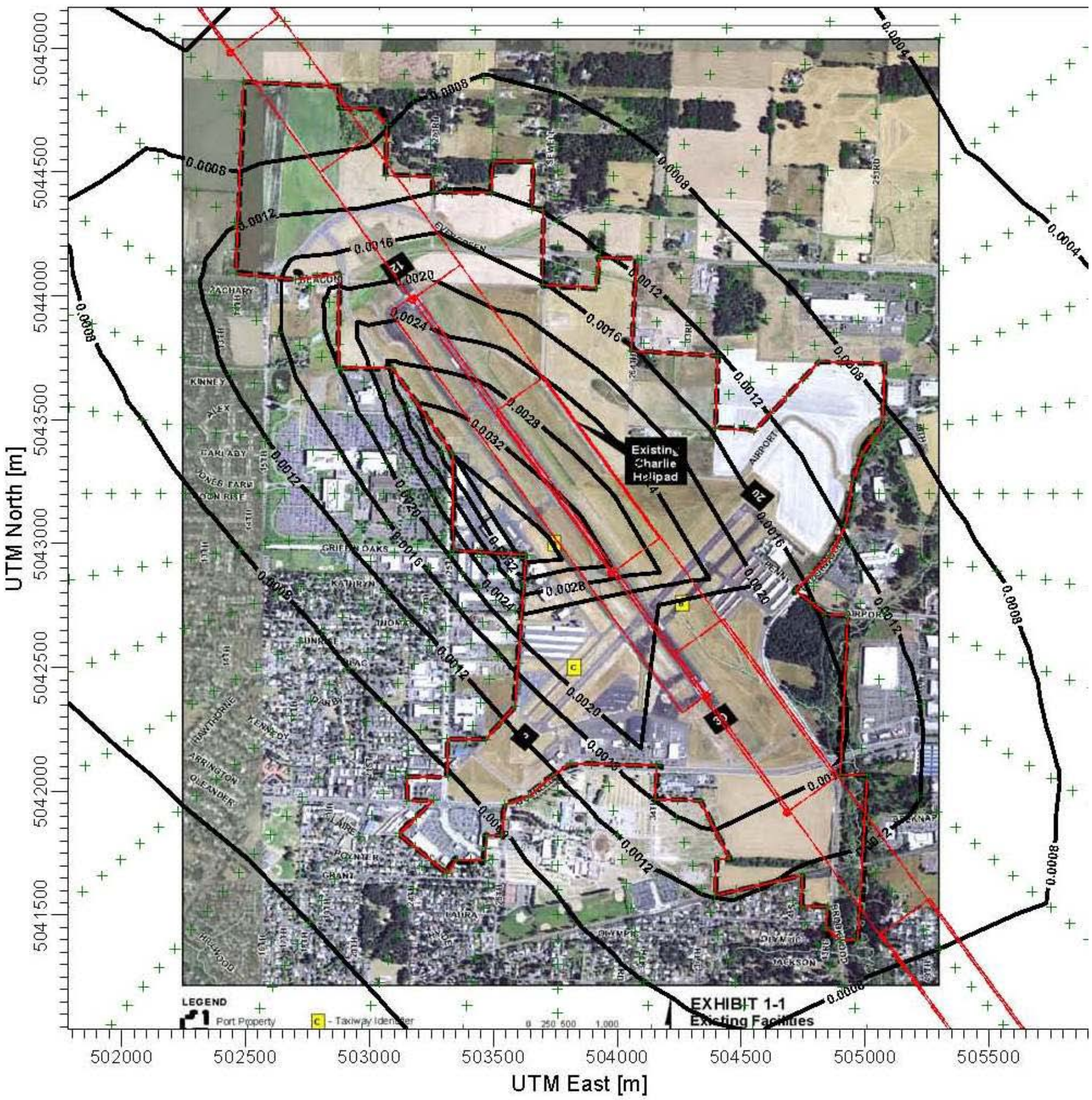


Figure 4-2
Lead Concentrations from Simplified AERMOD Modeling

4.3 Sensitivity Analysis

A sensitivity analysis was completed to evaluate how lead concentrations would be affected by different source scenarios.

4.3.1 Modified Source Release Height

An initial sensitivity analysis was completed by decreasing the height of the airborne release heights by 50 meters from the original simplified model. This resulted in airborne release heights of 50, 250, and 450 meters. The default release height for ground-level aircraft is 12 meters, which most closely represents the engine height of large jet aircraft. Since the only sources included in the modeling are small piston aircraft, the release height was estimated to be approximately half of the default height (6 meters).

The maximum ground-level concentration was estimated at 0.00766 $\mu g/m^3$, while the average concentration was estimated at 0.00104 $\mu g/m^3$. These values were found to be 89 percent and 26 percent higher, respectively, than the EDMS concentrations. Figure 4-3 shows the isopleths created with this model scenario.

4.3.2 Ground-Level Sources

A second sensitivity analysis was completed to evaluate the effect of concentrating all of the emissions associated with the airport (i.e., airborne and ground-level emissions) into the ground-based source for taxiing. This represents a scenario where all of the emissions that occur beyond the airfield are not simply dropped down to the ground-level; rather, as shown in Figure 4-4, the emissions from all of the sources are modeled in the source representing the runways and taxiways. Consistent with the defaults in EDMS, a release height of 12 meters was used for this source. The maximum ground-level concentration was estimated at 0.06567 $\mu g/m^3$, while the average concentration was estimated at 0.01007 $\mu g/m^3$. These values were found to be over 1,500 percent and over 1,100 percent higher, respectively, than the EDMS concentrations. Figure 4-4 shows the isopleths created with this model scenario.

4.4 Source Group Analysis

Source groups were used in the modeling to determining the contribution of an emission source to the overall concentration. The results of the simplified modeling indicate that on average airborne sources contribute 23 percent of the modeled concentration, whereas ground sources contribute the remaining 77 percent. The sensitivity analysis with the reduced release heights indicated that airborne sources represent 32 percent of the modeled concentration, whereas ground sources reflect 68 percent. The distribution of all source groups for the maximum concentration from the AERMOD models is provided in Figure 4-5.

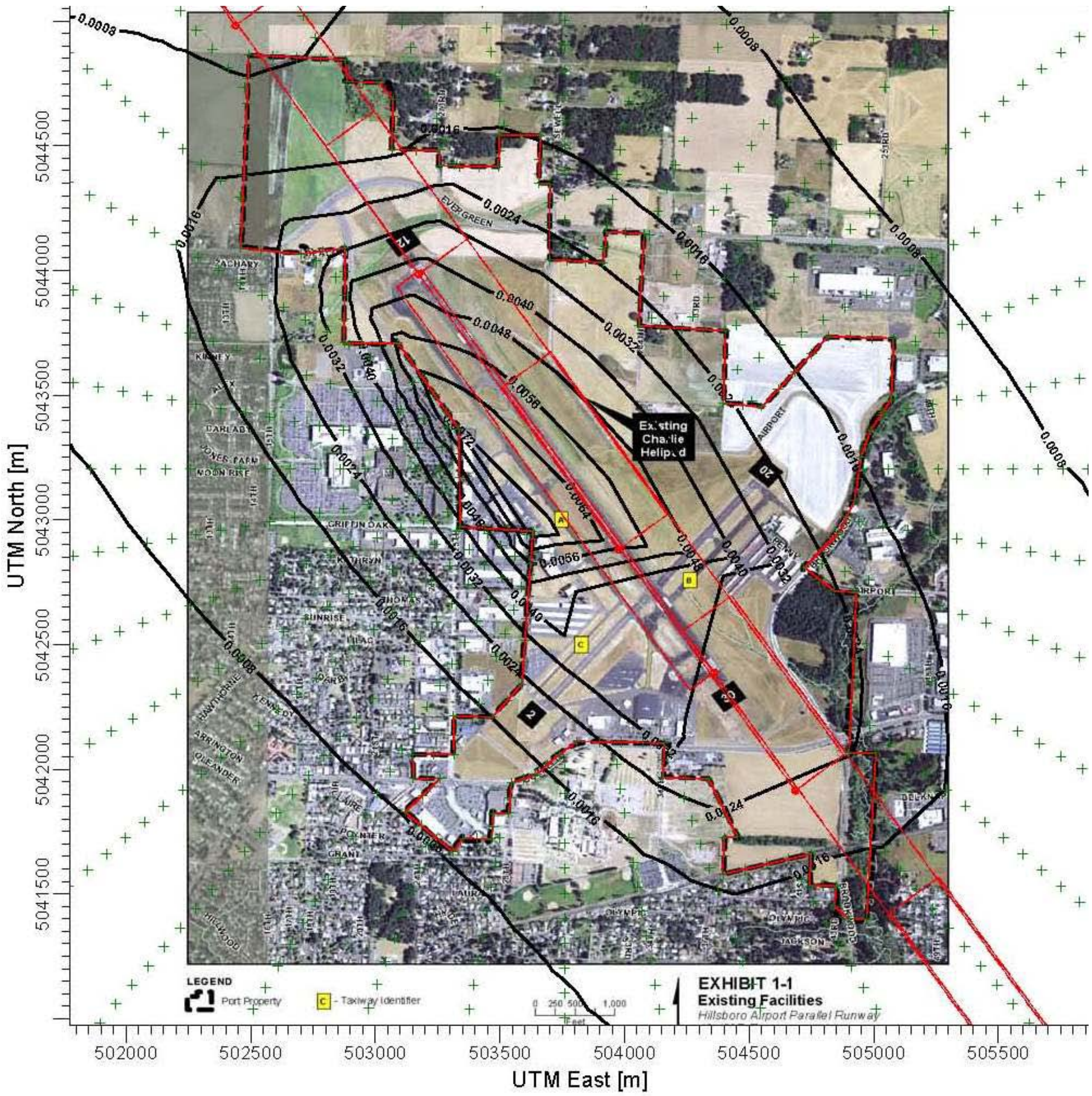


Figure 4-3
Sensitivity Analysis: Release Height Reduced by 50 Meters for Airborne Sources and Ground-Based Source Release Height Reduced to 6 Meters

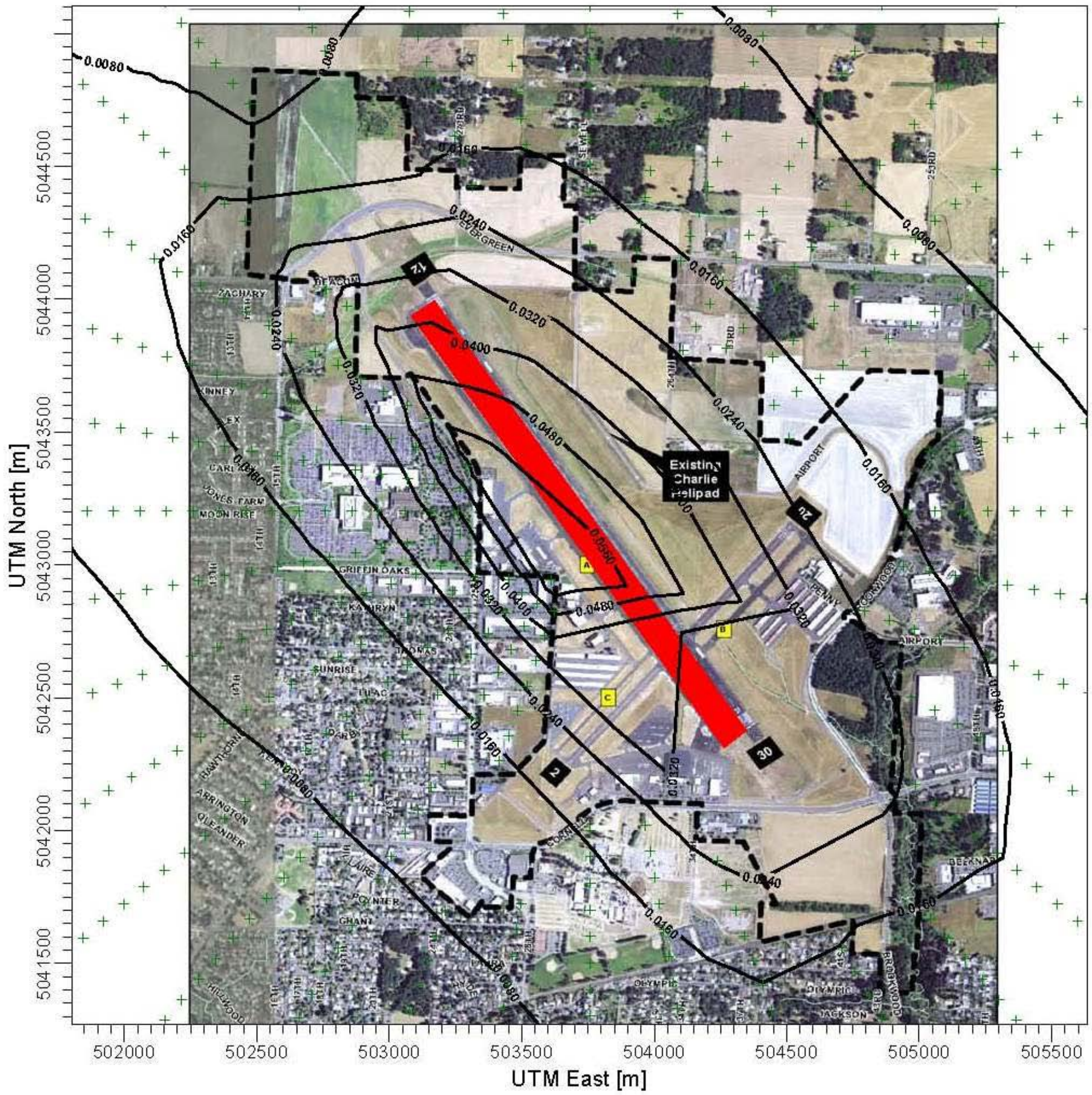
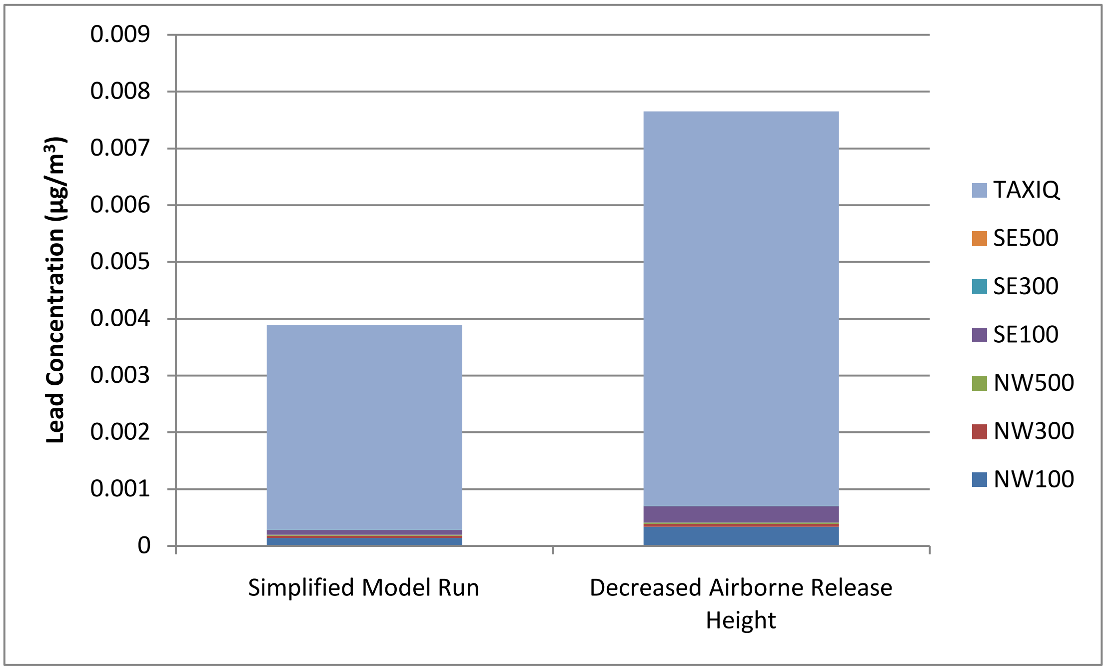


Figure 4-4
Sensitivity Analysis: Emission Rates for All Sources Consolidated into Ground-Level Source Group



Key:
TAXIQ = taxi/idle source group
SE500 = Takeoff (RW12) and Approach (RW 30) – 500/450 meter release height
SE300 = Takeoff (RW12) and Approach (RW 30) – 300/250 meter release height
SE100 = Takeoff (RW12) and Approach (RW 30) – 100/50 meter release height
NW500 = Takeoff (RW30) and Approach (RW 12) – 500/450 meter release height
NW300 = Takeoff (RW30) and Approach (RW 12) – 300/250 meter release height
NW100 = Takeoff (RW30) and Approach (RW 12) – 100/50 meter release height

Figure 4-5
Contribution of each Source Group to Overall Emissions (Based on Maximum Lead Concentration Determined from Modeling)