Aron Faegre Airport Planning & Design 13200 Fielding Road Lake Oswego Oregon 97034 aron@faegre.org

# Aurora State Airport (UAO)
# Proposed Modification of
# Runway Object Free Area (ROFA) Design Standards

Prepared by: Aron Faegre, AIA, PE
Aron Faegre Airport Planning & Design

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This memorandum provides an analysis and methodology by which a Modifications of FAA Airport Design Standards (MOS) at the Aurora State Airport (UAO), for the Runway Object Free Area (ROFA) can be justified as:

> "… resulting in an acceptable level of safety, useful life, lower costs, greater efficiency, or the need to accommodate an unusual local condition on a specific project through approval on a case-by-case basis." - FAA Order 5300.1G, page 1.

as defined and permitted under FAA Order 5300.1G Modifications to Agency Airport Design, Construction, and Equipment Standards[1].

## 1. BACKGROUND

The Aurora State Airport is surrounded by farm lands, near Aurora, Oregon, at the northern end of Marion County. It primarily serves aviation businesses involved with:

- emergency medical transport[2],
- aviation heavy-lift helicopter fire-fighting and power line construction companies (for which fixed wing aircraft are essential for support),[3]
- business jets for numerous major national corporations based within 10 miles,
- aircraft manufacturing for the S-LSA (Special Light-Sport Aircraft) and kit-build

[1] FAA Order 5300.1G Appendix A specifically gives FAA Office of Airport (ARP) and Region the authority to issue a MOS for Runway Object Free Areas. The Order can be downloaded at: https://www.faa.gov/documentLibrary/media/Order/order-5300-1G-modifications-to-standards.pdf .

[2] Regional headquarters for Life Flight Network, with bases all over Oregon, Washington, Idaho, Montana, and Nevada.

[3] Columbia Helicopters, Helicopter Transport Services, Wilson Construction, companies that work internationally with headquarters at Aurora Airport. The use of the Aurora Airport runway is essential to these companies for rapid providing of crews, equipment, and repairs to helicopters in active service of fighting fires, moving power lines, or doing rescue, relief, or humanitarian work.

industry[4], and

- other general aviation aircraft using the airfield for business, pilot training, and recreational flying.

There is no scheduled air service using the airport. The State of Oregon Department of Aviation (ODAV) owns, governs, and manages the public lands of the airport. Most of the business aircraft based at the airport access the runway via through-the-fence permits with ODAV.

Flights by based business jets, such as a Challenger 300, dictate that the Airport Reference Code is C-II. Due to the geometry of the existing site, the airport does not meet current FAA design standards for the ROFA, due primarily to adjacent Highway 551 to the west of the runway.

Most recently ODAV's planned solution[5] to meeting these standards ("Refined Preliminary Alternatives Summary", by Century West Engineering, dated July 31, 2024) is one of only two options:

- relocate the highway further west, (which involves acquiring both private residential and commercial properties further west), or
- relocate the runway, taxiway, and control tower east (which involves acquiring many acres of existing private property already developed with hangars, taxilanes, and aprons for aviation uses) and demolishing numerous large 40,000 square foot aviation hangars along the taxiway.

Both options have very high financial and environmental costs (probably in the greater than $100 million range), which would make them difficult to ever be implemented. If this master plan is approved as currently planned, and one of these options were not implemented, then ODAV and FAA have reported that the airport would only receive maintenance funding and no additional safety improvement funds. This would result in the airport not keeping pace with the aviation industry standards of safety. The second option (moving the runway, control tower, and demolishing hangars), If implemented, would in addition force closure of many of the major medical transport and fire-fighting facilities on the airport, and would put many of the airport's 1,500 employees out of jobs.

It is noted that in the 2012 Airport Layout Plan (ALP), approved (signed) by both ODAV and FAA, the airport also had the same Runway Design Code (RDC) status of C-II and

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[4] Van's Aircraft www.vansaircraft.com the international leader in S-LSA produced aircraft.

[5] Refined Preliminary Alternatives Summary document dated July 31, 2024 by Century West Engineer can be downloaded at: https://publicproject.net/files/UAOAMP/uao-refined-preliminary-alternatives-summary-1-.pdf?d952c4adef .

listed a MOS as the solution to the non-standard ROFA limitation on the west property line. At that time there was consensus between ODAV and FAA that a MOS was a reasonable solution.

This memorandum provides the evidence to show that the 2012 ALP was a good approach to resolution of the ROFA, and that it can reasonably be continued. This report demonstrates that there is an acceptable level of safety through modifying the ROFA standard for the specific deviation to standards located on the west side of the runway.

FAA standards for different airports ROFA's vary from 250 foot width, to an 800 foot width, depending on aircraft type using the airport. As will be shown below, the primary reason justifying the modification is that the going from B-II to C-II category is just where the 500-foot required ROFA width changes to an 800-foot wide required ROFA - yet this is the same width required for all RDC category aircraft all the way to E-VI -Portland International Airport, San Francisco Airport, and every other international airport in the country. UAO will never have the larger size of aircraft those airports accommodate – Boeing 737's to Boeing 777's – so a slight reduction in width on the west side provides a level of safety appropriate for UAO, which will always serve only much smaller aircraft.

Modifications of standards for ROFA's are common at even large national airports. For example, recently several MOS were adopted at San Jose International Airport for deficiencies in the ROFA, as well as for runway-taxiway separations, and for runway object free areas[6]. It even appears that Portland International Airport (PDX) may have their airport perimeter fence, the shoulder of NE Marine Drive, and improper grading within the 400-feet area from runway centerline, at the northeast corner of the ROFA for Runway 10L.

This memorandum provides the detailed technical background and mathematically calculated justification, needed for the FAA and ODAV to again approve a MOS for the ROFA at Aurora State Airport.

## 2. MOS PROCESS

The process for gaining a modification of standards is provided in FAA AC 150/5300-13B Airport Design[7] in Section 2.8. It states, and we provide commentary after each paragraph as to acceptability:

[6] Norman Y. Mineta San Jose International Airport Runway Incursion Mitigation/Airfield Design Standards Analysis, November 27, 2017. Justification for ROFA modifications in this document were often simply the practical and cost issues of modifying major adjacent highways, similar to what is at issue in a much smaller Aurora Airport.
[7] FAA AC 150/5300-13B Airport Design Available free on line at: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC-150-5300-13B-Airport-Design-Chg1.pdf

2.8 ***Modification of Standards.***

*Site-specific conditions may make it impractical to meet all FAA design standards at an airport. The FAA considers, on a case-by-case basis, modifications to design standards that result in an acceptable level of safety and efficiency. Specific operational controls may be necessary to establish an acceptable level of safety for operation of aircraft at the airport. FAA Order 5300.1 establishes FAA policy for administering airport requests for modification of standards. See paragraphs 2.4 and 2.5.*

This memorandum provides this information and finds that no specific operational controls are necessary, see comments on paragraph 2.4 below.

2.8.1 *The FAA views an approved modification of standards as an interim measure intended to mitigate unique site-specific conditions. Unless the FAA explicitly states otherwise in the approval action, the FAA expects airports with approved modifications to pursue ways to meet design standards. This may occur incrementally over time or at such time it becomes practical to correct the non-standard condition.*

The FAA and ODAV can work with Oregon Department of Transportation on master planning future revisions to State Highway 551 so that it can be corrected “at such time it becomes practical.” Also, there are potential options where ODAV and ODOT could jointly agree to relocate the airport perimeter fence closer to Highway 551, which could be an “incrementally” established improvement.

2.8.2 *The FAA will not consider any request to modify design standards associated with the following:*

- *RSA dimensions*
- *OFZ dimensions*
- *Approach or departure surface dimensions*
- *Standards established within a regulation (e.g., stopway, clearway).*

The ROFA is not one of these.

2.8.3 *An airport seeking FAA approval of modification to a design standard submits a request using the Modification of Standards application tool within the Airport Data and Information Portal (ADIP) at https://adip.faa.gov. The FAA relies on the following information, in part, to determine the acceptability of a modification to FAA design standards:*

- *Information on the standard proposed for modification.*
- *Description of proposed modification and why the airport cannot meet standards.*
- *Statement addressing how modification will provide an acceptable level of safety, economy, durability, and workmanship.*
- *Listing of any special operational measures necessary to accommodate the modification.*

This document was prepared to provide the analysis needed for ODAV to submittal for the MOS per Section 2.4.

2.4 *Addressing Non-standard Airport Conditions.*

> *The FAA expects airport owners to address non-standard conditions through the airport planning process. The FAA acknowledges that conformance to current standards is not always practical. However, the FAA expects airports to continue to investigate mitigation measures, whether in one or multiple phases, and correct the non-standard conditions over time.*

It is important to re-emphasize the above statement, that the FAA here "acknowledges that conformance to current standards is not always practical." Further, per this paragraph, the current master planning activity is the appropriate place for this analysis and the formal establishment of a MOS for the ROFA. This report and analysis identifies intermediate steps that can be taken, such as relocating the airport perimeter fence, that will iteratively move the airport closer to compliance.

This analysis utilizes an FAA established safety analysis methodology to show that the MOS provides an acceptable level of safety. The study found no special measures needed to accommodate the modification.

## 3. METHODOLOGY

In 2011, the Transportation Research Board (TRB) released Airport Cooperative Research Program (ACRP) Report #51 – Risk Assessment Method to Support Modifications of Airfield Separation Standards. The ACRP is funded by the Federal Aviation Administration (FAA). Report #51 is used to support the ROFA MOS requested at Aurora State Airport.

The proposed ROFA MOS is modeled in this report in accordance with Appendix A – Risk Assessment Methodology of ACRP Report #51[8].

This report uses risk plots, along with the annual number of operations, to analyze the cumulative risks associated with Runway to Object Separations. The operations numbers at UAO are taken from the current draft Master Plan, and are numbers already approved by the FAA in a letter[9] to ODAV dated November 15, 2023 (corrected January 23, 2024). For sake of a conservative analysis, we are using the most distant forecast projects for the year 2041, which are:

- 90,231 total operations all RDC categories, of which
- 862 operations are of RDC C-II and D aircraft

[8] ACRP Report #51 – Risk Assessment Method to Support Modifications of Airfield Separation Standards is available free on line at: https://nap.nationalacademies.org/catalog/14501/risk-assessment-method-to-support-modification-of-airfield-separation-standards

[9] Federal Aviation Administration (FAA) Aurora (UAO Aviation Activity Forecast Approval Airport Improvement Program Grant Number 3-41-0004-022-2021 available at: https://publicproject.net/files/2024-01/Aurora-Airport/uao-forecast-approval-20231115-corrected-20240123.pdf?57af6c19b7

For operations involving the runway, per the methods of Report #51, the risk is analyzed based on three distinct phases of flight:

a. Landing - Airborne Phase
b. Landing - Ground Phase
c. Takeoff

The separation distance from the runway centerline to an object is used with the associated risk plot to calculate the risk of collision per operation.

The risk of collisions per operation is then analyzed along with the number of annual airport operations for the appropriate phase of flight to determine the predicted frequency of occurrence. The frequency of occurrence is used to determine the FAA likelihood level using Table A-3 from ACRP Report #51 which is shown below:

**Table A-3. FAA likelihood levels (FAA, 2010).**

| | General | Airport Specific | ATC Operational | |
|---|---|---|---|---|
| | | | Per Facility | NAS-wide |
| Frequent A | Probability of occurrence per operation is equal to or greater than $1\times10^{-3}$ | Expected to occur more than once per week or every 2,500 departures ($4\times10^{-4}$), whichever occurs sooner | Expected to occur more than once per week | Expected to occur every 1–2 days |
| Probable B | Probability of occurrence per operation is less than $1\times10^{-3}$, but equal to or greater than $1\times10^{-5}$ | Expected to occur about once every month or 250,000 departures ($4\times10^{-6}$), whichever occurs sooner | Expected to occur about once every month | Expected to occur several times per month |
| Remote C | Probability of occurrence per operation is less than $1\times10^{-5}$ but equal to or greater than $1\times10^{-7}$ | Expected to occur about once every year or 2.5 million departures ($4\times10^{-7}$), whichever occurs sooner | Expected to occur about once every 1–10 years | Expected to occur about once every few months |
| Extremely Remote D | Probability of occurrence per operation is less than $1\times10^{-7}$ but equal to or greater than $1\times10^{-9}$ | Expected to occur once every 10–100 years or 25 million departures ($4\times10^{-8}$), whichever occurs sooner | Expected to occur about once every 10–100 years | Expected to occur about once every 3 years |
| Extremely Improbable E | Probability of occurrence per operation is less than $1\times10^{-9}$ | Expected to occur less than once every 100 years | Expected to occur less than once every 100 years | Expected to occur less than once every 30 years |

Note: Occurrence is defined per movement.

Source: ACRP Report #51

The key takeaway from Table A-3 is that for a specific airport, if the likelihood of incidence is less than once every 100 years it is considered a “Extremely Improbable” Class E occurrence.

A Hazard Severity Classification is then assigned based on the worst credible outcome of an incident. Since the ACRP method is based on wingtip separation, the report states that: “From the point of view of risk and based on the records of incidents and accidents, the worst credible consequence expected for wingtip collisions of two taxiing aircraft is aircraft damage" (ACRP Report #51 page 19). A similar aircraft damage expectation would be a wingtip collision with the airport perimeter fence, which is the ROFA limitation examined in this report.

The Hazard Severity Classifications were determined in accordance with Table A-4 FAA Severity Definitions from ACRP Report #51 and are shown below:

**Table A-4. FAA severity definitions (FAA, 2010).**

| Hazard Severity Classification | | | | |
|---|---|---|---|---|
| **Minimal**<br>**5** | **Minor**<br>**4** | **Major**<br>**3** | **Hazardous**<br>**2** | **Catastrophic**<br>**1** |
| No damage to aircraft but minimal injury or discomfort of little consequence to passenger(s) or workers | - Minimal damage to aircraft;<br>- Minor injury to passengers;<br>- Minimal unplanned airport operations limitations (i.e. taxiway closure);<br>- Minor incident involving the use of airport emergency procedures | - Major damage to aircraft and/or minor injury to passenger(s)/ worker(s);<br>- Major unplanned disruption to airport operations;<br>- Serious incident;<br>- Deduction on the airport's ability to deal with adverse conditions | - Severe damage to aircraft and/or serious injury to passenger(s)/ worker(s);<br>- Complete unplanned airport closure;<br>- Major unplanned operations limitations (i.e. runway closure);<br>- Major airport damage to equipment and facilities | - Complete loss of aircraft and/or facilities or fatal injury in passenger(s)/ worker(s);<br>- Complete unplanned airport closure and destruction of critical facilities;<br>- Airport facilities and equipment destroyed |

Source: ACRP Report #51

Then, using both the FAA likelihood level and the Hazard Severity Classification the risk is then analyzed using Figure A-1 FAA Risk Matrix from ACRP Report #51, shown below:

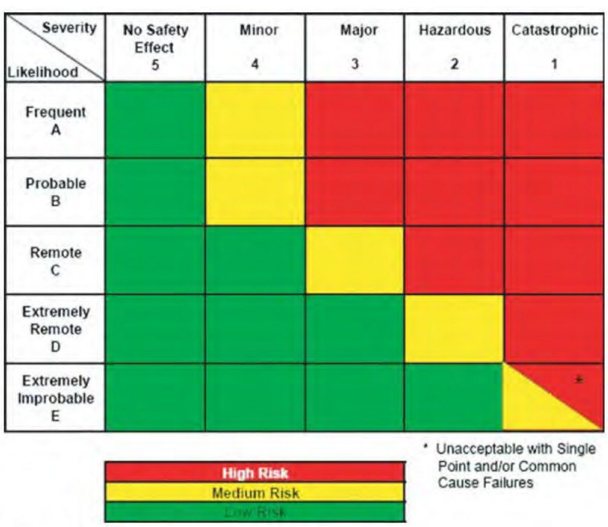



*Figure A-1. FAA risk matrix (FAA, 2010).*

Source: ACRP Report #51

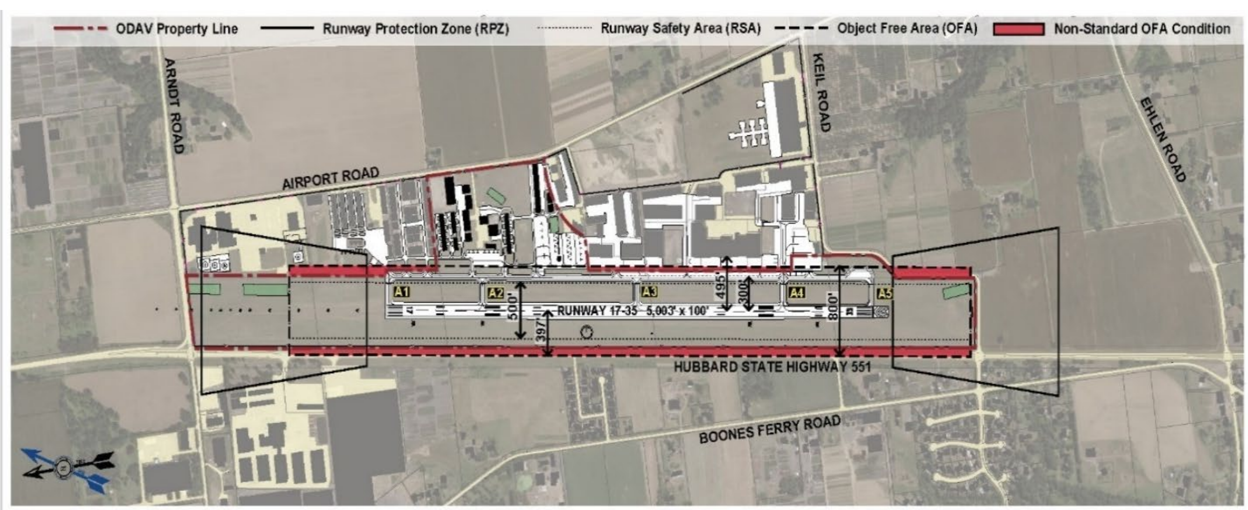
Based on Figure A-1 if the incident is Extremely Improbably (i.e. more than 100 years probability) the risk is considered “Low,” except for an incident considered catastrophic. We will use these graphs to evaluate the results from the detailed risk analysis of UAO below.

## 4. UAO ANALYSIS

In 2012 Master Plan and ALP established the UAO runway RDC, given existing based aircraft, as C-II, up from a B-II. The required ROFA width of a B-II runway is 500 feet centered on the runway. As it turns out, any runway of higher RDC than a B-II requires 800 feet in width. Thus, the UAO required C-II ROFA width is 800 feet centered on the runway. This 800-foot width is the standard used for aircraft ranging from a Challenger 300 business jet to the largest Boeing 777 or even the largest military aircraft. The 2012 approved ALP lists the ROFA deviation as a modification to standards, since the airport perimeter fence and Highway 551 were within the ROFA.

The UAO forecast of operations predicts that by the year 2041 there will be 90,230 annual operations at the airport, of which 862 would be an RDC above the B-II category. Thus, the 89,368 operations by B-II or lesser category clearly are operating well within ROFA safety standards, as the existing runway to road separations provide more than the 500-foot required width. It is just the 862 operations that need to be analyzed for ROFA safety relative to the required 800-foot width.

The deficiencies in the existing Runway OFA at UAO are shown in the Figure below:




UAO Figure A: Highway 551 Shown as ROFA Deviation Object
Source: Century West Engineers, Aurora State Airport Draft Airport Master Plan, Working Paper No. 1, Figure 2-15, November 2023 (Updated)

The current ROFA object deficiencies are:

d. Hubbard State Highway 551 for which the OFA penetrates 3 feet beyond the highway centerline. (368’ to 377’ clear width available from outer edge of highway gravel shoulder to Runway CL)
e. Perimeter Fence Inside OFA (312’ clear width from Runway CL)

Potentially the airport fence could be relocated to the east edge of the 12-foot-wide gravel shoulder, since both the highway and the airport are owned by the State of Oregon. There can be an agreement between ODOT and ODAV to allow this. Relocating the fence in this way would result in a minimum width of the ROFA on the west side of the runway, to a 368-foot clearance - which would be only 32 feet out of conformance.

However, we will evaluate the ROFA for the existing conditions, and thus use the location of the airport perimeter fence as the maximum ROFA available at this time.

When analyzing the risk associated with a reduction in Runway OFA it is important to consider the purpose of the design standard. Paragraph 3.12 of Advisory Circular 150/5300-13B defines the ROFA but does not give detailed design rational behind the standard:

> *“ROFA is a clear area limited to equipment necessary for air and ground navigation, and provides wingtip protection in the event of an aircraft excursion from the runway”*

Appendix I, Paragraph I.8 of Advisory Circular 150/5300-13B provides the only available reference to the design rationale behind the Runway OFA width:

> *“The ROFA serves two principal purposes: 1. Development buffer in proximity to a runway, and 2. Wing clearance for a runway excursion event to the outer limit of the RSA. `*

Appendix I, in Section I.8.2, also clarifies that part of the “development buffer” intent is:

> *“Protection of the ROFA also reserves space for future development of a parallel taxiway that permits proper alignment of aircraft at a holding position on an entrance taxiway.”*

However, for the given physical layout of UAO <u>there can be no plan for a parallel taxiway on the west side of the runway, because of the location of Highway 551</u> and that there never can be hangars or other aviation uses on that side of the runway. Therefore, that leaves the only ROFA purpose for UAO as only “wingtip clearance for a runway excursion” which is precisely what this analysis provides.

Below we will analyze resolving the ROFA utilizing the risk analysis method of ACRP Report #51, for the case:

- No Change to existing ROFA conditions on West Side of Runway (Hwy 551 and Airport Perimeter Fence remain as existing) resulting in a 312-foot clearance to runway CL.

Per the methodology of ACRP Report 51, we analyze the risks for each of the takeoff and landing scenarios. For landing operations, the analysis is further divided into two parts: airborne (approach) phase and ground (landing rollout) phase. However, because the risk of veering off the runway during takeoff is so much less than for during landing, the methodology indicates that usually it is not necessary to evaluate takeoff option except if there are runways that only are used for takeoffs and not for landings. We will do that takeoff evaluation in any case, just to clearly determine what it is in the UAO context.

Since the existing runway to taxiway separation meets the current criteria for a C-II airport, for this study that analysis would seem unnecessary. However, we will include that option in this report because it provides a baseline of safety that the AC 150-5300-13B Airport Design Standards have determined is an acceptable and appropriate level of safety for a C-II airport.

Thus, for this UAO ROFA analysis separate risks are developed for each of:

1. Airborne Phase (Landing) is for instrument approaches which terminate the approach as a missed approach, and the risk is hitting another object such as hitting the airport perimeter fence or a vehicle on Highway 551 (using ACRP Report 51 Fig. 31); “the airborne risk is computed only for missed approaches” (ACRP Report 51, page 21).
2. Ground Phase (Landing Rollout) where risk is veering off the runway into the reduced width ROFA and hitting the fence or a car on Highway 551 (using ACRP Report 51 Fig 42). Figure 42 is based on the assumption that the risk is between the two wingtips of two aircraft, one aircraft on the edge of the runway and the other at the centerline of a taxiway. The ACRP makes clear that the x-axis distance on the Risk Figures are centerline of runway to centerline of taxiway because the risk is assumed aircraft to aircraft. However, the predicted risk is based on the wingtip-to-wingtip distance. When using the Risk Figures for objects (not aircraft) like a fence or road (which has no wings), half of the wingspan should be added to the distance to compensate for the wingtip-to-wingtip assumption. Thus, per Group II standards, the clearance distance used for Figure 42 should add half of 79 feet (equals 39.5 feet) of additional clearance, which would create a total of 351 feet to use in Fig. 42. The risk shown with the 312 feet and the 351 feet are each shown in figures.

3. Ground Phase (Takeoff) where risk is veering off the runway into the reduced width ROFA and hitting the fence or a car on Highway 551 (using ACRP Report 51 Fig 49).

Finally, to have more relevant data, we will also perform the risk analysis of the standard required 300-foot separation between runway centerline and taxiway centerline for a landing, which is the level of safety the AC 150/5300-13B sets for in a C-II airport:

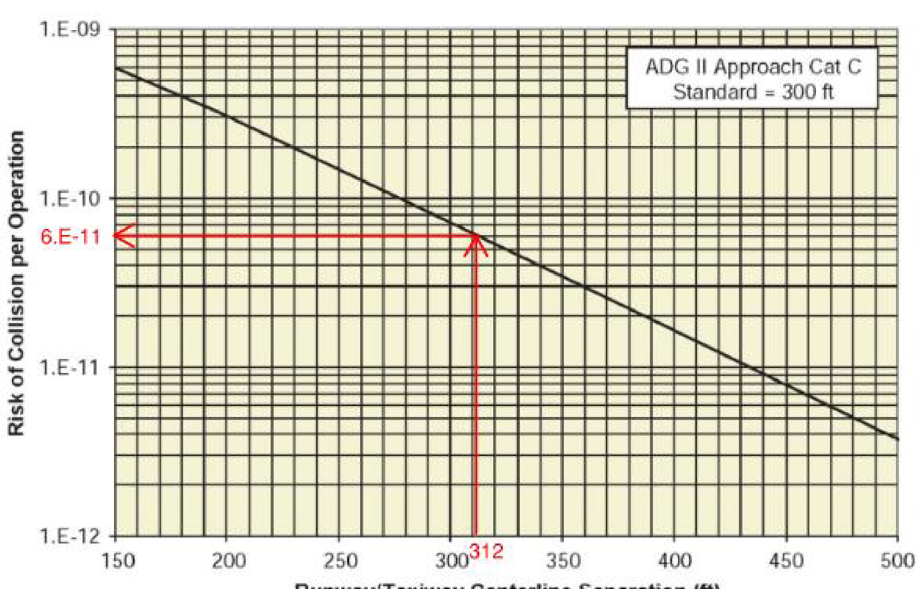
4. Ground Phase (Landing Rollout) where risk is veering off the runway into the taxiway (using ACRP Report 51 Fig 42).

This data will give us an example of an acceptable level of safety utilized in AC 150/5300-13B for a C-II airport.

## 5. Specific Analysis: Proposed MOS Option - No Change to Existing ROFA Conditions (312' Separation from Runway Centerline to Airport Fence)

The Perimeter Fence at the west side is located 312 feet from the runway centerline. The risks associated with leaving it there as a modification of standards, for each of the phases of flight are analyzed below:

1. Airborne Landing Phase Risk from Reduced ROFA – For a very conservative analysis we will assume that this includes all approach to landings, not just missed approaches. Using the separation of 312' and Figure AA-33 in Appendix A of ACRP Report #51, the following provides a risk level 6.0E-11 of occurrence per landing (which as an inverse, is one chance in a 16.7 trillion landings) that an aircraft gets 312' from the runway centerline. This can be seen in the figure below:

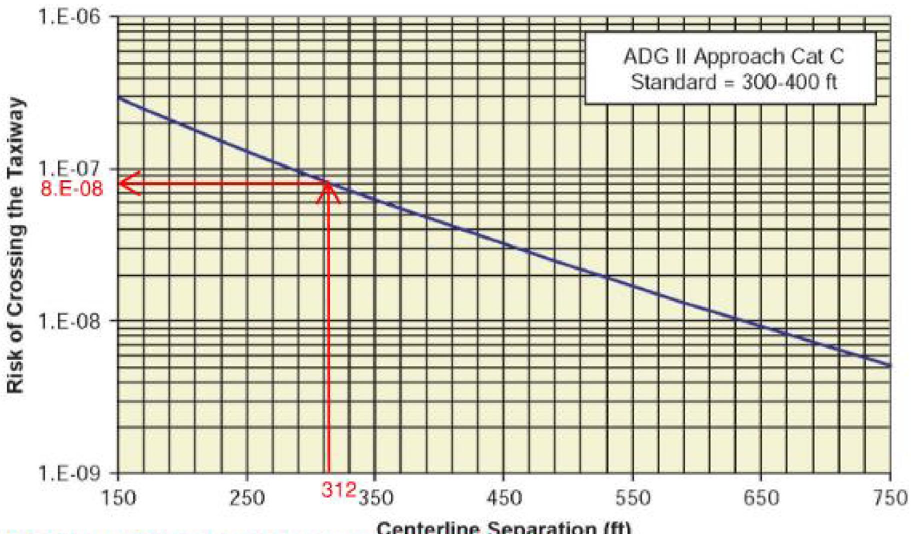


UAO Figure B: Runway CL to Airport Perimeter Fence

*Figure AA-31. Missed approach collision risk for ADG II Cat I.*

The current annual number of landing operations at UAO is approximately 45,115 or half of the 90,230 annual operations. As the risk is one incident in every 16.7 trillion landings, the time between occurrences is calculated as 16 trillion landings divided by 45,115 landing operations per year which equates to one incident every 369,000 years. Thus, this risk is of no significance.

2. Landing Roll Phase Risk for Reduced ROFA - Using the separation of 312' and Figure AA-43 in Appendix A of ACRP Report #51, provides a risk level 8.0E-08 or in the inverse: one chance in 12.5 million landings. This can be seen in the figure below:



UAO Figure C: Runway CL to Airport Perimeter Fence

*Figure AA-42. Landing veer-off collision risk for ADG II.*

As the risk is one incident in every 12.5 million landings, the rate of occurrence is calculated as 12.5 million landings divided by 45,115 landings per year which equates to one incident every 277 years.

Using the ACRP described adjustment when the object is not another aircraft and half the C-II wingspan can be added to the clearance distance, results in a separation of 351' and Figure AA-43 in Appendix A of ACRP Report #51, provides a risk level 6.0E-08 or one chance in 16.7 million landings. This can be seen in the figure below:

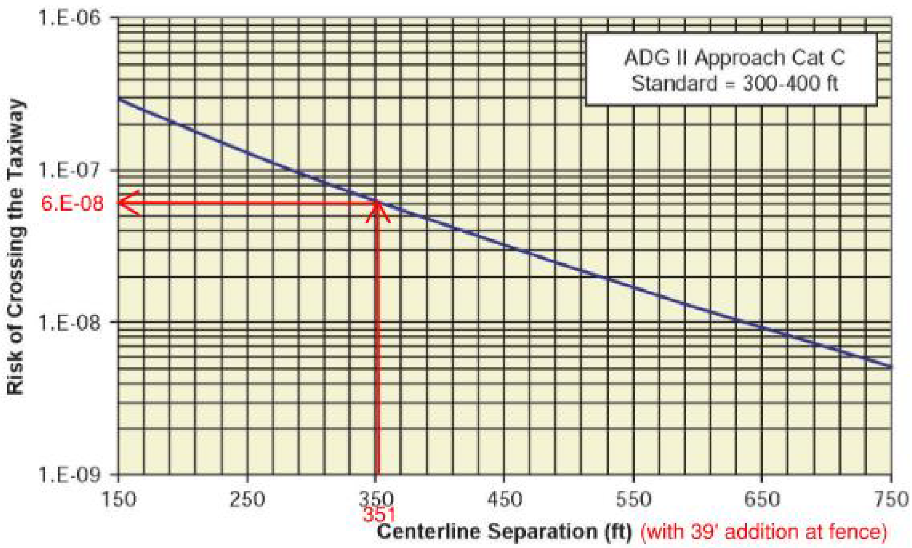
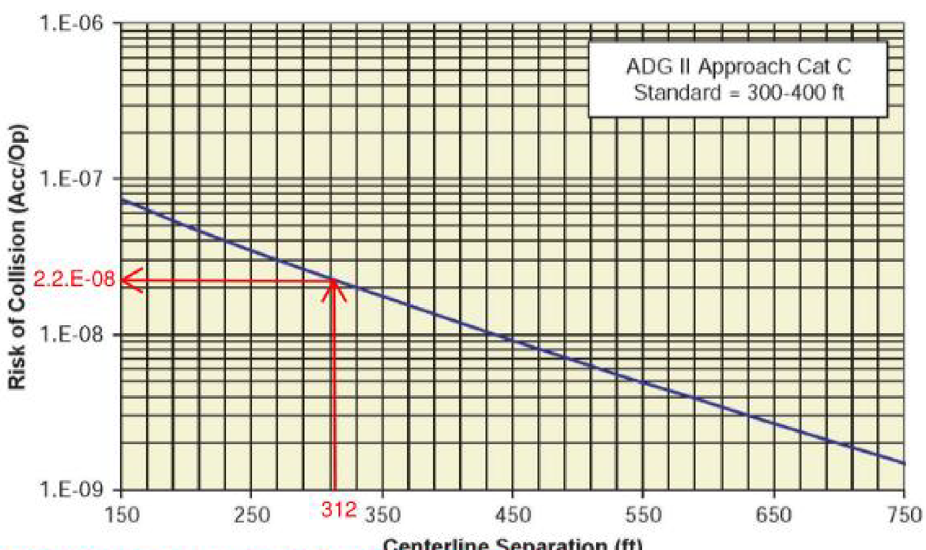



*Figure AA-42. Landing veer-off collision risk for ADG II.*
**UAO Figure D: Runway CL to Airport Perimeter Fence Including Wingspan adjustment**

As the risk is one incident in every 16.7 million landings, the rate of occurrence is calculated as 16.7 million landings divided by 45,115 landings per year which equates to one incident every 369 years.

3. Takeoff Roll Phase Risk for Reduced ROFA - Using the separation of 312' and Figure AA-49 in Appendix A of ACRP Report #51, provides a risk level 2.2E-08) or one chance in 45.5 million takeoffs. This can be seen in the figure below:

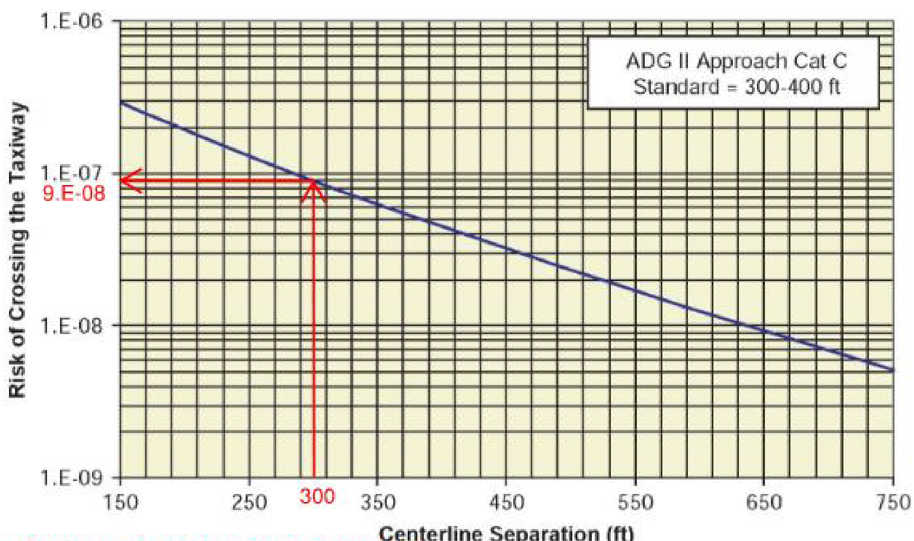



**UAO Figure E: Runway CL to Airport Perimeter Fence**
*Figure AA-49. Takeoff veer-off collision risk for ADG II.*

As the risk is one incident in every 45.5 million takeoffs, the rate of occurrence is calculated as 45.5 million takeoffs divided by 45,115 takeoffs per year which equates to one incident every 1,008) years.

Finally, as a test of the level of safety that AC 150/5300-13B considers acceptable we check what the predicted risk level is of the existing runway-taxiway separation considered appropriate[10] by FAA.

4. Landing Roll Phase Risk to Taxiway Consistent with Safety Standards of AC 150/5300-13B - Using the separation of 300' and Figure AA-43 in Appendix A of ACRP Report #51, provides a risk level 9.0E-08 or one chance in 11.1 million landings. This can be seen in the figure below:



UAO Figure F: Runway CL to Taxiway CL

*Figure AA-42. Landing veer-off collision risk for ADG II.*

As the risk is one incident in every 11.1 million landings, the rate of occurrence is calculated as 11.1 million landings divided by 45,115 landings per year which equates to one incident every 246 years.

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[10] Note that Section 3-24 of Order 5100.38D Change 1 states that the FAA will not fund airport safety greater than that in the Airport Design standards, so the standard set by the runway-taxiway separation is a significant number. Order 5100.38D Change 1 can be downloaded for free at: https://www.faa.gov/documentLibrary/media/Order/AIP-Handbook-Order-5100-38D-Chg1.pdf

## 6. Conclusions

Considering the risk of each phase of flight, the risk of collision during the landing roll is the controlling factor. The Hazard Severity Classification for this type of operation would be major and the acceptable probability of occurrence is remote (1E-05) or less than once every 1-10 years. The following table summarizes the risk associated with each phase of flight:

| Phase of Flight | Rate of Occurrence | Acceptable Level |
|---|---|---|
| **Airborne Phase** | Once every 369,000 years | Yes |
| **Landing Roll Phase** | Once every 277 years (or 369 years with calculation adjustment for fence object in lieu of wing object) | Yes |
| **Takeoff Roll Phase** | Once every 1,000 years | Yes |

A runway to object separation of 312’ provides an acceptable level of safety as the controlling occurrence is once every 277 years (or 369 years with the adjustment for wingspan at the fence as allowed in the ACRP method). This is much less risk than the once per 100 years FAA standard shown in Table A-3 and results in a Category E “Extremely Improbable” occurrence. Further, per ACRP’s method, a wingtip to fence occurrence is considered by ACRP’s method to be a Table A-4 Minimal Severity occurrence. This combination via Figure A-1 concludes that the outcome as Low Risk.

Figure UAO F shows that the existing risk of occurrence between the existing runway and existing taxiway, which fully meets FAA standards, is one in every 246 years. This means that the risk to an occurrence at the taxiway, is much less (i.e. longer duration between events) than the FAA’s 100-year standard. The risk of collision with the perimeter fence is then even much less than that of a taxiway collision.

Finally, there is an incremental improvement option of ODAV and ODOT coming to an agreement to move the perimeter fence further west, to the east edge of the 12’ wide gravel shoulder, which would result in a 368-foot separation. If the 39.5-foot wing span correction is added at the new fence location, this results in an equivalent distance of 407 feet for use on Figure AA-42. That in turn would result in an ACRP predicted probability occurrence being once every 515 years, almost half the risk of a taxiway collision.

Given that the commercial use of aviation is itself only around 100 years old, these numbers of one predicted occurrence at the existing airport fence every 277 or 369 years, demonstrates the high level of safety that will be maintained at Aurora Airport with this MOS.

Given the regional and national importance of Aurora Airport for emergency medical, firefighting, and emergency power line moving, along with the use by local national corporations, using the MOS ensures the airport can continue to upgrade with safety improvements, and can continue to support the approximately 1,500 employees that rely on the airport for their livelihood.

This study shows definitively that the 2012 signing off on the Aurora Airport master plan and ALP with a modification of standards for the ROFA, by FAA and ODAV, was a reasonable and appropriate action to take. The same action should be taken for the current 2024 master plan work.

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Author: Aron Faegre is an architect, civil engineer, physicist, and pilot who has been the lead planner and designer on over two hundred airport planning and development projects in Oregon, Washington, California, New York, and British Columbia over the past 35 years. He has a Master of Architecture from MIT and a Bachelor of Physics from Reed College.

**ARON FAEGRE AND ASSOCIATES**
**AVIATION PLANNING AND DESIGN SERVICES FIRM PROFILE**

**Introduction**

Aron Faegre and Associates is a multi-disciplinary firm with a special interest in performing planning and engineering for aviation projects. The principal of the firm, Aron Faegre, personally manages the firm's key projects and is an aviation planner, architect, civil engineer, and landscape architect. He is also an instrument rated commercial pilot.

Mr. Faegre's firm has completed aviation projects for the following clients:

- Oregon Department of Aviation
- Port of Walla Walla
- Quinault Indian Nation
- Horizon Air
- Southwest Airlines
- Columbia Helicopters
- Helicopter Transport Services
- Oregon Health Sciences University
- Kaiser Hospital
- Atlantic Aviation
- The Port of Portland
- Port of Columbia County Scappoose)
- The City of Portland
- City of Pendleton
- Washington State DOT
- Life Flight Network
- Van's Aircraft
- City of Newberg
- Transwestern Aviation
- Flightcraft PDX

**Aviation Services**

Aron Faegre & Associates provides consulting services on all aspects of aviation facilities design including:

- Airport Master Plans
- Maintenance Hangars and Shops
- Storage Hangars
- Terminals and Concourses
- Airport Layout Plans
- Runway Design
- Access Road Design
- Instrument Approach Drawings
- Apron Design
- Airport Economic Impact
- Noise Abatement Planning
- Environmental Assessment
- Fixed Base Operator Facilities
- Air Cargo Facilities
- Tenant Fit-up
- Obstruction Survey
- Taxiway Design
- Airport Security Design
- Aviation Land Use Planning
- Public-Private Partnerships

Aron Faegre, P.E, AIA is the principal of AFA, a multi-disciplinary planning and design firm. Mr. Faegre has a Master's Degree in Architecture from the Massachusetts Institute of Technology, during which he was also a National Science Foundation Fellow for three years. Mr. Faegre has a Bachelor's Degree in Physics from Reed College and has published research in scientific journals. He is licensed as a civil engineer, architect, and landscape architect. He is a commercial pilot with instrument rating. He also serves on the board of the Airway Science for Kids, an Oregon non-profit, where he also leads the TeenFlight program – where teams of 15 teenagers build an RV-12is aircraft, and then get to experience flying the airplane they built.