Roseburg Regional Airport – Roseburg, Oregon

Instrument Approach Procedures Investigative Assessment

The purpose of this assessment is to determine what, if any, options are available to the City of Roseburg to improve all-weather reliability into Roseburg Municipal Airport (Roseburg). The investigative process used for completing this assessment included the following two components: 1) interviews of airport management, a variety of local aircraft operators familiar with Roseburg, and technical staff within the Flight Safety and Flight Standards Divisions of the Federal Aviation Administration (FAA) and 2) preliminary technical evaluations using available data and design criteria. The conclusions drawn from these two components are summarized in the "Findings" section. Lastly, the "Options" section summarizes the options available to the airport for moving forward.

OVERVIEW

Overall reliability is restricted by mountainous terrain encompassing much of the area surrounding Roseburg and by the accuracy of navigation technologies that have historically been available. Since about 1995, all airport planning and development at Roseburg has progressed so as to avoid creating any on-airport conflicts which might preclude future approach improvements into the airport. Also since about that time, navigation and on-board computer technologies advanced considerably and may offer new opportunities. According to the current Airport Layout Plan (ALP) and associated ALP Report, the airport will undertake additional obstacle/topographic surveys and seek to improve reliability by obtaining a new or amended approach procedure using the latest technologies. Such improvements could offer the following benefits to the Roseburg area: improved aviation safety, increased local commerce via improved transportation access, and improved mobility for emergency medical/fire and disaster relief operations. Any improvements in reliability would be an important consideration for an airline considering adding Roseburg to its transportation network and also to businesses considering locating nearby.

The airport is located in one of many low-lying "Umpqua valleys" that are characteristic of the Roseburg area at an elevation of 525 feet above mean sea level (AMSL). This area of southwestern Oregon is situated between the Cascade and Coastal Mountains. While the airport site itself is relatively flat, the terrain immediately surrounding the airport is generally 800 to 1,000 feet higher. Within 20 miles peak elevations fall between 2,500 and 3,500 feet. The topography also affects local weather patterns. The higher terrain helps push coastal fog upward, which improves surface visibility and increases the cloud base. Conversely, the mountainous topography obscures the terrain during arrival/departure operations during altitude transition into and out of the airport. This concern is heightened during particularly inclement weather involving high winds/turbulence, icing conditions, and/or darkness.

Currently, there are two published instrument approach procedures into Roseburg:.

- VOR-A (Figure 1)— Utilizes a very-high frequency omni-directional range (VOR) ground-based radio transmitter as the primary source of navigation. The VOR-A procedure uses the Roseburg VOR located about four miles south of the airport. Only circling minimums are authorized, meaning the approach is not to a specific runway and that visual maneuvers will be required to complete the landing. The lowest published minimums for this approach are 1215-1¼.

- GPS-B (Figure 2)— Uses space-based global position system (GPS) satellites as the primary form of navigation. Only circling minimums are authorized, the lowest being: 1175-1¼.

Both of the approach procedures approach minimums exceeding standard visual requirements (typically 1,000 feet and 1 mile for local operations). The high minimums result in poor reliability in that aircraft intending to land at Roseburg must often divert to another airport even during moderately fair weather when visual operations are being safely conducted below the overcast.

According to FAA records and personnel, the existing GPS-B approach will be discontinued and simultaneously replaced by a nearly identical procedure entitled RNAV (GPS)-B. The approach minimums will not be affected by the change although the published missed-approach course and hold will be altered in addition to some minor adjustments to some segment altitudes. The scheduled effective date for the change is June 22, 2007 which coincides with the regular cycle of terminal procedures publication for Roseburg.

Preliminary Concepts

Before this assessment was undertaken, the airport sponsor had identified two concepts (not including obstacle surveys/removal) for improving approach minimums and initiated a dialogue with FAA technical staff. The two alternatives are generally defined as follows:

- Concept 1, *Develop GPS-WAAS*— Essentially would take advantage of recent improvements in GPS navigation. A stand-alone GPS approach does not meet the FAA's requirements for accuracy, integrity, and availability. Consequently, the obstacle clearance surfaces used to construct a GPS approach (e.g., GPS-B) are often wider than ground-based radio-aids. The width can result in high altitude segments and approach minimums if obstacles/terrain are present well to the sides of the intended course. The wide-area augmentation system (WAAS) uses additional ground and space-based reference stations that correct most of the errors of the original GPS signals. Due to the higher accuracy, the course width being protected is significantly narrowed, which may allow a lower altitude and approach minimums. Aircraft must be equipped with a WAAS-enabled GPS receiver in order to obtain improved accuracy and potentially lower approach minimums.

- Concept 2, *Point-in-Space Approach*— Involves the construction of a new approach procedure based loosely on helicopter-only approach criteria. The intent is to take advantage of lower terrain west of the airport that may allow a safe descent through a cloud layer into visual conditions from which the aircraft would navigate visually to the airport and land. The approach itself would be to a point in the general vicinity of the airport and not the airport itself. There would most likely be a period where the airport would be obscured from pilot view by terrain and/or weather during visual maneuvering. Like Concept 1, the procedure would use GPS-WAAS, which is widely available. However, the standards for designing such a procedure do not currently exist and must first be developed and approved by FAA.

A third concept involved the development of a "special approach" requires some clarification. A "special approach" is an authorization granted by the FAA to specific operators on a case-by-case basis. In general, in order to receive these authorizations, certain requirements must be satisfied which may include: specific crew training/recordkeeping requirements, specific on-board aircraft equipment requirements, and/or specified aircraft performance criteria. Either of the two previously identified concepts could potentially be developed as a "special" procedure. For example, it is a fairly common practice for the FAA to publish an instrument approach with high minimums and then authorize "lower" special minimums to certain multi-engine operators that can accept a steeper than standard climb gradient requirement. This is more likely to affect Concept 1. In the case of Concept 2, the FAA may opt to accept the new procedure only as a "special" and then determining if a published procedure is appropriate.

Departure Restrictions

Roseburg Regional Airport is a non-towered airport. In addition, terrain "shadows" air traffic radar such that aircraft operating at lower altitudes in the vicinity of the airport (and while on approach) cannot be detected by air traffic control. To avoid an unforeseen conflict, controllers protect a large portion of airspace anytime once an aircraft is established on an instrument approach during instrument meteorological conditions. Controllers do not clear additional aircraft to use the airspace until receiving confirmation that the cleared aircraft has landed (or aborted). The long final approach combined with the additional time it takes for pilots to inform air traffic control after landing causes a "release" delay for departing instrument aircraft. The situation is fairly common at many non-towered airports. Discussions with local operators confirmed occasional departure delays and that there is good radio communication between control from the ground. Without a tower that would allow additional controller subjectivity in clearing aircraft for departure, it is unlikely that departure delays can be reduced. Some pilots indicated that they will perform a single-turn in hold or otherwise slow an approach to allow a waiting aircraft to depart. A local initiative to increase pilot awareness of this courtesy procedure could informally help to reduce departure delays.

INVESTIGATIVE INTERVIEWS

A series of telephone interviews were conducted to more clearly identify the instrument approach concerns being experienced at Roseburg Regional Airport and to gather ideas that might be helpful for improving overall reliability. Phone interviews consisted of a kickoff meeting with airport and City staff, discussions with individual operators, and conversations with FAA Airports, Flight Safety, and Flight Standards specialists.

Kickoff Teleconference

The kickoff teleconference was primarily conducted to introduce the consultant team and to establish administrative protocols to be followed. In addition, airport staff provided an explanation of current weather restrictions and recent attempts to improve all weather reliability. Airport management estimated that during the winter months, the airport is essentially inaccessible for about 45 days due to low cloud ceilings and visibility. A reduction in the cloud ceilings of just 200 feet could significantly improve accessibility. Local representatives met with FAA staff to discuss, among other things, potential lowering of the approach minimums. Initially, FAA did not think this would be possible due to topography. However, after consulting additional FAA specialists, it was determined that new flight procedures might offer some potential for exploration. The most promising idea centered on the then-called "Point-in-Space" Approach. The basic idea being that the instrument approach would be to a less topographically constrained valley west of the airport from which an arriving aircraft would then be able to navigate visually to the airport and land.

Telephone Interviews with Local Pilots

Interviews were conducted individually with local pilots and businesses familiar with instrument operations at Roseburg. Major points / concerns brought up during these interviews are summarized below:

- General concurrence with winter reliability concerns expressed during the kickoff teleconference, although it was difficult to determine the true impact in terms of cancelled flights and diversions. The cargo operators who fly a regular schedule seem to cancel/divert 3-4 flights per week each during winter. The threshold for significant improvement ranged from 200 FT to 500 FT reduction in the ceiling requirement (e.g., at exactly a 200 FT improvement, may not be as dramatic an improvement in reliability as we hope to see).
- Pilots were not sure what the critical component of the approach is: approach or missed-approach. Some spoke about terrain on all sides and particular east of the airport. No one concern stood out although the faster/heavier airplane operators consistently described the existing approach as: "hairy", "tight", and "steep".
- Some pilots considered improved instrument approaches in terms of fair weather with high fog while others considered it from a worst case (night, turbulence, icing, etc.). How and what restrictions can be added may be an important consideration: e.g., procedure not authorized at night, etc.
- Many of the operators were familiar with special approach procedures and operate these at other airports today.
- Suggestions for improvement included: WAAS-GPS, point-in-space, precision approach, special approach, and no change from current.
- In terms of the "point-in-space" idea, at least at this initial stage, there is an inverse relationship between those operators that are best equipped and most likely to receive FAA approval and those willing to seek authorization.
- Any concern about departure delays seemed minimal to non-existent/unaware.

FAA Interviews

The Flight Safety (Victor Zembruski) and Flight Standards (Norman LeFevre) Divisions of the FAA's Northwest Mountain Region were each contacted for their insight regarding approaches at Roseburg. Both had attended an earlier meeting with airport staff and were very familiar with Roseburg's approach constraints. The interview with Mr. Zembruski of flight safety focused primarily on the restrictions to the existing GPS-B approach that are resulting in high-circling approach minimums. The interview validated the work being done by the consultant team in terms of FAA obstacle height assumptions and climb/descent gradient application. The conclusions from Mr. Zembruski's interview are as follows:

- The reason why the GPS-B is limited to circling-only minimums and not straight-in is because the required descent gradient between the final approach fix (OCUKY) and the runway elevation exceeds the maximum of 400 FT/NM for that segment. Terrain restricts the elevation of over OCUKY to 2,500 FT MSL.
- FAA applied a 100-FT adverse assumption to the terrain impacting the altitude requirement over OCUKY. It may be possible to reduce the altitude over this point by using a narrower GPS-WAAS corridor and/or expanding the obstruction survey to validate the critical elevation and natural growth. It seems unlikely that the obstruction clearance will increase by the 525 feet required to meet the maximum authorized descent gradient for a straight-in approach.
- The circling minimums are based on tree heights within the surveyed area. Removal of critical obstructions would reduce the circling minimums by 40 to 50 feet.
- Terrain in the missed-approach area is not critical with the approach minimums provided.
- Provided all FAA forms pertaining to the new RNAV (GPS)-B that would be required to refine the approach and improve the minimums to the extent allowed by FAA standards.
- Not aware of any criteria for point-in-space approach for fixed wing aircraft, however, Vic recently received notice of a new procedure that has some resemblance. FAA Order 8260.49 (6/26/06) makes limited use of the point-in-space concept for use in simultaneous approaches to closely-spaced parallel runways.

Norman LeFevre, FAA Flight Standards, recalled the earlier meeting with airport staff and some of his routing ideas for a point-in-space approach to the Garden Valley. The following are the conclusions drawn from the conversation for this study:

- Evaluated the existing GPS-B approach while on the phone and determined not much room for improvement under the existing criteria.
- Felt that a point-in-space procedure is the best bet for improvement, but is not aware of any criteria that will allow it for fixed wing aircraft. He thought it was being worked on and that there may be some draft criteria.
- In reviewing the topography again, his opinion was that the best option would be for an approach from the south into the Garden Valley would offer lower minimums. He was concerned about not having any visible part of the airport while also not being on an intercept course.
- Another idea was to approach from the southwest to a point near the Roseburg VOR.

- The whole procedure would need to utilize GPS-WAAS. If draft criteria exists, may be able to approve a special for certain operators with special equipment- he mentioned the air ambulance. Possibly upgrade to a public procedure if the criteria gets published and approved.

- All the valleys seem very narrow. Even under draft criteria, the required obstacle clearance and surface widths may result in higher approach minimums. Norman agreed to contact FAA Headquarters Technical Standards Branch and determine if any draft criteria exists.

- FAA Technical Standards response indicates that they have still not been authorized to develop point-in-space procedures for fixed wing aircraft. However, an upcoming change to U.S. Terminal Instrument Procedures (TERPS) will include new circling criteria that can terminate at a "charted visual path" to the runway that seems to accomplish the same thing. HQ has forwarded the draft to Norman for review. Follow-up required.

PRELIMINARY TECHNICAL EVALUATION

After discussing some of the basic operator concerns with major users of the airport and prior to contacting FAA technical staff, the consultant team collected and assessed the following information:

- Weather and wind information (National Climatic Data Center, 1996 – 2005)
- Current VOR-A and GPS-B approach procedures publications
- Instrument Flight Procedures Production Plan (as of 1/18/2007)
- U.S. Geological Survey Topographic (USGS) Quadrangle Maps (electronic, geo-referenced)
- Airport electronic basemap and aerial photo (Roseburg Public Works Department, 2004)
- Roseburg Regional Airport- Airport Layout Plan Report (March 2006)
- Airport Obstruction Chart (National Oceanic and Atmospheric Administration, 01/1993)
- National Aeronautical Charting Office (charted obstacles within 5 miles)
- FAA Order 8260.3B and related Orders (U.S. Terminal Instrument Procedures- TERPS)

TERPS Review (Existing GPS-B)

The airport's geo-referenced basemap was expanded to include USGS topographic quadrangle maps, airport obstruction information, aeronautical chart obstruction information, GPS waypoint information, and navigational aid (NAVAID) information. From this data, the existing GPS-B approach, circling, and missed-approach areas and corresponding obstacle clearance surfaces could be constructed and evaluated. The VOR-A approach information was also entered, although primary focus centered on the GPS information. The following conclusions were drawn from the TERPS evaluation:

- Airport obstacle survey data includes all areas within 10,000 feet of each runway ends and within 10,000 feet to each side of the runway. Outside of this area, FAA applies an "adverse assumption" to terrain to account for natural growth or man-made construction of less than 200 feet in height. The typical assumption is a 200-FT. Charted obstacles outside of the airport survey area have a larger error margin in terms of lateral position and height.
- The circling minimums for approach categories A-C are established by a tree northwest of the airport at elevation 1,395 feet. We could not verify the critical obstacle for approach category D. Circling is not authorized east of the runway centerline.
- Terrain in the vicinity of the final approach fix restricts the approach to circling-only minimums that would require a descent gradient exceeding 400 FT / NM. The critical terrain is located ap-

proximately 1 mile east of the fix at elevation 1,753 feet. FAA assesses the non-surveyed area as 1,853 feet.

- A 15-degree turn is required over the final approach fix, which is the maximum allowed given that segment's length.
- The altitudes of the initial and intermediate approach segments are set by terrain east and south of course.
- The initial approach segment altitude of 4,000 feet does not appear to provide standard terrain clearance over "Big Baldy", which has a peak elevation of 3,145 feet (higher southeast). A segment altitude of 4,300 or 4,400 feet is necessary for TERPS compliance. Big Baldy is located about 2 miles north of Nickel Mountain, which the segment appears to have been designed to clear.
- The missed-approach clearance surface is clear. Lowering the final approach segment altitude could create an adverse obstacle penetration of the missed approach surface in the area between 10 and 20,000 feet northeast of the north end of runway. Additional survey would be required to remove or identify these assumed obstacles.

Weather Evaluation

Wind and weather data was collected and assessed to 1) validate the primary instrument approach direction and 2) help assess the degree of improvement that would be obtained by lowering the ceiling requirement by 200 feet. The results, though not conclusive, are indicated in the table below:

Ceiling (FT AGL)	Total	Winter	Oct.	Nov.	Dec.	Jan.	Feb.
≥ 1200	84.46	78.64	83.20	75.98	74.34	79.98	82.80
1000 – 1199	1.35	1.63	2.03	1.28	1.55	1.83	1.63
< 1000	14.19	19.73	14.78	22.74	24.11	18.20	15.57

On the whole, it appears that lowering the ceiling requirement by 200 feet will increase the time the airport is accessible to instrument operations by 1.5 to 2.0 percent during winter. Based on the anecdotal information provided during the interviews, it is believed that any additional lowering would significantly increase accessibility. It also seems to promote some of the assertions that more than 200 feet is needed (300 – 500 feet).

FINDINGS

The conclusions drawn from this investigative assessment are summarized as follows:

- GPS-WAAS, in combination with additional obstruction surveys, and obstruction removal could lower the cloud ceiling requirement by as much as 100 Feet.
- New circling approach criteria is being developed to allow for descent to a lower altitude and then to visually fly to the airport for landing. This new, probably WAAS-GPS procedure offers the most opportunity for lower minimums at Roseburg. However, it is unclear what the design criteria for such a procedure will be. Additional follow-up is required.

- In terms of improving reliability during inclement weather, the threshold of significance may be greater than a 200-ft improvement in cloud ceiling.
- Local operators and pilots expressed a comfort threshold. Generally this did not extend far beyond a 200-foot lowering of the final altitude.

OPTIONS AVAILABLE

In addition to identifying and removing obstacles affecting approach minimums, there are two new approach options available: GPS-WAAS and the Extended Circling Procedure.

Lower the Circling Minimums

Determine what the critical obstructions are that set the circling minimums and determine if they can be removed. This process could reduce the circling approach minimums between 40 and 100 feet. In some cases, additional airport obstructions may be required (particularly for Category D).

GPS-WAAS

The criteria for developing a GPS-WAAS approach, obstacle clearances, and obstacle survey requirements are well established. The best case scenario involves reducing the obstacle clearance surface width so as to clear the terrain that currently restricts the procedure to circling-only. The preliminary review indicated that the improvement will be limited, but without additional survey is not ruled out.

Extended Circling Procedure

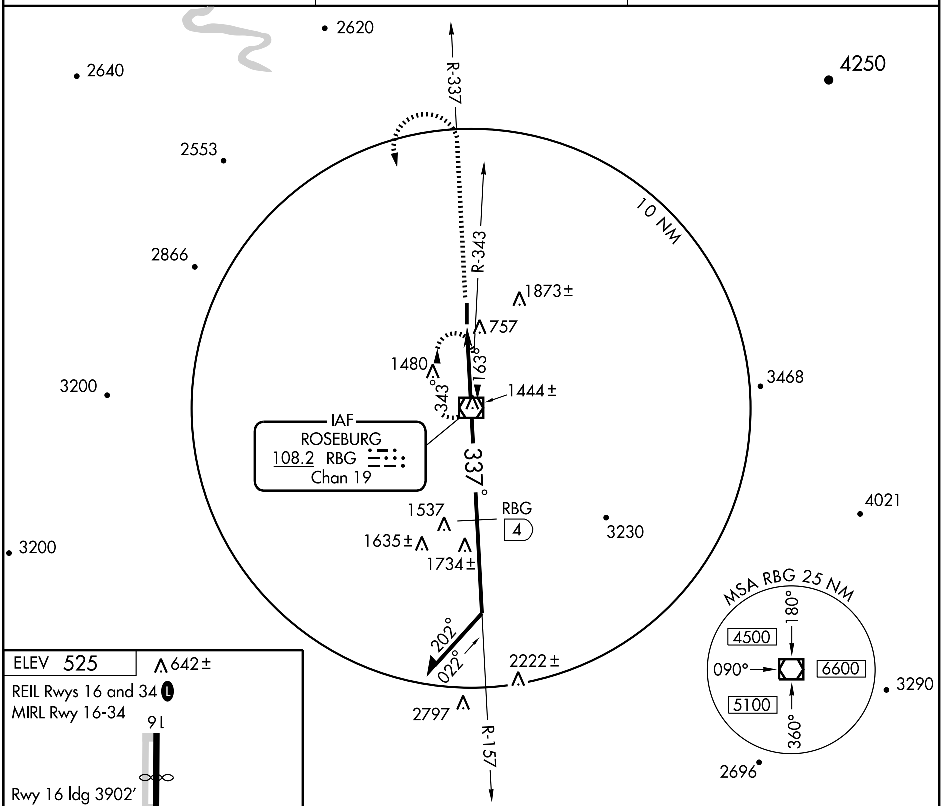
Process involves pushing the FAA to share the draft criteria and perform an initial review to see if any reduction is possible. FAA cooperation is needed to explore this option since all the information is held in house an has not been made publicly available. If they share the criteria and it looks promising, it may be possible to obtain a special authorization, possibly as a test case before the procedure is published. Depending on the criteria itself, it is possible that this option does not improve upon the existing approach.

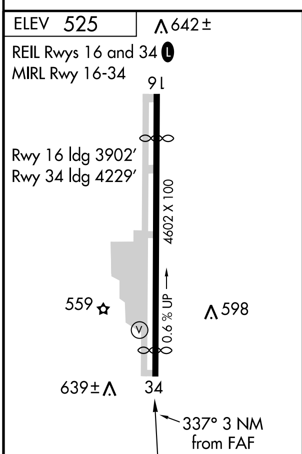
VOR-A
ROSEBURG REGIONAL (RBG)

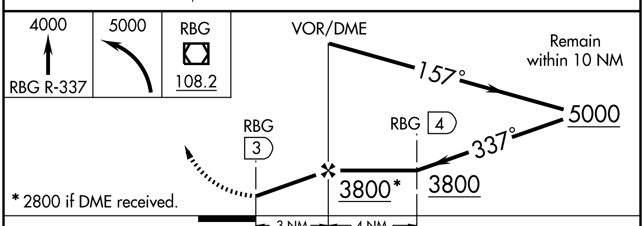
VOR/DME RBG 108.2 Chan 19	APP CRS 337°	Rwy ldg N/A TDZE N/A Apt Elev 525

T, A NA — Circling not authorized east of Rwy 16-34.	MISSED APPROACH: Climb to 4000 via RBG R-337 within 15 NM; then climbing left turn to 5000 direct RBG VOR/DME and hold.

ASOS	SEATTLE CENTER	UNICOM
135.475	**121.4 239.0**	**122.8** (CTAF) L







FAF to MAP 3 NM					
Knots	60	90	120	150	180
Min:Sec	3:00	2:00	1:30	1:12	1:00

CATEGORY	A	B	C	D
CIRCLING	2600-1¼ 2075 (2100-1¼)	2600-1½ 2075 (2100-1½)	2600-3 2075 (2100-3)	
DME MINIMUMS				
CIRCLING	1740-1¼ 1215 (1300-1¼)	1740-1½ 1215 (1300-1½)	1740-3 1215 (1300-3)	1920-3 1395 (1400-3)

Figure 1

APP CRS	Rwy ldg	N/A
342°	TDZE	N/A
	Apt Elev	525

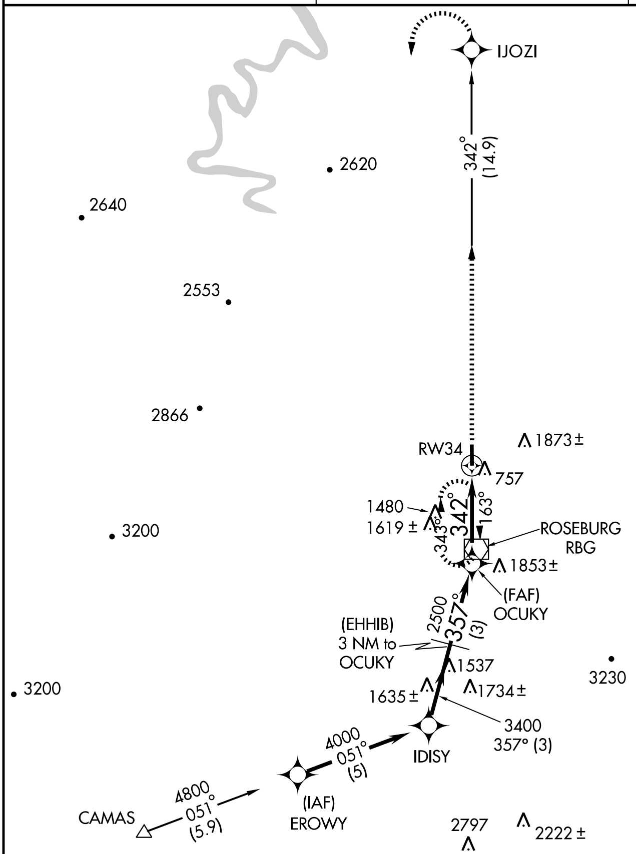
GPS-B
ROSEBURG REGIONAL (RBG)

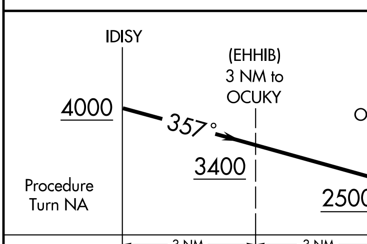
T
A NA

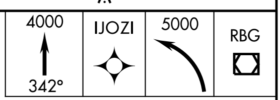
Circling not authorized east of Rwy 16-34.

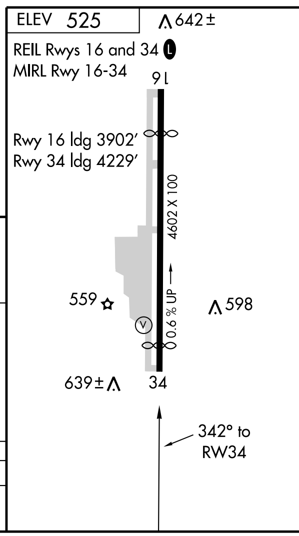
MISSED APPROACH: Climb to 4000 via 342° course to IJOZI WP; then climbing left turn to 5000 direct RBG VOR/DME and hold.

ASOS	SEATTLE CENTER	UNICOM
135.475	**121.4 239.0**	**122.8** (CTAF) L









CATEGORY	A	B	C	D
CIRCLING	1700-1¼ 1175 (1200-1¼)	1700-1½ 1175 (1200-1½)	1700-3 1175 (1200-3)	1920-3 1395 (1400-3)

Figure 2

NW-1, 08 JUN 2006 to 06 JUL 2006