

NATIONAL TRANSPORTATION SAFETY BOARD
Investigative Hearing

Alaska Airlines Flight 1282

Boeing 737-9, N704AL

Left Mid Exit Door Plug Separation in Portland, OR

January 5, 2024

Docket No.	SA-543
EXHIBIT	
2F	

**Operational Factors Group
Chairman's Factual Report -
Attachment 5 - Simulator Evaluation**
(20 Pages)

DCA24MA063

OPERATIONAL FACTORS

Attachment 5
Simulator Evaluation
April 15, 2024

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A. ACCIDENT

Operator: Alaska Airlines
Location: Portland, OR
Date: January 5, 2024
Time: Approximately 17:14 PDT

B. OPERATIONAL FACTORS GROUP

Starr Blum - Chairman
Operational Factors (AS-30)
NTSB

Marvin Frantz - Member
Operational Factors (AS-30)
NTSB

JP Wilson - Member
PDX Base Chief Pilot
Alaska Airlines

Dennis Vorpahl - Member
737 Line Check Airman
ALPA/Alaska Airlines

Ryan Iwasaki - Member
Senior Safety Pilot
The Boeing Company

Gary Pitchford - Member
Aircrew Program Manager
Cascadia CMO - FAA

C. SUMMARY

On January 5, 2024, about 1714 Pacific standard time, Alaska Airlines flight 1282, a Boeing 737-9, N704AL, returned to Portland International Airport (PDX), Portland, Oregon, after the left mid exit door (MED) plug departed the airplane leading to a rapid decompression. The airplane landed on runway 28L at PDX without further incident, and all occupants (2 flight crewmembers, 4 cabin crewmembers, and 171 passengers) deplaned at the gate. Seven passengers and one flight attendant received minor injuries. The flight was operated under Title 14 *Code of Federal Regulations (CFR)* Part 121 as a scheduled domestic passenger flight from PDX to Ontario, California (ONT).

D. SIMULATOR EVALUATION

Location: Boeing Sims Longacres Facility, Seattle WA
Date: April 10, 2024
Time: 0900 PST

Overall Objectives:

- Document simulator fidelity
- Document procedures for rapid depressurization and emergency descent from high altitude
- Document oxygen mask procedures
- Document establishing crew communications
- Document crew considerations for rapid depressurization from low altitude
- Document 737-9MAX and 737NG differences

Aircraft:

Sim MAX3 - Boeing 737-9
Sim 803 - Boeing 737-800 SFP NG
(No runs, documentation only)

Airport:

Portland International Airport (PDX)

Invited Participants:

Starr Blum (NTSB, Operations)
John Lovell (NTSB, IIC)
JP Wilson (Alaska Airlines)
Gary Pitchford (FAA)
Ryan Iwasaki (Boeing)
Dennis Vorpahl (ALPA)¹
Marc Henegar (ALPA)²
John Miller (Boeing)³
Alaska Airlines Simulator Operators

Initial Simulator Setup:

- ***First Demonstration Configuration***
 - Simulator motion: on
 - Altitude FL350
 - Mach .785
 - Weight ~ 163,000 lbs.
 - Fuel ~ 20,400 lbs.
 - MEL's⁴
 - RH Main Aft Fuel Boost Pump Inop (28-22-01A)
 - Foreign Documents Missing (25-70-01C)
 - FWD Galley Comp Latch or Quarter Turn (25-28-01D)

¹ Dennis Vorpahl was unable to attend due to prior commitment.

² Marc Henegar attended in place of Dennis Vorpahl

³ John Miller was not a part of the Ops group. Available to answer technical questions.

⁴ None of the MEL's should have been a factor on the accident.

- **Second Demonstration Configuration**⁵
 - Simulator motion: on
 - PDX Runway 28L Departure
 - Weight ~ 163,000 lbs.
 - Fuel ~ 20,400 lbs.
 - CG ~ 21.5 MAC
 - OAT - 10°C
 - V1 153, VR 154, V2 160
 - Flaps - 5
 - MEL's
 - RH Main Aft Fuel Boost Pump Inop (28-22-01A)
 - Foreign Documents Missing (25-70-01C)
 - FWD Galley Comp Latch or Quarter Turn (25-28-01D)
- Weather
 - **METAR KPDX 060153Z 18010G19KT
10SM BKN055 OVC150 10/03 A3020
RMK AO2 SLP226 T01000033 \$=**
- Left seat is Pilot Flying and Right seat is Pilot Monitoring
- Fuel freeze to be utilized during the entire simulator evaluation in order to repetitively simulate the accident flight

⁵ Based on Dispatch paperwork computed on 01/05/2023.

E. CHECKLISTS

1.0 Normal Checklist

737MAX Normal Checklist		Alaska®
Before Start	Descent	
Oxygen Checked, 100%, R,L	Recall. Checked	
Transfer Switches Normal	▲ FMC Route Verified L/R	
Seat Belt ON	▲ Landing Data VREF____, Minimums ____	
Window Heat ON	▲ (RNAV) RNP Value Set	
Pressurization AUTO, Set for ____	▲ Pressurization Set for ____	
▲ MCP (HDG), (ALT)	Start Switches ON	
▲ Altimeter ____ , ____ , Accel Height ____		
Terrain Display ON	Approach	
Auto Brake RTO	Altimeter ____ , ____	
▲ FMC Route Verified R,L	Seat Belt ON	
Parking Brake Set	PA Complete	
Rudder, Aileron Trim Free, Zero		
Prior to Push	Landing	
Ice Check Complete/Not Required	Speed Brake Armed, Green Light	
Fuel ____ Pumps ON, ____ , ____ Req'd	Gear Down, 3 Green	
Maint Log Aboard, Reviewed ____	Flaps ____ , Green Light	
Doors, Windows Closed, Locked		
TCAS, Transponder Set, ON	Shutdown	
Anti-Collision ON	Parking Brake Set	
After Start	Start Levers CUTOFF	
Start Switches. ON	Electrical APU / GROUND POWER	
Electrical Generators ON	Seat Belt OFF	
APU ON / OFF	Exit Lights OFF	
Probe Heat ON	Probe Heat AUTO	
Anti-Ice ON / OFF	Anti-Ice OFF	
Packs, Bleeds Packs AUTO, Bleeds Set	Packs, Bleeds Packs OFF / AUTO, Bleeds Set	
Recall. Checked	Anti-Collision OFF	
Before Takeoff	Start Switches. OFF	
PA Complete	Fuel Pumps. One ON / OFF	
Flight Controls Tops, Bottoms	Radar, Transponder OFF, STBY	
▲ FMC, Flaps ____ , ____ , Green Light	IRS OFF / NAV	
▲ Takeoff Data Set, Rwy ____	Quantities. Checked	
▲ V2 Set	(< -10°C) Outflow Valve 90% Closed	
After Takeoff	Secure	
Bleeds Set	Aircraft ground time greater than 90 minutes:	
Pressurization Checked	Window Heat OFF	
Start Switches. ON / OFF	Electric Hyd Pumps OFF	
Gear Up	Packs OFF	
Auto Brake OFF	HGS. Stowed	
Flaps Up, No Lights	FDAS Switch. OFF	
	APU, Fuel Pumps ON / OFF	
	GRD Power (if available). ON	
	Battery. ON / OFF	

Re-accomplish relevant portions of the Departure or Arrival/Approach Setup and Briefing. Then re-accomplish appropriate ▲ checklist items.

2.0 Quick Reference Checklist

QUICK REFERENCE CHECKLIST

737MAX

Runaway Stabilizer		
1 Control Column.....	Hold firmly	
2 Autopilot (if engaged).....	Disengage	
3 Autothrottle (if engaged).....	Disengage	
4 Control Column and Thrust Levers.....	Control aircraft pitch attitude and airspeed	
5 Main Electric Stabilizer Trim	Reduce control column forces	
6 If the runaway stops after autopilot is disengaged: Do not re-engage autopilot or autothrottle.		
■ ■ ■ ■ ■		
7 If the runaway continues after the autopilot is disengaged: STAB TRIM cutout switches (both).....CUTOUT If the runaway continues : Stabilizer Trim Wheel		Grasp & Hold
See QRH – E4.1		
CABIN ALTITUDE WARNING or Rapid Depressurization		
CABIN ALTITUDE		
1 Oxygen Masks & Regulators	ON, 100%	
2 Crew Communications.....	Establish	
3 Pressurization Mode Selector	MAN	
4 Outflow VALVE Switch.....	Hold in CLOSE until outflow VALVE indicates fully closed	
5 If cabin altitude is uncontrollable: Seat Belt		ON
If the cabin altitude exceeds or is expected to exceed 14,000 ft: PASS OXYGEN Switch.....		ON
►► Go to the Emergency Descent QRC checklist below		
■ ■ ■ ■ ■		
See QRH – E5.1		
Emergency Descent		
1 Emergency Descent.....		Announce
Advise the Cabin Crew, on the PA System, of the impending rapid descent using one of the following choices: "Ladies and Gentlemen, pull and use your oxygen masks and fasten your seat belt please." or, "Ladies and Gentlemen, please fasten your seat belts."		
2 Seat Belt	ON	
3 Without delay , descend to the lowest safe altitude or 10,000 ft, whichever is higher.		
4 START Switches	ON	
5 Thrust Levers	Reduce thrust to minimum or as needed for anti-ice	
6 Speed Brake.....	FLIGHT DETENT	
If structural integrity is in doubt, limit speed as much as possible and avoid high maneuvering loads.		
7 Target Speed	Mmo/Vmo	
8 ATC.....	Advise	
Note: If unable to establish immediate communications with ATC, squawk 7700.		
See QRH – E5.3		
LANDING CONFIGURATION		
1 Ensure proper aircraft landing configuration.		
■ ■ ■ ■ ■		
Airspeed Unreliable		
1 Autopilot (if engaged)	Disengage	
2 Autothrottle (if engaged)	Disengage	
3 F/D Switches (both).....	OFF	
4 Set the following gear up pitch attitude and thrust: Flaps Extended		10° and 80% N1
Flaps Up	4° and 75% N1	
See QRH – E6.1		
Passenger Evacuation		
On the Captain's command, FO read, Captain do.		
1 Parking Brake	Set	
2 Speed Brake.....	DOWN	
3 Flap Lever	40	
4 Pressurization Mode Selector	MAN	
5 Outflow VALVE Switch.....	Hold in OPEN until the outflow VALVE position indicates fully open	
6 If time allows, verify that the flaps are 40 before the Start Levers are moved to CUTOFF.		
7 Start Levers (both).....	CUTOFF	
8 Advise the cabin to evacuate: Use the PA to initiate evacuation by announcing: "EVACUATE, EVACUATE"		
9 Advise the tower.		
10 Engine and APU Fire Switches (all).....	Override & pull	
11 If an engine or APU fire warning is observed or indicated : Illuminated Fire Switch		Rotate to the stop and hold for 1 second
Time permitting, see QRH – E6.8		

Revision Date: 10/5/23

3.0 QRH Rapid Depressurization Checklist

	EMERGENCY	E5.1
CABIN ALTITUDE WARNING or Rapid Depressurization		
CABIN ALTITUDE Condition: One or more of these occur: - A cabin altitude exceedance - In flight, the intermittent Cabin Altitude / Configuration Warning Horn sounds or a CABIN ALTITUDE light illuminates at an aircraft altitude above 10,000 ft MSL.		
Note: The warning horn may be silenced by pressing the ALT Horn Cutout switch on the forward overhead panel.		
1 Oxygen Masks & Regulators ON, 100% 2 Crew Communications Establish		
3 Pressurization Mode Selector MAN 4 Outflow VALVE Switch. Hold in CLOSE until outflow VALVE indicates fully closed		
5 If cabin altitude is uncontrollable: Seat Belt ON If the cabin altitude exceeds or is expected to exceed 14,000 ft: PASS OXYGEN Switch ON		
▶▶ Go to the Emergency Descent checklist on page E5.3		
Continued from QRC		
6 If cabin altitude is controllable: Continue manual operation to maintain correct cabin altitude. When the cabin altitude is at or below 10,000 ft: Oxygen masks may be removed.		
7 Checklist Complete Except Deferred Items.		
Deferred Items		
Accomplish Approach Setup and Briefing (TPC).		
Descent Checklist		
Recall Checked ▲ FMC Route Verified R,L ▲ Landing Data VREF __, Minimums __ ▲ (RNAV) RNP Value __ Set		
▼ Continued on next page ▼		
12/19/22	737MAX QRH	E5.1

▼ **CABIN ALTITUDE WARNING or Rapid Depressurization**
continued ▼

▲ Pressurization **Move outflow VALVE switch to OPEN or CLOSE as needed to control cabin altitude and rate**

Note: Use momentary actuation of the outflow VALVE switch to avoid large and rapid pressurization changes.

START Switches ON

Approach Checklist

Altimeter. ____ / ____
Seat Belt. ON
PA Complete

At Pattern Altitude

Outflow VALVE Switch. . . Move to OPEN until outflow VALVE indication shows fully open to depressurize the aircraft

Landing Checklist

Speed Brake Armed, Green Light
Gear. Down, 3 Green
Flaps ____ , Green Light



LANDING CONFIGURATION

Condition: In flight, the steady warning horn sounds.

- 1 Ensure proper aircraft landing configuration.



4.0 QRH Emergency Descent Checklist

Alaska.

EMERGENCY

E5.3

Emergency Descent

Condition: One or more of these occur:

- Cabin altitude cannot be controlled when the aircraft is above 14,000 ft
- A rapid descent is needed

Note: If the Cabin Altitude Warning Horn sounds, it may be silenced by pressing the ALT Horn Cutout switch on the forward overhead panel.

- 1 Emergency Descent Announce
Advise the cabin crew, on the PA System, of the impending rapid descent using one of the following choices:
 "Ladies and Gentlemen, pull and use your oxygen masks and fasten your seat belt please."
 or
 "Ladies and Gentlemen, please fasten your seat belts."
- 2 Seat Belt ON
- 3 **Without delay**, descend to the lowest safe altitude or 10,000 ft, whichever is higher.
- 4 START Switches ON
- 5 Thrust Levers Reduce thrust to minimum or as needed for anti-ice
- 6 Speed Brake FLIGHT DETENT
 If structural integrity is in doubt, limit speed as much as possible and avoid high maneuvering loads.
- 7  Target Speed. Mmo/Vmo
- 8 ATC Advise
Obtain the area altimeter setting and minimum safe altitude.

Note: If unable to establish immediate communications with ATC, squawk 7700.

Note: Transition level for oceanic flight is 5500 ft.

Continued from QRC

Note: If in the Gunnison, CO (KGUC) area, see guidance on next page.

- 9 **When** approaching the level off altitude:
Smoothly lower the Speed Brake Lever to the DOWN detent and level off. Add thrust and stabilize on altitude and airspeed.
- 10 Crew Oxygen Regulators. NORMAL
Flight Crew must use oxygen when cabin altitude is above 10,000 ft. To conserve oxygen, position the NORMAL/100% selector to NORMAL.
- 11 Advise the cabin crew when the aircraft is at a safe altitude and oxygen masks may be removed.
- 12 START Switches ON / OFF
- 13 The new course of action is based on weather, terrain, obstacles, oxygen, fuel remaining and available airports. Use of long range cruise may be needed.



12/19/22

737MAX QRH

E5.3

F. RUN 1

Rapid Decompression at Cruise FL 350

Procedure

- Normal cruise flight at FL350
- Note cabin altitude and differential pressure at FL 350 prior to event
- Rapid Decompression and Emergency Descent procedures (**using QRC**)
- Observe callouts and checklist usage
- Note descent rate
- Note and photo-document any warning/caution lights
- Note any alarm bells
- Note and photo-document oxygen mask donning and establishing communication procedures
- Note and photo-document communication procedures with cabin crew

Notes
Normal flight at FL350. Cabin altitude was about 7000' and cabin differential was 7.8 psi. Rapid depressurization was indicated by the following: cabin pressure differential dropping to zero, cabin altitude gauge climbing, cabin altitude warning horn, Master Caution lights, CABIN ALTITUDE warning lights, and the PASS OXY ON light.
The crew removed their headsets, donned oxygen masks, then headsets and established communications by depressing the speaker, interphone, and cabin switches on the audio control panel. Interphone communications were by way of the lower half of the control wheel push to talk switch and/or the push to talk switch on the ACP to talk to each other.
Descent rate approximately 4,000 to 5,000 fpm
During the Emergency Descent checklist, a PA was made to the flight attendants and passengers.
Using the QRC and the QRH, the rapid depressurization checklist was conducted in 1:01 and the emergency descent in 2:52.

G. RUN 2

Normal takeoff and climb out on the CASCADE 2 RNAV DEP

Procedure

- Normal takeoff and climb from runway 28L at PDX
- Note cabin altitude and differential pressure prior to 14,000
- Time the event to the end of emergency checklists

- Rapid Decompression between 14,000' and 15,000'
- Rapid Decompression and Emergency Descent procedures **(using QRH)**
- Observe callouts and checklist usage
- Note descent rate
- Note and photo-document any warning/caution lights
- Note any alarm bells
- Note and photo-document oxygen mask donning and establishing communication procedures
- Note and photo-document communication procedures with cabin crew

Notes
Rapid depressurization was conducted climbing through 14,500'. The rapid depressurization was indicated by the following: cabin pressure differential dropping to zero, cabin altitude gauge climbing, cabin altitude warning horn, Master Caution lights, CABIN ALTITUDE warning lights, and the PASS OXY ON light. The crew donned oxygen masks and established communications by depressing the speaker, interphone, and cabin switches on the audio control panel. Interphone communications were by way of the lower half of the control wheel push to talk switch and/or the push to talk switch on the ACP to talk to each other. The QRH rapid depressurization and emergency descent checklist began about 12,000'. A PA was made to the cabin crew and passengers approximately the same time. After descending below 10,000' the crew took off the oxygen masks and reestablished headset communications by closing the right door on the oxygen mask stowage box and pressing the TEST/RESET switch. The flight attendants were called on the cabin interphone about 3000'. Using the QRH, the rapid depressurization checklist and emergency checklist were completed in 6:00.

H. PHOTOS



Figure 1. Cabin Altitude and Differential Pressure prior to Rapid Depressurization at FL350 (MAX)



Figure 2. Oxygen Mask in Stowage Box (MAX and NG)



Figure 3. Donning oxygen mask (both stowage doors open) (MAX)



Figure 4. Donning the oxygen mask (MAX)



Figure 5. Establishing communication on the audio control panel (MAX)



Figure 6. MASTER CAUTION and CABIN ALTITUDE Warning lights (MAX)



Figure 7. Reestablishing communications to headset (MAX)



Figure 8. B-737 NG Audio Control Panel (note mask/bloom switch)



Figure 9. Oxygen mask mock-up trainer for B737 MAX and B737 NG.

I. NAVIGATION CHARTS

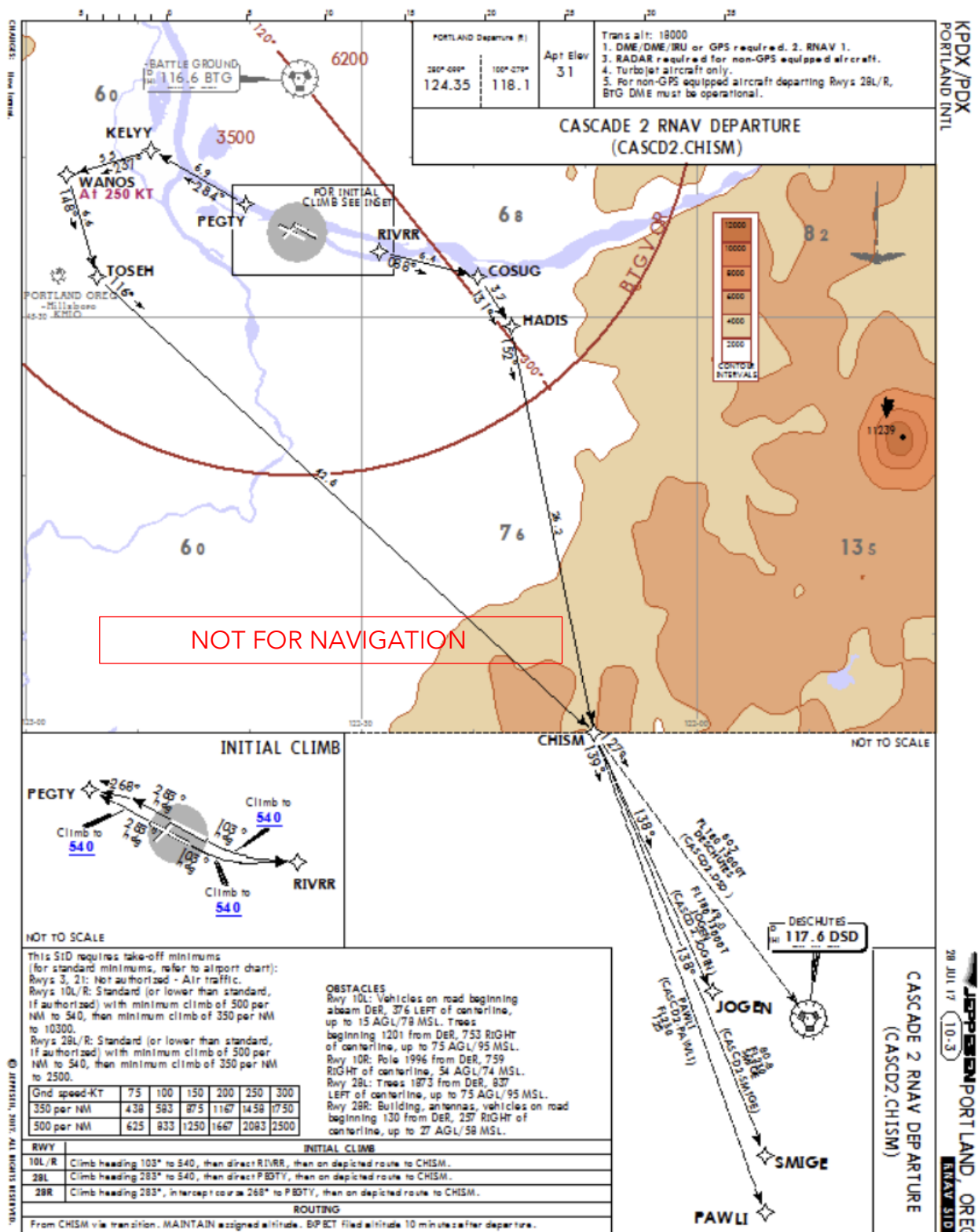


Figure 10. PDX CASCADE 2 RNAV Departure: Courtesy of Jeppesen

KPDX/PDX
PORTLAND INTL

JEPPesen
2 OCT 20 11-4

PORTLAND, OREG
ILS or LOC Rwy 28L

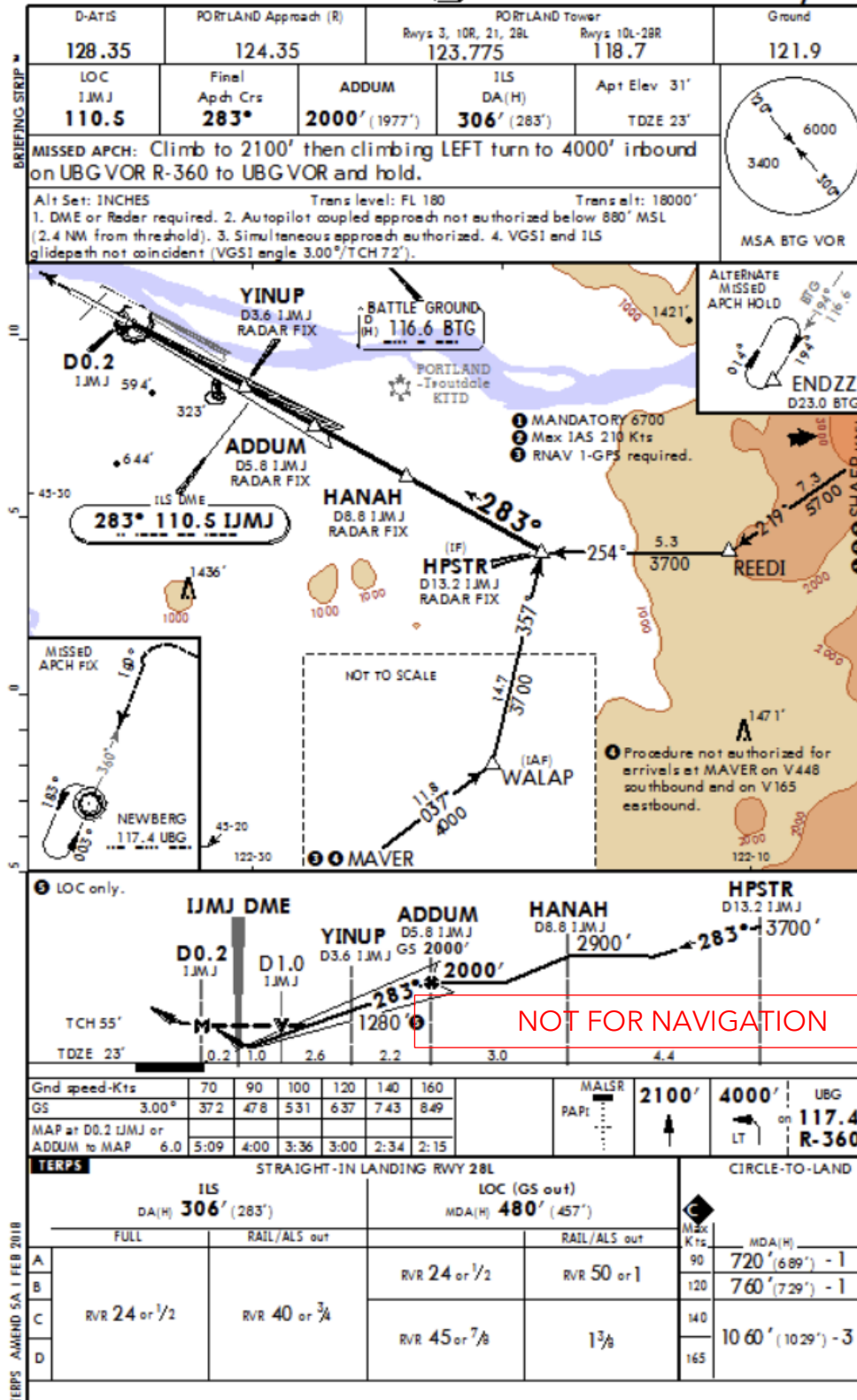


Figure 11. PDX ILS RWY 28L Approach Chart: Courtesy of Jeppesen