

AC 120-91A: Airport Obstacle Analysis

Presented by: FLIGHT STANDARDS SERVICE

By: AFS-400

Date: March 10, 2022

Airport Obstacle Analysis

March 10, 2022



**Federal Aviation
Administration**



PURPOSE

- This AC describes acceptable methods and guidelines (i.e. Takeoff and Initial Climb-out Airport Obstacle Analysis)
- Describes Engine-Out Procedures (EOP)
- Complies with the intent of regulatory requirements of 14 CFR Part 121 & Part 135
- Two methods for the development of Engine-Out Procedures





APPLICABLE REGULATIONS

- Sections 121.177, 121.189, 135.367, 135.379, and 135.398
- The takeoff flightpath must meet the specified obstacle clearance requirements in the event of an engine failure.





EOP DEVELOPMENT GUIDELINES

- **Derived from extensive FAA and industry experience.**
 - Similar methods used by the industry for over 13 years as a DRAFT Document (AC 120-OBS).
- **Signed by AFS-1 on May 5, 2006.**
 - Applies to operations conducted under Part 121 and operations of large transport and commuter category airplanes conducted under Part 135 and Part 91K.
 - Concepts encouraged for all Part 91 operations.





TYPES OF PROCEDURES

- **Public IAPs**: 14 CFR Part 97 (Regulatory), TERPS, Flight Checked>AFS-1.
- **Special IAPs**: Orders 8260.19 and 8260.60 (Enabled), TERPS, Flight Checked>AFS-400.
- **SIDs, STARs**: TERPS, Flight Checked> National Flight Data Digest (NFDD).
- **Chartered Visual Flight Procedures (CVFPs)**: NFDD.
- **Engine-Out Procedures (EOPs)**: Developed by Operator, Accepted By POI.





WHY AC 120-91 WAS DEVELOPED

- 14 CFR Part 25 provides requirements for establishing the Airplane Flight Manual (AFM) performance data.
- 14 CFR Part 25 provides detailed instructions for determining **vertical** obstacle clearance requirements.
- 14 CFR Part 25 offers **little** guidance on the **lateral** or horizontal clearance requirements.





OEI CRITERIA - VERTICAL

FOR TWO ENGINE TURBOJET AIRCRAFT

- **14 CFR Part 25:** Min *Gross* Flight Path: 2.4%
- **14 CFR Part 25:** Min *Net* Flight Path:
 - $2.4\% - 0.8\% = 1.6\%$ (62.5:1 Slope)
- **14 CFR Part 121.189.D (2):**
 - *Net* Flight Path must clear all obstacles by 35 feet vertically.

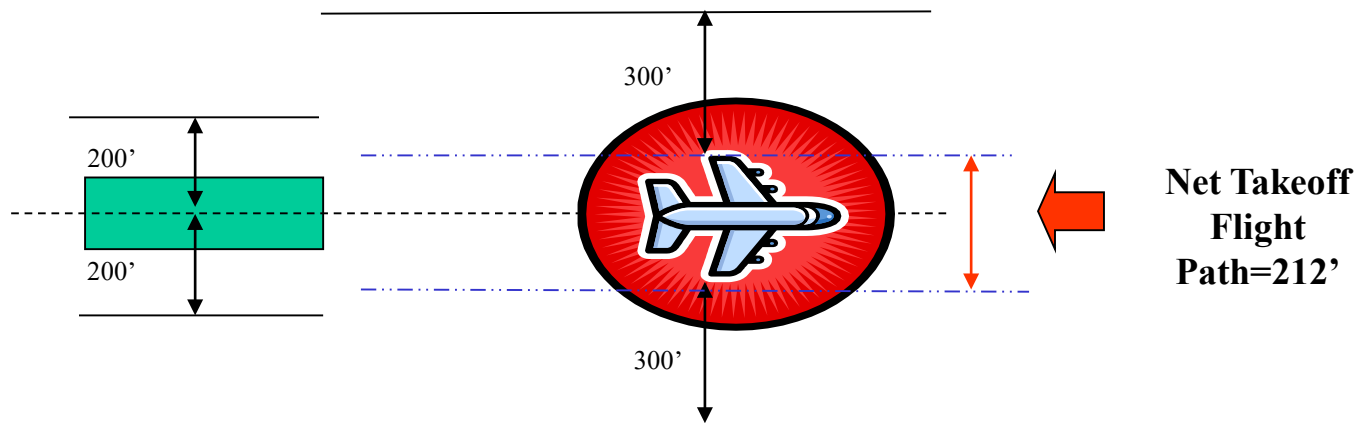




One-Engine Inoperative, Vertical (CFR)



14 CFR Part 121.189 (Some Major U.S. Carriers)





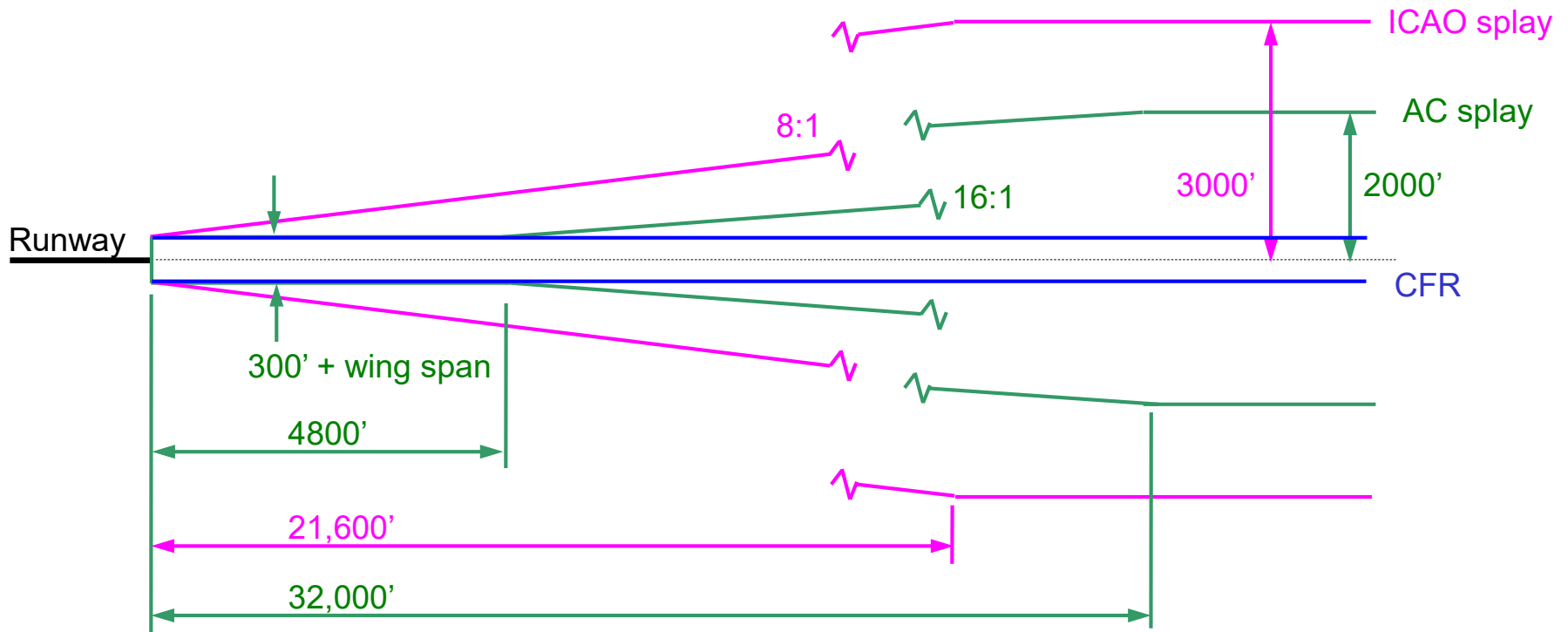
OEI CRITERIA: HORIZONTAL

- **AC-120.91A** (Most Major US Carriers)
 - Incorporates best industry practices to provide an operationally realistic horizontal clearance plane.
 - 16:1 'Splay' reaching maximum +/- 2000'
- **ICAO** (Some Major US Carriers and CFR 129)
 - 8:1 'Splay' reaching maximum +/- 3000'



OEI OBSTACLE EVAL CRITERIA

One-Engine Inoperative, Horizontal (FAR / AC / ICAO)





OBSTRUCTION EVAL (OE) CRITERIA

All-Engines Operating (OE Criteria)

- **FAA Order 8260.3 (TERPS)**
 - Various horizontal and vertical protection surfaces
 - Vertical surface: 200 Ft/Nm
 - >Obstacle Identification Surface (OIS, Net Surface) of 40:1
 - Horizontal surface typically ‘splays’ at a 15 deg angle, typical maximum +/- 2 Nm





TERPS CRITERIA vs ONE-ENGINE-INOPERATIVE (OEI) REQUIREMENTS

- **SIDs or DPs:** TERPS or ICAO PANS-OPS based on Normal (All Engine) Operations
 - Independent and Exclusive
- **EOPs** Do Not need to meet TERPS requirements
 - TERPS does not assure that OEI obstacle clearance requirements are met



TERPS CRITERIA vs OEI REQUIREMENTS (CONT'D)

- **TERPS:** Uses All-Engines-Operating Climb Gradients to an altitude in a Linear fashion
 - OEI Airplane Performance Flightpaths are Segmented
- **TERPS:** Standard of 200 Ft/NM unless greater needed
 - Operators Must comply with 14 CFR requirements
 - Differences between TERPS and OEI criteria

NOTE: An Engine Failure during Takeoff is a Non-normal Condition, and therefore takes precedence over noise abatement, Air Traffic, SIDs, DPs, and other normal operating considerations.



EOPs ARE NOT

- **EOPs are NOT:**
 - TERPS Or PANS-OPS Criteria
 - Promulgated under CFR Part 97
 - “Flight Checked” routinely, except to validate course guidance & NAVAID coverage
 - “FAA Approved” (although the development process may be) they are “Accepted”
- **EOPs do NOT:**
 - Provide Takeoff Data
 - Provide an ATC departure procedure





WHAT EOPs ARE

- Utilize 14 CFR performance requirements and concepts
- May increase allowable Pax/Cargo load and safety margins
- Provide safe, standard, and repeatable “escape routing” (where necessary)
- Developed by the Operator, a contractor, or commercial source for airport/runway analysis
- At the discretion of POI and/or Operator, validated via simulator to evaluate cockpit workload and control speed characteristics





ENGINE – OUT DEPARTURE PROCEDURE DEVELOPMENT

- Should consider that engine failure could occur at Any Point on the departure routing
- Use an EOP route in the event of an engine failure on takeoff
- Obstacles along this track are used to determine the Maximum Allowable Takeoff Weight for that runway





OBSTACLE CONSIDERATIONS

- Use the best and most accurate available obstacle data for a particular airport at the time of analysis
 - Frangible structures
 - Indeterminate objects (objects without recorded height; e.g. trees)
 - Operators shall take into account local temporary or transient obstacles





SOURCES OF OBSTACLE DATA

NOS Airport Obstruction Chart (OC)

- FAA Form 5010
- Topographical Quadrangle Charts
- Jeppesen/Lido Departure & Approach Charts
- National Flight Data Digest
- Low Altitude Instrument Approach Charts (DoD)
- Aeronautical Information Publication (AIP)
- ICAO Type A/B/C Charts (TPC)
- USGS 3 Arc Second Terrain Data
- USGS 1 Arc Second Terrain Data
- Digital Vertical Obstacle File (DVOF)
- Digital Terrain Elevation Data (DTED)
- National Geodetic Survey (NGS)
- Area Navigation Approach Survey (ANA)
- NOTAMs





TAKEOFF SEGMENT TERMINATION

- The end of the Takeoff Segment/Flightpath is considered to occur when:
 - Reaching the MCA or MEA; or
 - Able to comply with en route obstacle clearance requirements; or
 - Reaching the MVA.
- When determining the *Limiting* Takeoff Weight...the Obstacle Analysis should be carried out to the end Takeoff Segment defined above.





METHODS OF ANALYSIS

- The Net Takeoff Flightpath must clear all obstacles by 35 feet vertically or 200/300 feet laterally
- This AC focuses on Two methods which may be used to identify and ensure adequate clearance of critical obstacles:
 1. The Area Analysis Method
 2. The Flight Track Analysis Method





AREA ANALYSIS METHOD

- Defines an Obstacle Accountability Area (OAA)
- The **minimum width** of the OAA is 200 feet within airport boundaries / 300 feet outside airport boundaries on each side of the Intended Track
- The **maximum width** of the OAA is 2,000 feet on each side of the Intended Track.



OAA: STRAIGHT OUT DEPARTURES

APPENDIX 1. OBSTACLE ACCOUNTABILITY AREA

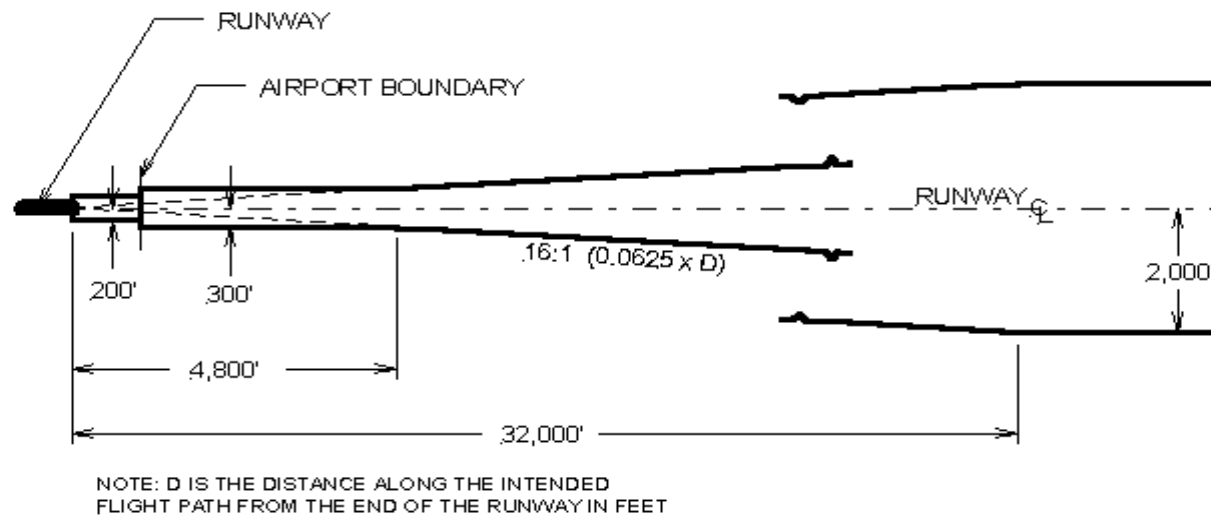
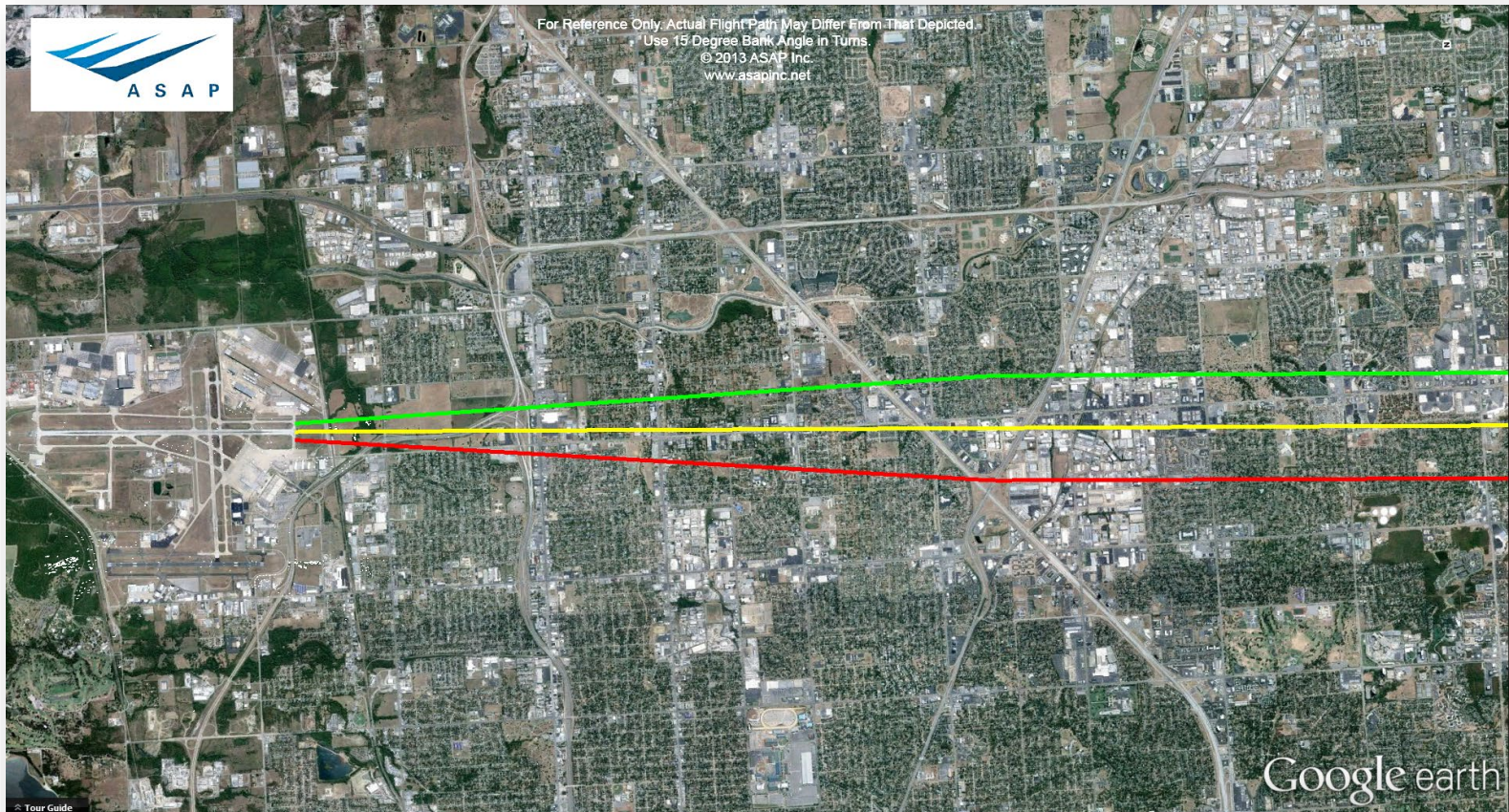


FIGURE 1. STRAIGHT-OUT DEPARTURES

AREA ANALYSIS

STRAIGHT-OUT DEPARTURE





AREA ANALYSIS METHOD (cont'd)

- During **Turns** the following criteria apply:
 - The Initial Straight Segment...described above
 - The width of the OAA at the beginning of the Turning Segment is the greater of:
 - 300 feet on each side of the Intended Track
 - The width of the OAA at the end of the Initial Straight Segment
 - The Maximum Width of the OAA is 3,000 feet on each side of the Intended Track.



OAA: TURNING DEPARTURES

APPENDIX 1. OBSTACLE ACCOUNTABILITY AREA

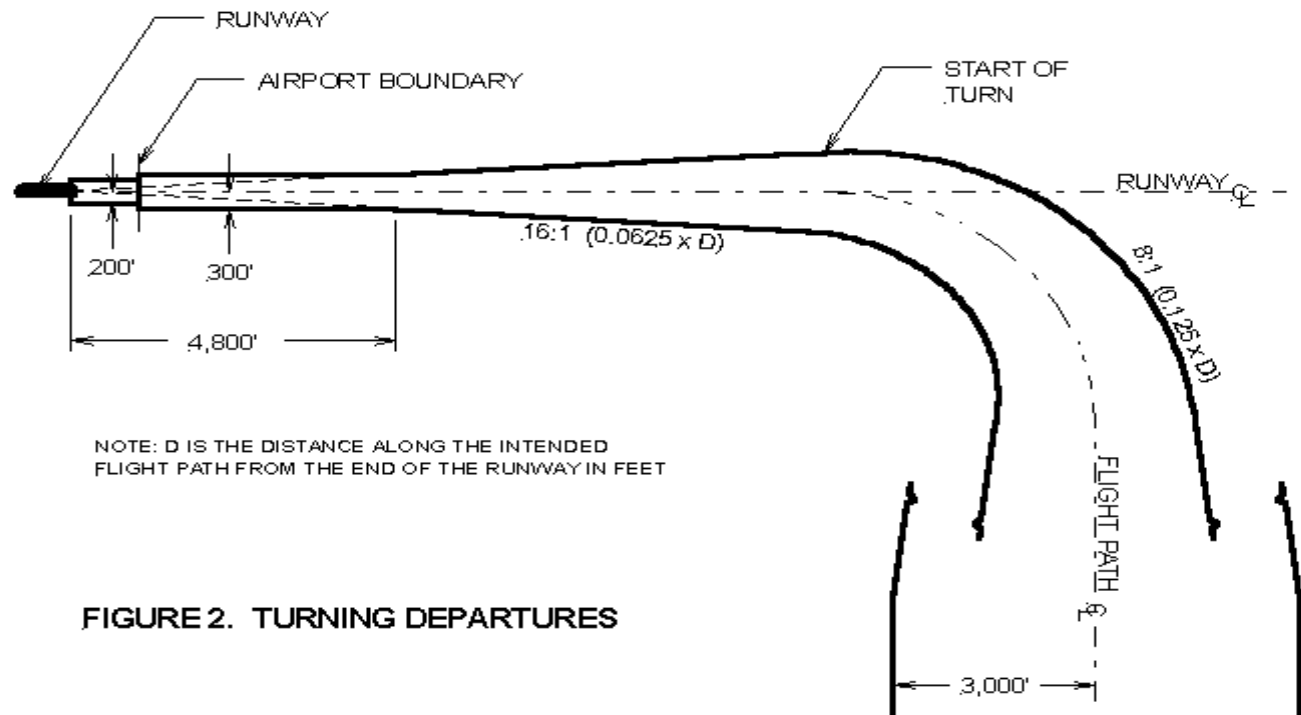
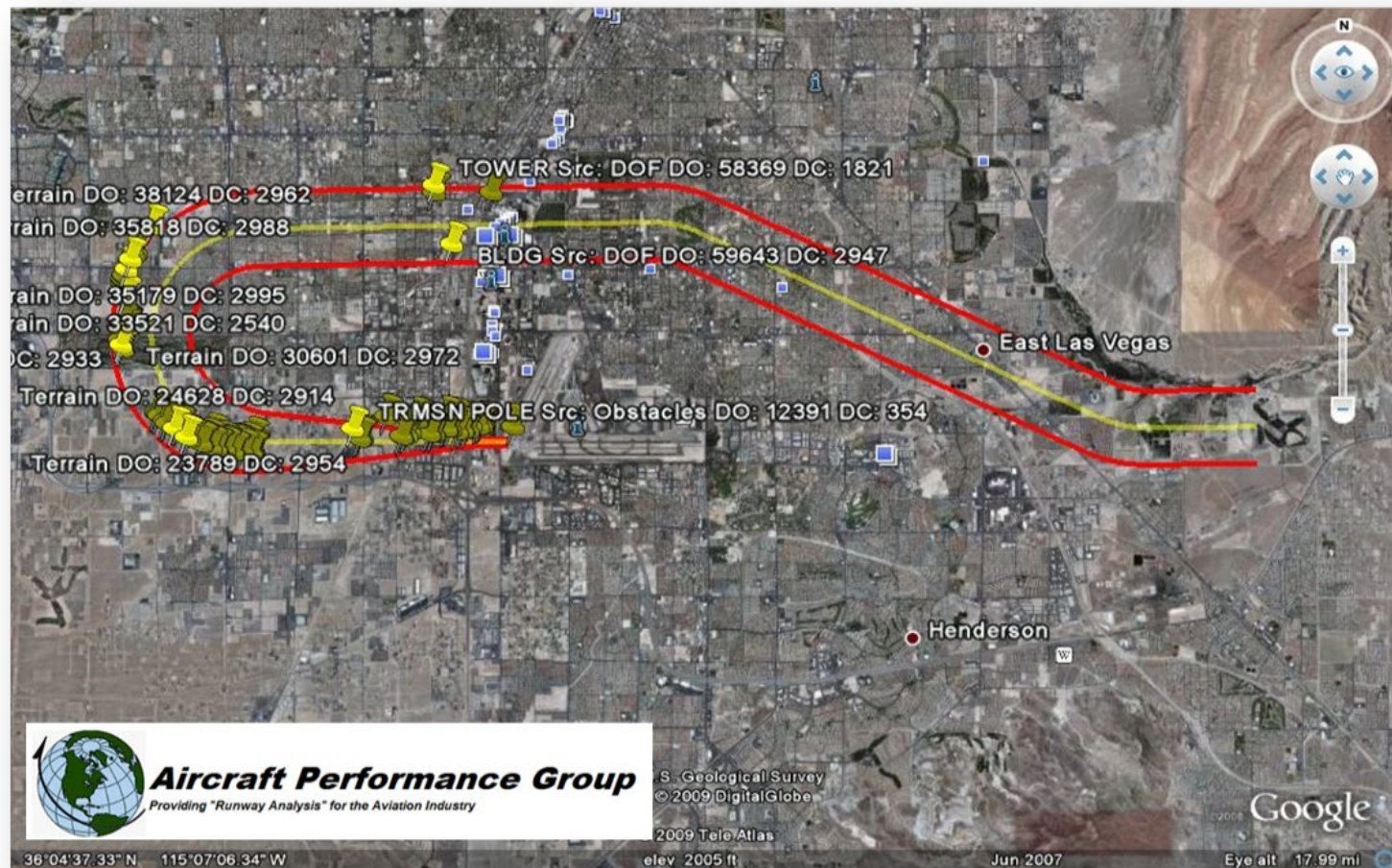


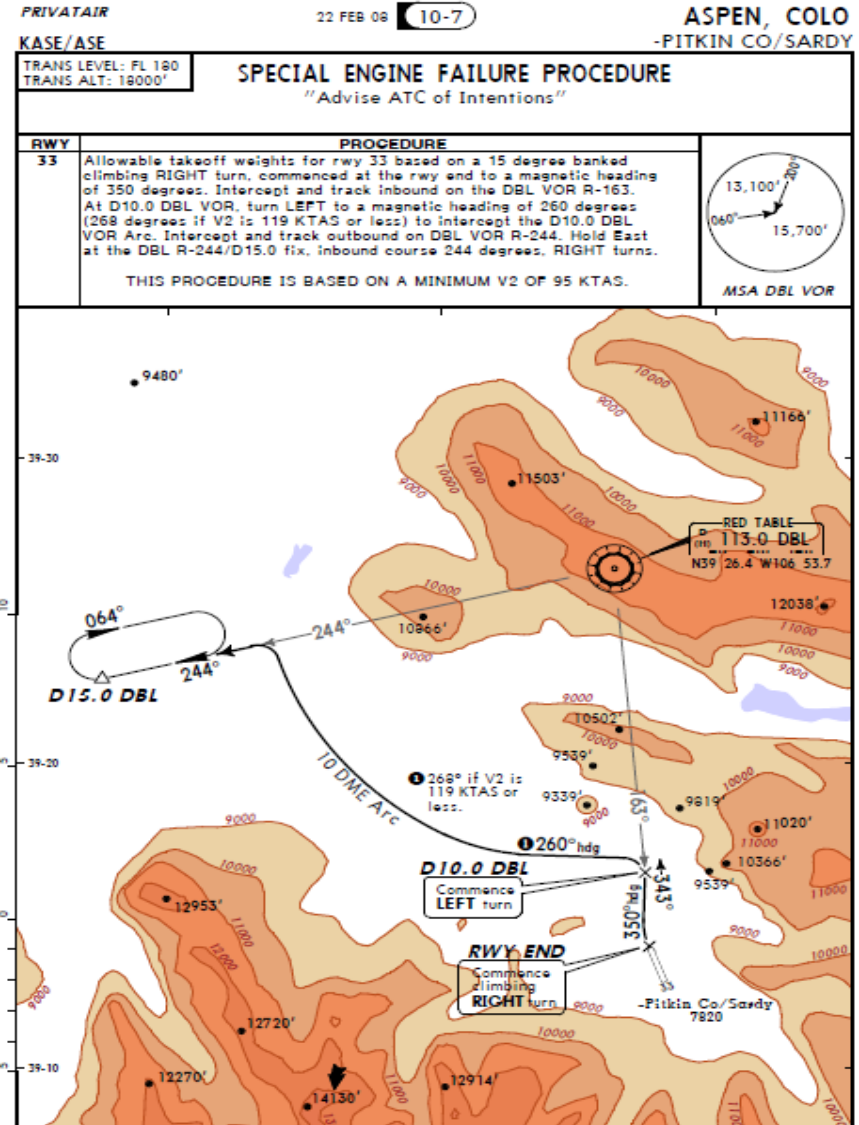
FIGURE 2. TURNING DEPARTURES

AREA ANALYSIS TURNING DEPARTURE



AREA ANALYSIS METHOD

(KASE) Aspen – Pitkin RWY 33 “Special Engine Failure Procedure”





FLIGHT TRACK ANALYSIS METHOD

- Involves analyzing the Ground Track of the flightpath.
- Alternative means of defining the OAA is based on the navigational capabilities of the aircraft.





FLIGHT TRACK ANALYSIS METHOD (cont'd)

- Three factors that the Operator must consider in performing a Flight Track Analysis are:
 - Pilotage In Turns
 - Winds
 - Course Guidance





COURSE GUIDANCE

- Operators may take credit for Available Course Guidance
- Allowance for ground-based course guidance:
 - Localizer (LOC)—plus/minus 1.25 Degree Splay
 - VOR—plus/minus 3.5 Degree Splay
 - ADF—plus/minus 5 Degree Splay
 - DME Fix—plus/minus 1 Minimum Instrument Display Increment but not less than plus/minus 0.25 NM.





COURSE GUIDANCE (cont'd)

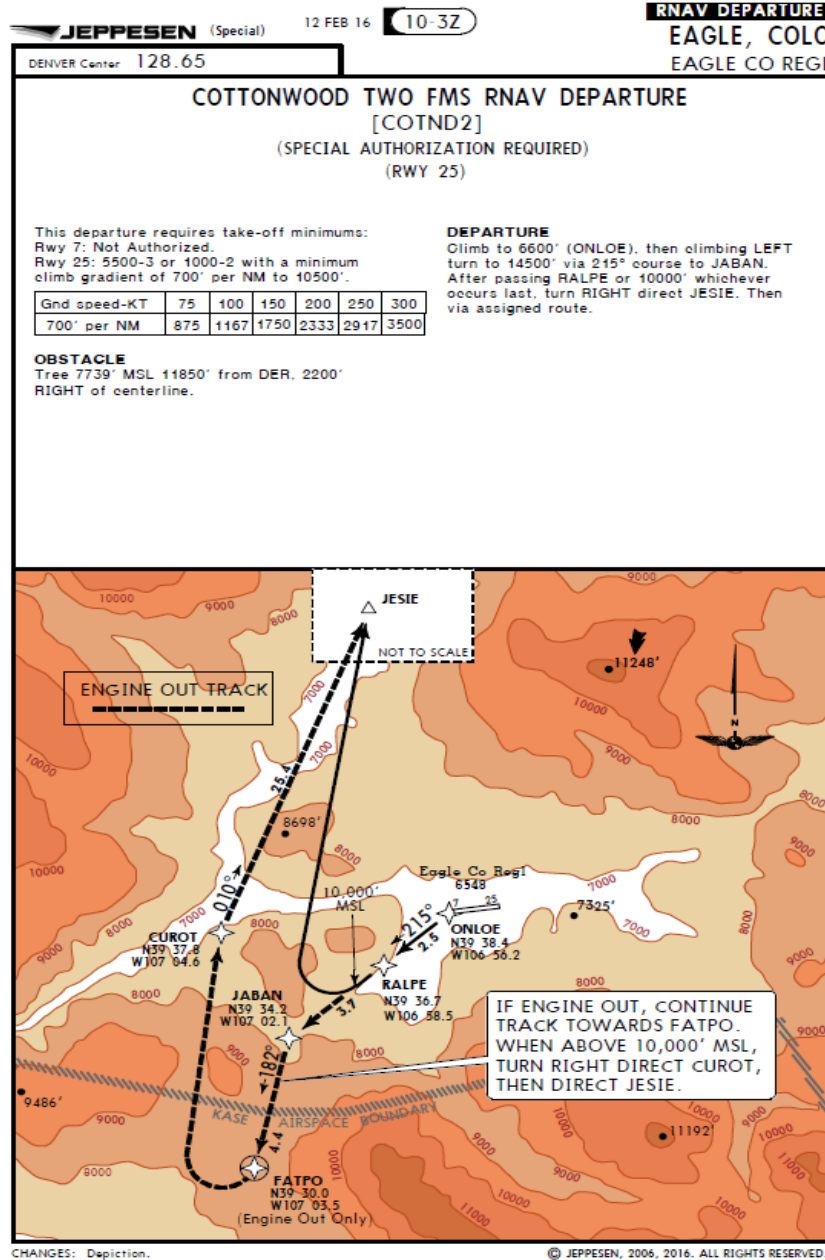
- Airplane performance-based area navigation capabilities (details yet to be defined) Must be retrievable from database
- Area Navigation refers to a system that permits airplane operations on any desired course...
- Minimum allowance is the system's demonstrated accuracy

NOTE: “Under no circumstances can the OAA half-width be reduced to less than the regulatory minimums of 200 feet within the airport boundaries and 300 feet after passing the boundaries.”

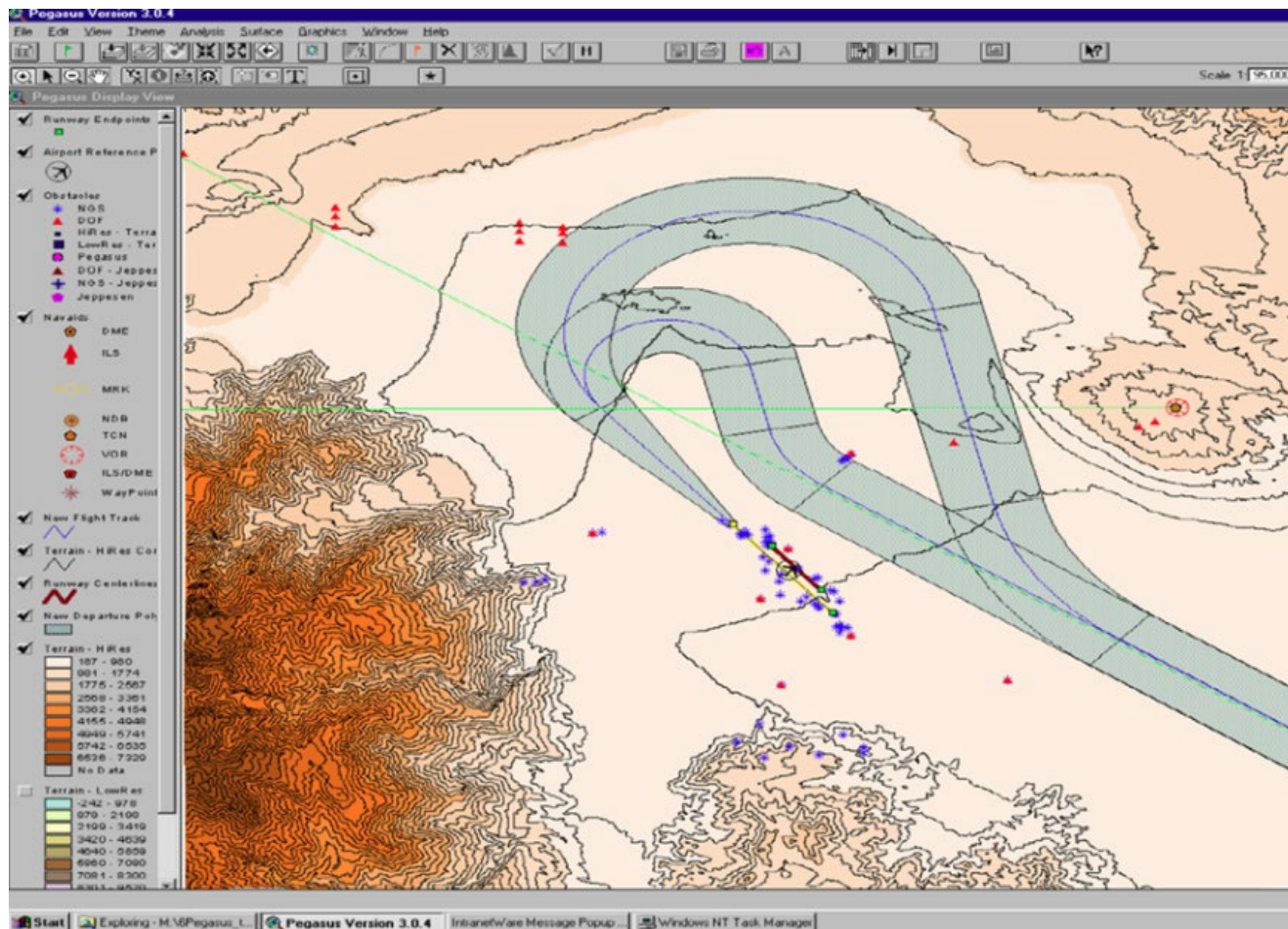


Course Guidance (cont'd)

(KEGE) Eagle County Cottonwood FMS RNAV RWY 25 Departure "Special"



COURSE GUIDANCE (cont'd)







VISUAL COURSE GUIDANCE

- Visual Ground Reference Navigation is another form of course guidance
- To laterally avoid obstacles by visual reference can be *Very* precise
- Must continuously determine and maintain the correct flightpath
- Procedure should be well defined





VISUAL COURSE GUIDANCE (cont'd)

- An **Unambiguous** written and/or pictorial description of the procedure must be provided for crew use
- The limiting environmental conditions must be specified for the use of the procedure (e.g. wind, ceiling/vis, day-only, etc.)





ADDITIONAL CONSIDERATIONS

- AFM data must be used for OEI Takeoff Analysis
- Acceptable data in various sources
- Terrain and obstacles at certain airports may require a higher-than-standard acceleration/cleanup altitude to be used





FLIGHTCREW INFORMATION

- Flightcrew instructions
- Flight Operations Bulletins, revisions to selected Flightcrew Manuals, EOP Takeoff Charts, NOTAMS, or special ground or simulator training.
- Flightcrew Engine-out Briefings (Jeppesen 10-7 or equivalent)
- EOP routings and transition from ATC IFR departure to EOP routing is a critical crew coordination item





FLIGHTCREW INFORMATION (cont'd)

- At a **minimum** the Operator's Instructions should advise flightcrews of the following:
 - Speeds and bank angles required
 - Intended Track in case of engine failure
 - Flap retraction and thrust reduction initiation point (i.e., acceleration height).





MISSED APPROACHES, REJECTED LANDINGS, AND BALKED LANDINGS

- Parts 121 and 135 **Do Not** address One-Engine-Inoperative Missed Approaches or Rejected Landings
- The *Intent* is to identify the *Best Option* for a safe lateral ground track and flightpath to follow





MISSED APPROACH VS REJECTED LANDING

- A **OEI Missed Approach** can frequently be flown following the published missed approach procedure
- A **Rejected Landing** may require some other procedure and/or fight track





ASSESSMENT CONDITIONS FOR BALKED LANDING

- Begins at the end of the Touchdown Zone (TDZ)
- First one-third of the Landing Distance Available or 3,000 feet, whichever is less
- Operators may propose to use a different designation for a TDZ





SUMMARY

- Briefing describes AC-120-91A, *Airport Obstacle Analysis* (Published: 13 Jan 2020) in general terms
 - Takeoff and Initial Climb-Out Airport Obstacle Analyses and Engine Out Procedures
 - Delineates between TERPS Requirements and 14 CFR Requirements for Engine-Out Planning
 - Two Methods which may be used to identify and ensure clearance of Critical Obstacles:
 - 1.The Area Analysis Method
 - 2.The Flight Track Analysis Method





QUESTIONS AND COMMENTS

- **Flight Ops Group Contact Information:**
 - ian.spaudefaa.gov
or
 - christopher.p-ctr.jonesfaa.gov

