Transport Airplane Performance Planning Group/ACF/AFS-410

### Primary Part 25 Performance Subjects

Presented to: ACF October 2015

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Date: Sept 15, 2015



### **TAPP WG – Who are we?**

- Chartered through the FAA Aeronautical Charting Forum
- FAA & Industry Representation
  - NBAA
  - Society of Aircraft Performance and Operations Engineers (SAPOE)
  - Airlines & Aircraft Manufacturers
  - FAA (Operations, Procedures, Aircraft Certification)



## TAPP Objectives: <a href="https://www.faa.gov/tv/">https://www.faa.gov/tv/</a>

The Transport Aircraft Performance Planning Group videos -- definitive U.S. technical work on the major subjects covered. <u>Those include</u>:

- Eliminating confusion among
  - Pt 25 Certification requirements
  - 121, 135, 91 K and other operating rules
  - Complying with TERPS climb gradient requirements
  - Other lesser known complicated subject areas
  - Close in obstacles
  - Useable runway distance vs. declared distances
  - 142 centers & 135 operators misapplying rules



### **The Immediate Problem**

**Recurrent 135** class in 142 center taught to use OEI AFM data to determine allowed takeoff weight for all engines operating departure





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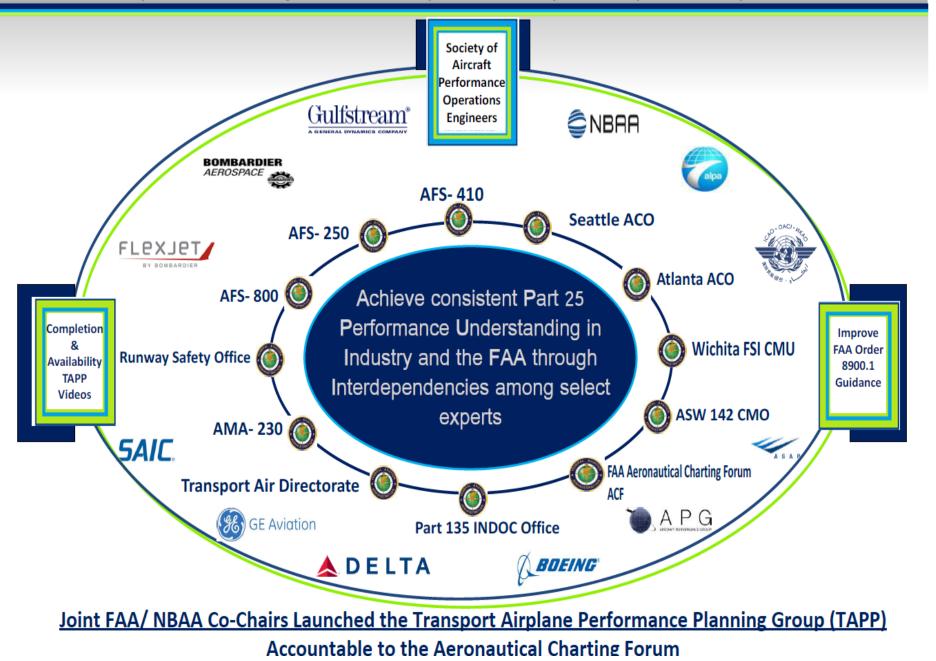


- Pilot/Operator understanding of certification & operating rules with respect to one-engine-inoperative (OEI) takeoff obstacle clearance
- Compliance with a climb gradient published on an instrument flight procedure
  - SID or ODP
  - Missed Approach





Federal Aviation Administration A proven track record of working across the FAA and Industry with established Interdependencies to improve FAA Part 25 Operations



### TAPP Proposal to Aviation Rule Making Advisory Committee

• Amend Task 1.B. of Preflight Preparation to to include additional performance objectives and limitations:

e. one-engine-inoperative takeoff obstacle clearance - use of the closein, and distant takeoff flight path data, transition segment data, and final segment flight path data to determine obstacle clearance with available obstacle data, or the use of airport runway analysis in determining takeoff weight limit required for obstacle clearance.

k. if applicable to the operating rules, minimum field length required at the destination and alternate airport, and the associated limit on maximum allowable takeoff weight.



# **Knowledge Gap Driving change**

 The TAPP has both anecdotal and documented evidence of a significant knowledge gap and misapplication of requirements for Part 25 aircraft operators that has persisted for over 30 years



# Current Examples of Knowledge Gap

- 142 faulty training to use OEI 2<sup>nd</sup> segment
- Misunderstandings within FAA inspector ranks leading to misapplication of performance reqs
- 142 schools requiring 60% rule at time of landing
- Lack of technically accurate training anywhere but in the 121 air carrier community
- FMS rwy length data contrary to declared distance reqs
- Failure to factor close in obstacles not covered by TERPS
- Misunderstanding flight test landing vs. operational factors



### Change PTS- Principles to Include in Training

- Departure Planning (Aspen)
- Understanding Declared
   Distances
- Wet Runway Takeoff
   Performance
- Effect of Slope on Takeoff
   Performance
- Divergent Departure
   Procedures
- Landing Distance
   Assessments

- One engine inoperative extraction procedures
- Use of AC 120-91
- Effects of grooved runways and PCV
- Use of "unbalanced" field calculations
- FMS data base potential shortcomings
- SID climb gradient requirements



# The Draft INFO to Address the Confusion

 The FAA is aware that inappropriate takeoff and climb performance training is being provided to operators and pilots of part 25 certificated turbine-powered airplanes. This InFO provides guidance to pilots and operators of these airplanes to correct misunderstandings and misuse of the part 25 airplane performance data...



# **INFO Supplement Example**

TERPS departure procedure design criteria begin with the assumption that the aircraft will cross the departure end of the runway (DER) at a height of 35 feet, and thereafter, maintain a minimum (standard) climb gradient of 200 feet per NM until the minimum IFR altitude is reached (see Figure 1).

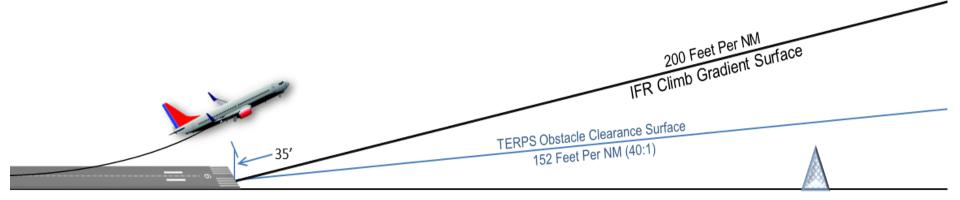


Figure 1 – Departure Procedure IFR Climb Gradient Surface – Standard Climb Gradient

The obstacle environment beyond the runway may require a climb gradient greater than 200 feet per NM to a specified altitude to achieve the required obstacle clearance as specified in TERPS (see Fig 2).



### Higher Than Normal SID Climb Gradient Requirement

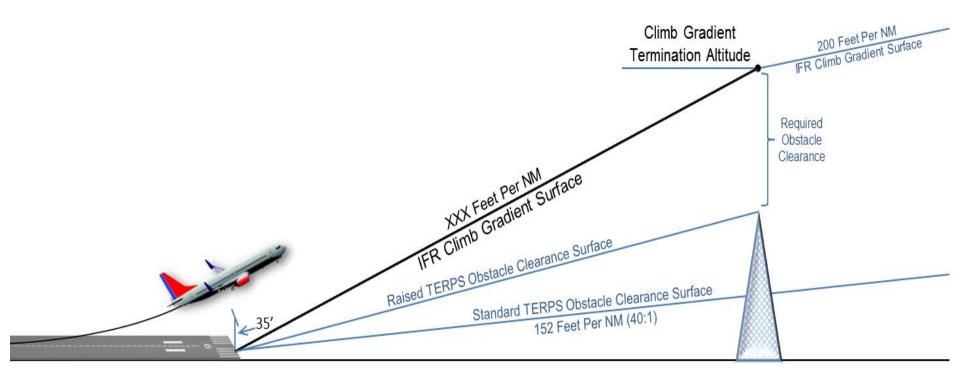


Figure 2 – Departure Procedure IFR Climb Gradient Surface – Higher Than Standard Climb Gradient



### **TAPP Produced 4 Major Videos**

- Planning for Takeoff
   Obstacle Clearance
- Declared Distances
- Wet Runway Takeoff
   Performance
- Landing Distance Assessment





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## 3 Major Subject Areas Impact Part 25 Aircraft Performance

- Part 25 Certification Requirements
- TERPS Regulatory Aircraft
   Performance Requirements
- 121/135 Regulatory Aircraft Performance Requirements



### Discussion

### and

### Questions

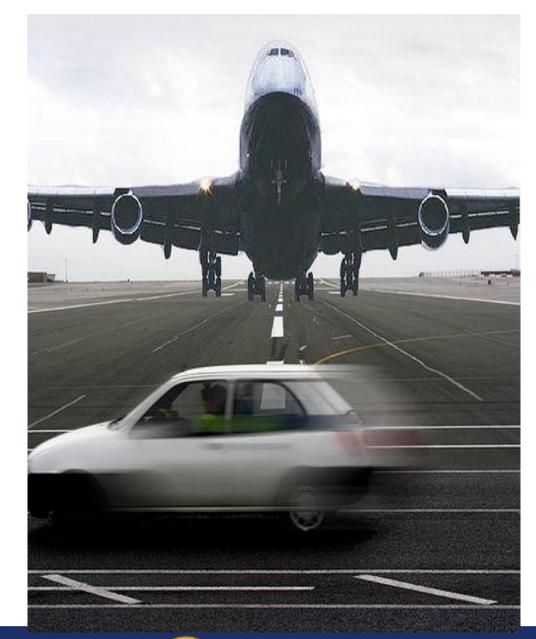




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### **EXTRA**

# **SLIDES**





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### Part 25 Takeoff Flight Path



- "Gross" Takeoff Flight Path = Demonstrated performance.
- "Net" Takeoff Flight Path = Incorporates regulatory reduction.
  - Two-engine airplanes: 0.8%
  - Three-engine airplanes: 0.9%

1,500 Feet (Minimum) Above Runway

Actual (Gross) Takeoff Flight Path 35 Feet



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### Part 135 Takeoff Obstacle Clearance Operating Rules

### §135.379 Large transport category airplanes: Turbine engine powered: Takeoff limitations.

(d) No person operating a turbine engine powered large transport category airplane may take off that airplane at a weight greater than that listed in the Airplane Flight Manual—

(2) For an airplane certificated after September 30, 1958 (SR422A, 422B), that allows a net takeoff flight path that clears all obstacles either by a height of at least 35 feet vertically, or by at least 200 feet horizontally within the airport boundaries and by at least 300 feet horizontally after passing the boundaries.

Identical to the Part 121 Rule for Turbine-Powered Transport Category Airplanes



### **OEI Climb Gradient**



#### Climb Performance Loss with Height:

- Thrust Lapse Rate Loss
- TAS Increase with Altitude

Initial 2<sup>nd</sup> Segment Climb Gradient



\*\*\*\*\*\*\*\*\*

# **Gradient vs. Flight Path**

The Part 25 OEI takeoff is not a constant gradient.

OEI takeoff flight path and net flight path slope downward with height gain.

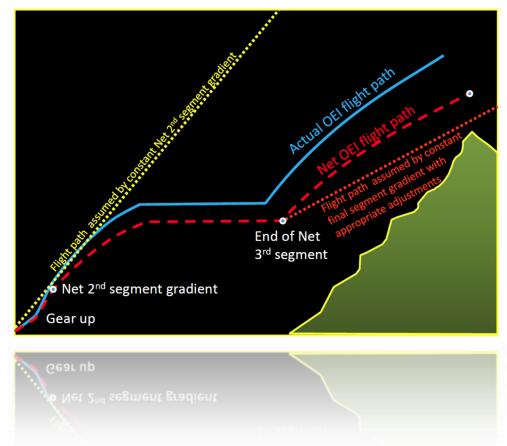
1<sup>st</sup>, 2<sup>nd</sup>, transition, & final segments flight path composed of individual segments, synthesized into complete path.

"Ad-Hoc" rise v. run obstacle clearance check does not account for:

Segmented flight path resulting from configuration/speed/thrust changes.

Rise v. Run acceptable only when changes configuration/speed/thrust are complete.

Final Segment





Many Part 25 Aircraft have no AFM all engine climb data beyond 1500 ft AGL because Part 25 does not require it

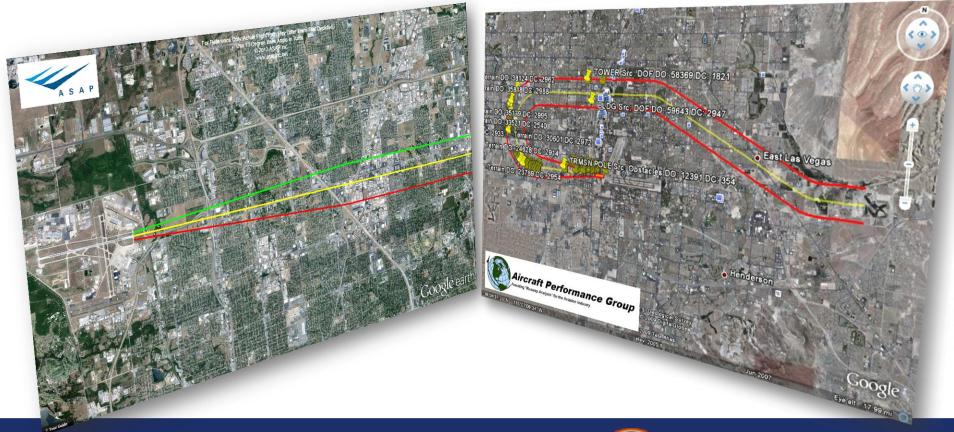


### PILOTS Generally best kept on a short leash.



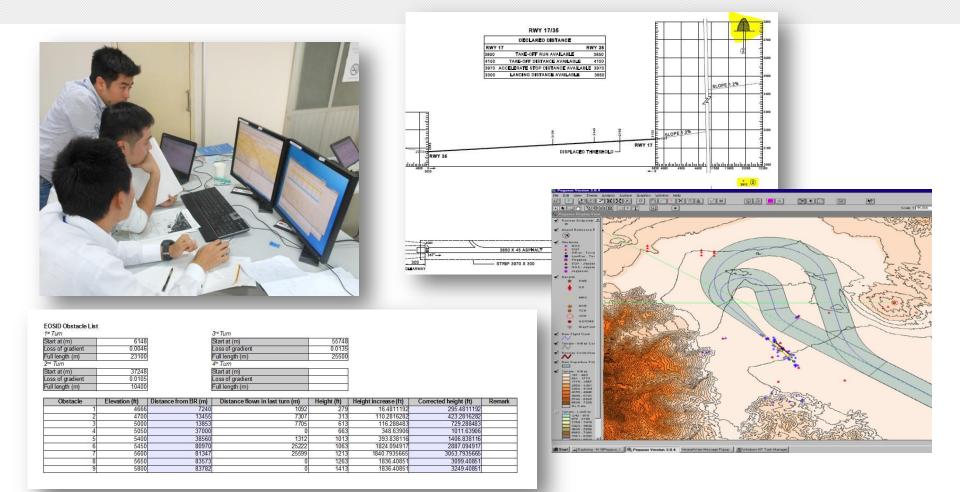
### AC 120-91 Airport Obstacle Analysis

Defines The Obstacle Assessment Area Where Obstacles Must Be Cleared Vertically By The Net Takeoff Flight Path





### **Performance Engineer**





### IFR Departure Procedures (SID & ODP)

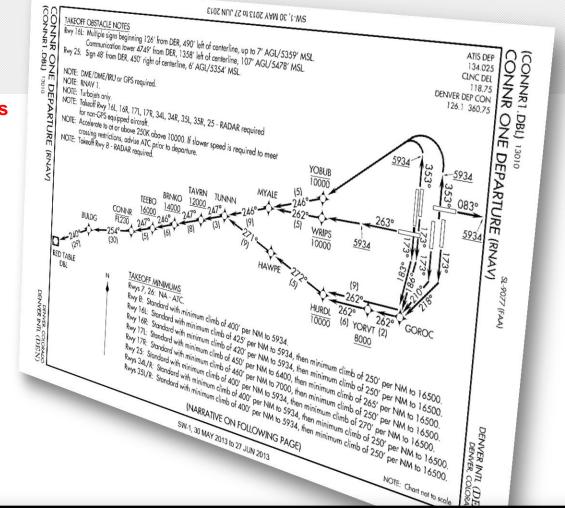
Assume normal aircraft operations – All engines operating.

SID climb gradient may be for:

- Obstacle clearance.
- Procedure criteria.
- NAVAID reception.
- ATC requirements.
- Airspace.

ODP climb gradient is for:

- Obstacle clearance.
- Procedure criteria.
- NAVAID reception
- Airspace.



Rwy 25: Standard with minimum climb of 400' per NM to 5934, then minimum climb of 270' per NM to 16500.





### **TAPP WG ACTIONS**



### **TAPP WG Performance Videos**

#### • 4 Videos:

- Planning for Takeoff Obstacle Clearance
- Declared Distances
- Wet Runway Takeoff Performance
- Landing Distance Assessment
- Video of TAPP WG workshop at NBAA BACE 2013
  - TAPP WG SME Q&A
- Hosted on NBAA's website:

#### http://www.nbaa.org/ops/safety/cli mb-performance/videos/

 Soon to be hosted on FAA TV's website

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Communications, Navigation &			5					
Surveillance (CNS) Environment International Operations Maintenance Part 125 Part 135 Safety	FAMInvalvy Transport Algebra Performance Planning Working Group (TAPP WO), intertend through the FAA denonated Chamble, each to improve folls and operative undentanding of transport arginane performance planning, and operational practices. The TAPP WO has begun this process by addressing long-standing userions and issues related to one-empirical-inoperative takeof Obstacke excidence planning. IFR departure procedure planning, landing distance assessment and user to https://brough-takends/orderstate/tableof-table.com/state/ with participation of subject matter operatin under the factor of the inoperative reformance empiricing, and IFR procedure devolvement with the goal of providing operators with the definitive explanation of the certification rules and their application to the operating rules in part 51 and pro 15.					RELATED RESOURCES           One Engine Incorrative Takeoff Planning and Climb Performance           Members of the NBAA Domesic Operations Committee have recently created an article that settlesses one argine mogenative takeoff and climb performance planning.           EAA Acconsuital Information Manual Section 52.3		
NBAA Top Safety Focus Areas						Section 5-2-8, revise covers Instrument De		
In Flight Safety	FAA Workshop on					(DP), Obstacle Depa	rture Procedures (ODP nent Departures (SID)	
Hangar and Ground Safety Professionalism in Business Aviation VLJ Training Guidelines Aviation Safety Reporting System Safety Statistics Human Factors	A 18AA2012; FAX Fight Standards Division presented a workshop on transport aligne performance planning. Hotel day AFS 1079 Michael Pay, Johnson and Standards Division groups, and the instance of the series of videos instance to advect software in the series of the series of videos intered to address to po-standing questions in the operator community regarding one-engine-inoperative taked obtack clearance. Earling running performance. Courtey of NBAA Member company Airca Defended to Michael Software Standards workshop including inomative FAX videos.					FAA AFS-110 Airport Obstacle Analysis Web Page. This FAA web page contains information on developing takeoff and initial climb-out airport obstacle analyses and in-flight procedures to comply with the takeoff limitation requirements of parts 121 and 133		
	Run time: 2:39:16				ſ			
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	Declared Distances	declared distances, the part 25 takeoff a significance of decl design standards. I distances during th video also cautions landing performance	pilots and operators ar It defines these distant k landing runway requir ared distances in meeti also discusses the app a ctual takeoff and lan pilots against overrelia e computations where I ed distances.	es and how they ements. It demon ng runway and air blicability of decla ding operation. Fi nce in FMS takeo	relate to strates the port red nally, the ff and		nimediately azine on your oid device!	



### TAPP on FAA/TV

### FAA TV: Planning for Takeoff Obstacle Clearance



## (www.faa.gov/tv)

#### Now Playing Planning for Takeoff Obstacle Clearance

July 30, 2015 | Running time 45:04

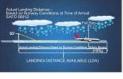
This video reviews the part 25 takeoff performance certification rules applicable to one -engine-inoperative (OEI) takeoff climb performance and obstacle clearance. It addresses the OEI takeoff obstacle clearance rules applicable to part 121 and part 135 operators and the FAA-approved means by which an operator ensures compliance. It compares these rules to the all-enginesoperating IFR takeoff requirements applied to Standard Instrument Departures (SIDs) and Obstacle Departure Procedures (ODPs). **Share This Video** <u>http://www.faa.gov/tv/?mediald=1131 (?</u> mediald=1131)



Landing Distance Assessment (?mediald=1134) Play Now



<u>Performance</u> (?mediald=1133) Play Now



Declared Distances (?mediald=1132)

Play Now



Planning for Takeoff Obstacle Clearance (?mediald=1131) Playing

AFS-400 Program Review August 2015

