Runway Length Calculations with SARLAT 2
Aircraft with Takeoff Weights less than 60,000 lbs

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Runway Design Mode

Objective: Estimate the unconstrained runway length required by a known aircraft fleet mix

Example: Runway Design Example

- Airfield elevation - 2132 feet
- Design temperature (mean of maximum temperatures of the hottest month of the year) - 86 degrees. Fahrenheit
- Runway grade - 0.4% (estimated due to sloping terrain)

Fleet Mix for Runway Design Example

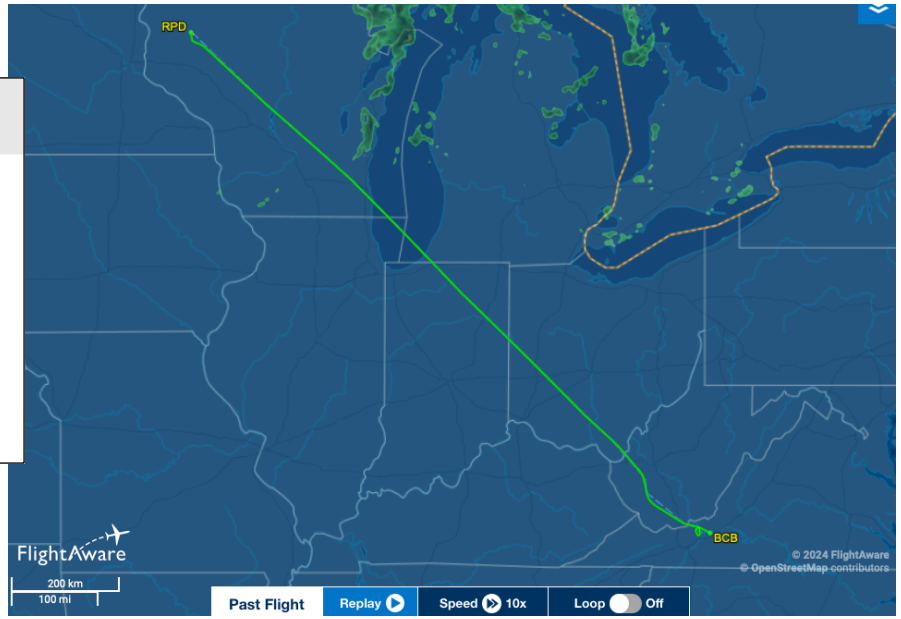
Aircraft	*Departures/ Arrivals*	*Useful Load (%)*	*Engine Type*
Cessna 172	*3000 / 3000*	*100*	*Piston*
Beechcraft King Air B350ER	*400 / 400*	*70*	*Turboprop*
Cessna Citation Latitude	*350 / 350*	*80*	*Jet*
Cessna 560XL	*400 / 400*	*80*	*Jet*
Bombardier Challenger 350	*350 / 350*	*70*	*Jet*

Obtaining Flight Records and Trip Length Data

- The fleet mix is a forecast of the types of aircraft expected to operate at the new airport
- The FAA has traffic counts at all NPIAS airports that can be used to estimate the trip lengths flown by each aircraft type
- TFMS-C is the FAA traffic management system - a real-time time system that stores and processes all flight plans filed by flights

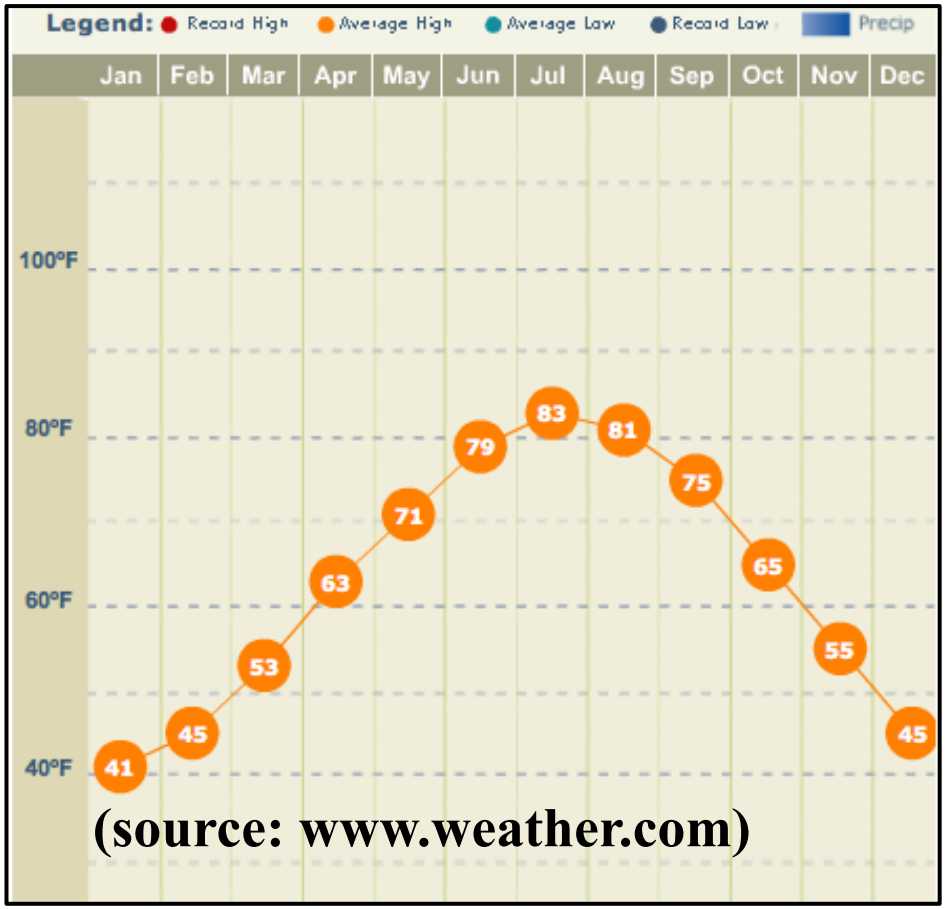
Flight Data

Speed	Filed: 540 mph
Altitude	Filed: 41,000 ft
Distance	Actual: 854 mi (Planned: 818 mi/Direct: 817 mi)
Route	AUGER J70 BAE DAIFE RGERS



Route data in TFMS filed by a corporate jet flying intoVirginia Tech

Obtaining Airport Design Temperature (Mean Maximum Daily Temperature of the Hottest Month of the Year)

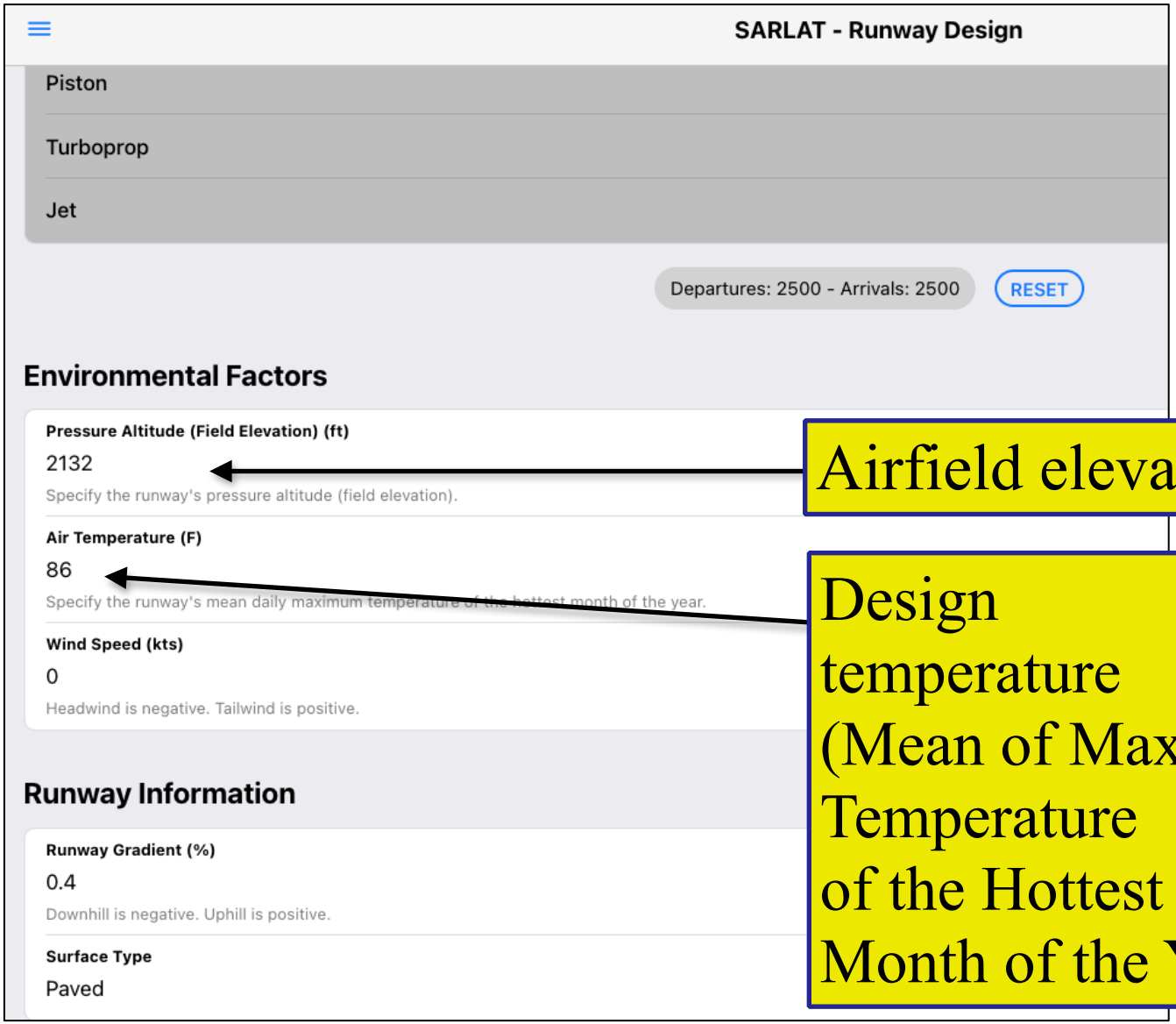


(source: www.weather.com)

https://crt-climate-explorer.nemac.org/climate_graphs/

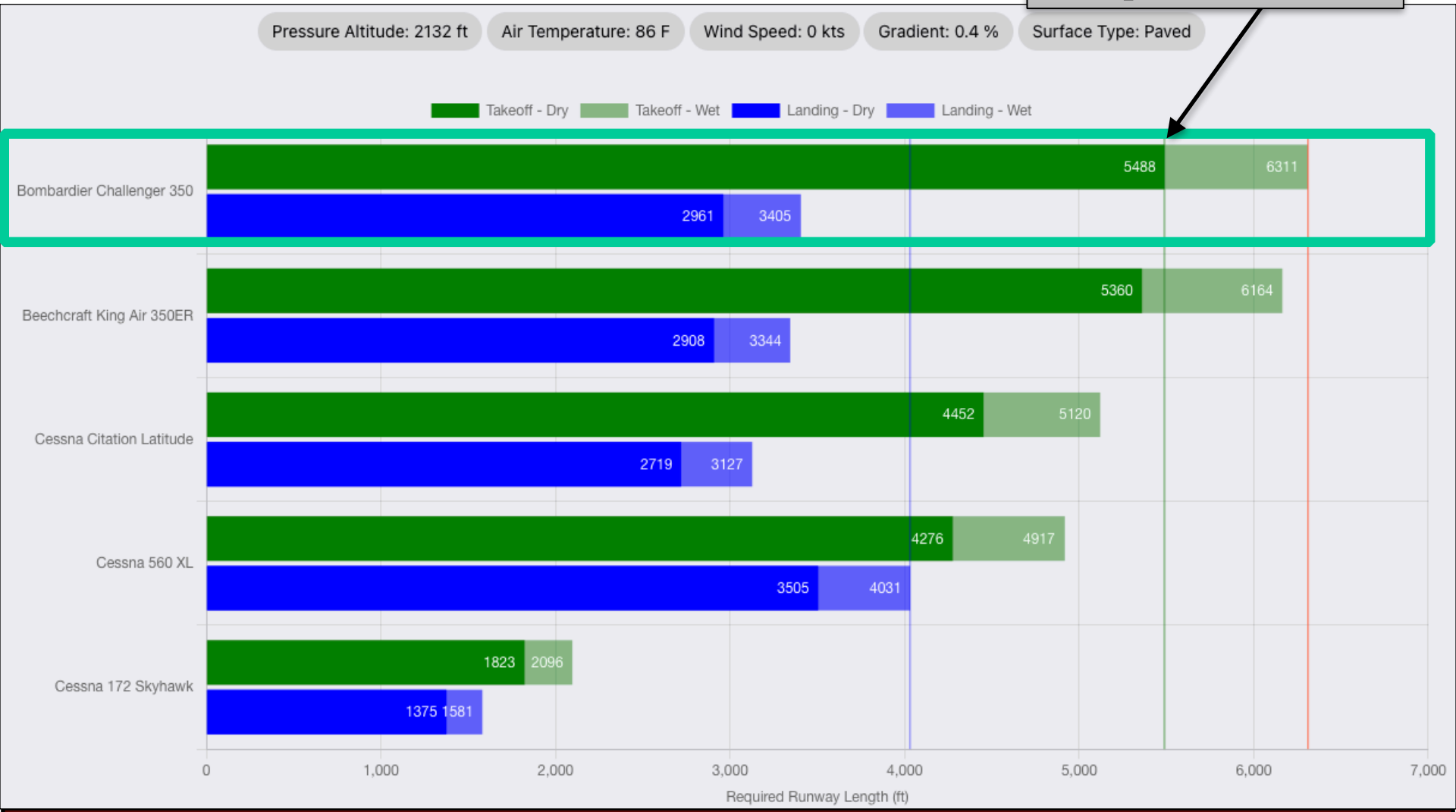
86 degrees Fahrenheit considering higher emissions

SARLAT 2 Analysis (Design Case)



SARLAT 2 Design Analysis

Critical aircraft
From a runway length
view point



New Runway Design Analysis

- **The Bombardier Challenger 350 (operated at 70% helpful load) requires 5,500 feet of runway (dry takeoff)**
  - We usually round the runway length to the nearest 100 feet
- During the runway extension project at Virginia Tech Montgomery Executive Airport, the runway was extended to 5,500 feet using the old analysis method.

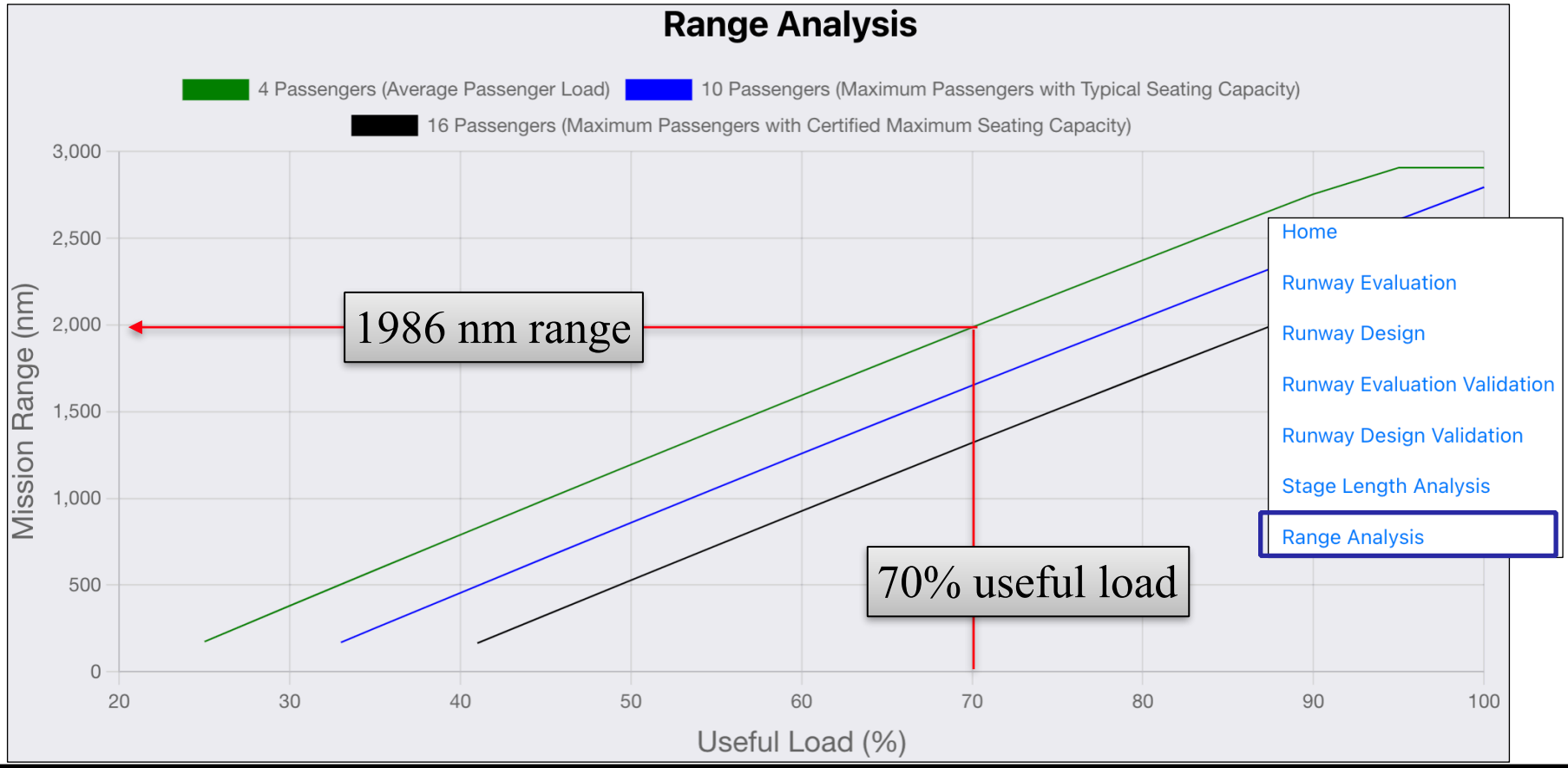
New Runway Design : Table of Results

Aircraft Name	Useful Load (%)	Takeoff (ft)		Landing (ft)					
				No Correction		Part 135 Eligible		Part 135	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Piston									
Cessna 172 Skyhawk	85	1823	2096	1375	1581				
Turboprop									
Beechcraft King Air 350ER	70	5360	6164	2908	3344				
Jet									
Bombardier Challenger 350	70	5488	6311	2961	3405				
Cessna 560 XL	80	4276	4917	3505	4031				
Cessna Citation Latitude	80	4452	5120	2719	3127				

Critical aircraft
From a runway length view point

New Runway Design : Range Analysis

- Departing the new airport, the Bombardier Challenger 350 can carry two pilots and four passsengers (with 70% useful load)



New Runway Design : Critical Aircraft

- SARLAT 2 reports the critical aircraft for the following conditions:
  - Runway length critical aircraft
  - ADG, TDG, RDC and AAC critical aircraft

Critical Aircraft for Runway Length

Bombardier Challenger 350 is the critical aircraft and requires **5488 ft** of runway to be fully accommodated in the full range of specified operating conditions.

Aircraft Name	Engine Type	Aircraft Design Group (ADG)	Aircraft Approach Category (AAC)	Taxiway Design Group (TDG)	Useful Load (%)	Annual Operations	Cumulative Annual Operations	Dry Takeoff (ft)	Wet Landing (ft)
Bombardier Challenger 350	Jet	II	C	1B	70	700	700	5488	3405
Beechcraft King Air 350ER	Turboprop	II	B	2A	70	300	1000	5360	3344
Cessna Citation Latitude	Jet	II	B	1B	80	700	1700	4452	3127

The Challenger 350 has 700 annual operations, so it is the critical aircraft for the new airport.

New Runway Design : Critical Aircraft

- SARLAT 2 reports the critical aircraft for the following conditions:
  - ADG - Aircraft design group
  - TDG - Taxiway design group
  - RDC - Runway design code
  - AAC - Aircraft approach category

Group	Critical Group
Aircraft Design Group (ADG)	II
Aircraft Approach Category (AAC)	C
Runway Design Code (RDC)	C-II
Taxiway Design Group (TDG)	2A

Runway Evaluation Mode

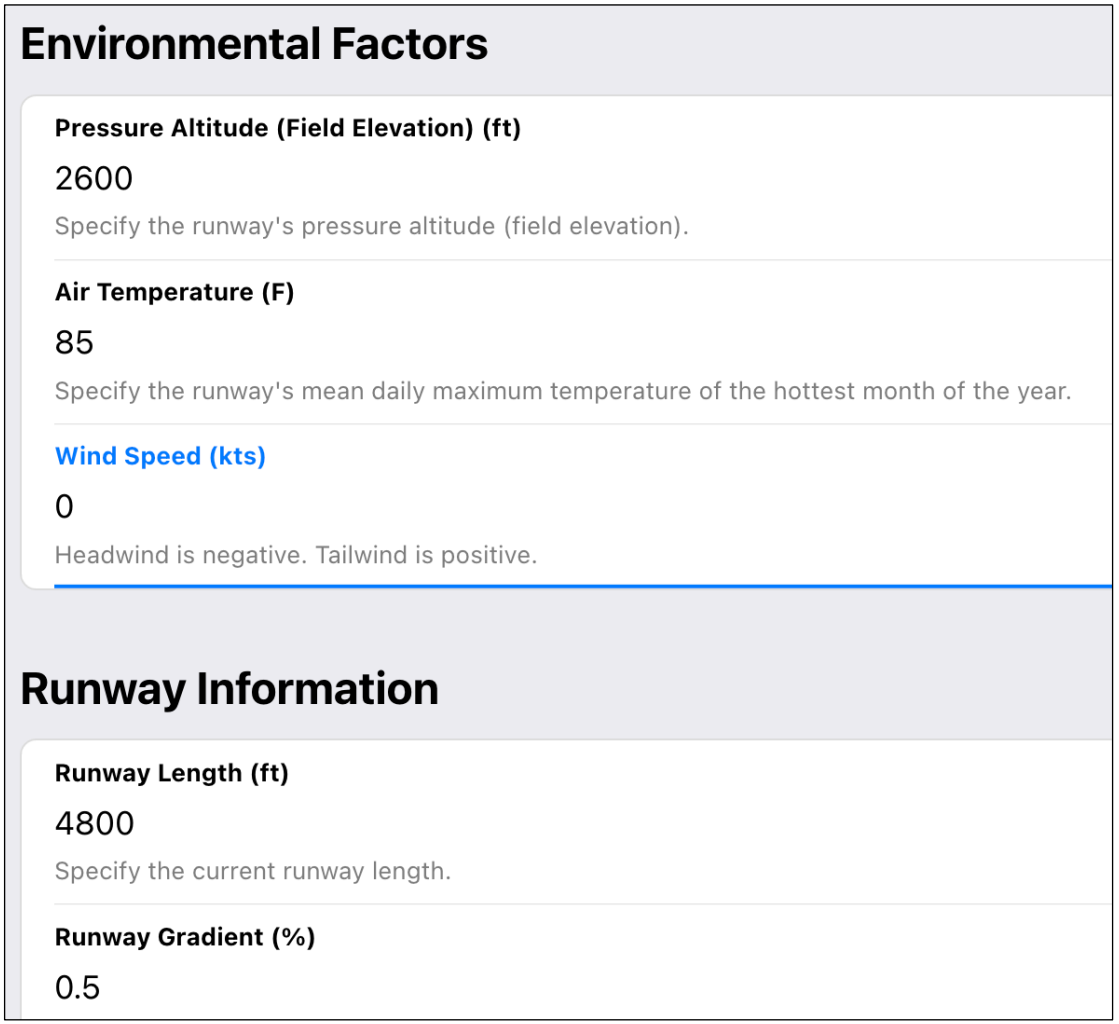
Objective: Determine if a group of aircraft can safely operate from an existing runway

Example: Runway Evaluation Example Using SARLAT 2

Aircraft	*Departures/Arrivals*	*Engine Type*
Beechcraft Baron 58	*2100 / 2100*	*Piston*
Beechcraft King Air B200GT	*400 / 400*	*Turboprop*
Cessna Citation Jet 1	*400 / 400*	*Jet*
Bombardier Challenger 350	*350 / 350*	*Jet*

Example: Runway Evaluation Example Using SARLAT 2

- Existing runway length - 4800 feet
- Airfield elevation - 2600 feet
- Design temperature (mean of maximum temperatures of the hottest month of the year) - 85 degrees. Fahrenheit
- Runway grade - 0.5%



Runway Evaluation Example Using SARLAT 2

Pressure Altitude: 2600 ft | Air Temperature: 85 F | Wind Speed: 0 kts | Runway Length: 4800 ft | Gradient: 0.5 % | Surface Type: Paved

Aircraft Name	Aircraft Mix	NBAA IFR Maximum Range		Useful Load (Takeoff Weight)		Landing a	
						No Correction	
		Dry	Wet	Dry	Wet	Dry	Wet
Piston							
Beechcraft 58 Baron	64%			100 % 5400 lbs	100 % 5400 lbs	✓	✓
Turboprop							
Beechcraft King Air B200GT	12%	100 % FLIGHTS IN NAS 891 nm / 4 pax	100 % FLIGHTS IN NAS 891 nm / 4 pax	100 % 12500 lbs	100 % 12500 lbs	✓	✓
Jet							
Bombardier Challenger 350	12%	70 % FLIGHTS IN NAS 790 nm / 4 pax		40 % 31190 lbs	✗	✓	✓
Cessna CitationJet 1	12%	100 % FLIGHTS IN NAS 895 nm / 3 pax	89 % FLIGHTS IN NAS 615 nm / 3 pax	85 % 9873 lbs	70 % 9373 lbs	✓	✓

Runway Evaluation Example Using SARLAT 2

The Bombardier Challenger 350 can operate from the 4800-foot runway (dry pavement) at 40% useful load

The Cessna Citation Jet 1
Can operate at 85% useful load from a dry 4800-foot runway

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		Dry	Wet	Dry	Wet	Dry	Wet
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Runway Evaluation Example Using SARLAT 2

- SARLAT 2 provides information about useful load, maximum distance flown, and passenger load from the existing runway condition
- The Bombardier Challenger 350 can operate from a dry 4800-foot runway at 40% useful load
- The Challenger 350 can fly 790 nm distance which covers 70% of the flights in the National Airspace System (NAS)

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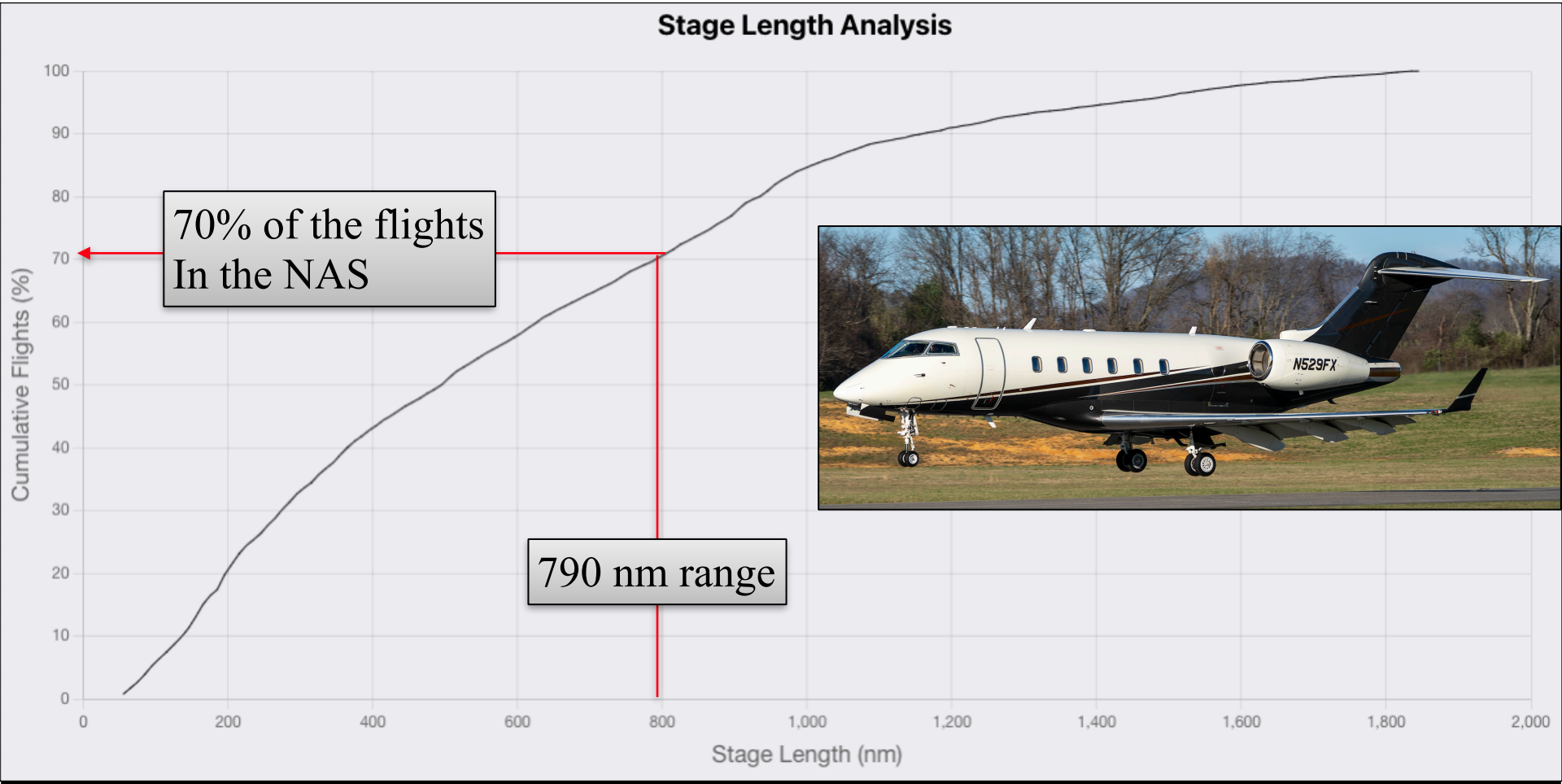
Runway Evaluation Example Using SARLAT 2

- The Challenger 350 can fly 790 nm distance which covers 70% of the flights in the US National Airspace System (NAS)



Runway Evaluation Example Using SARLAT 2

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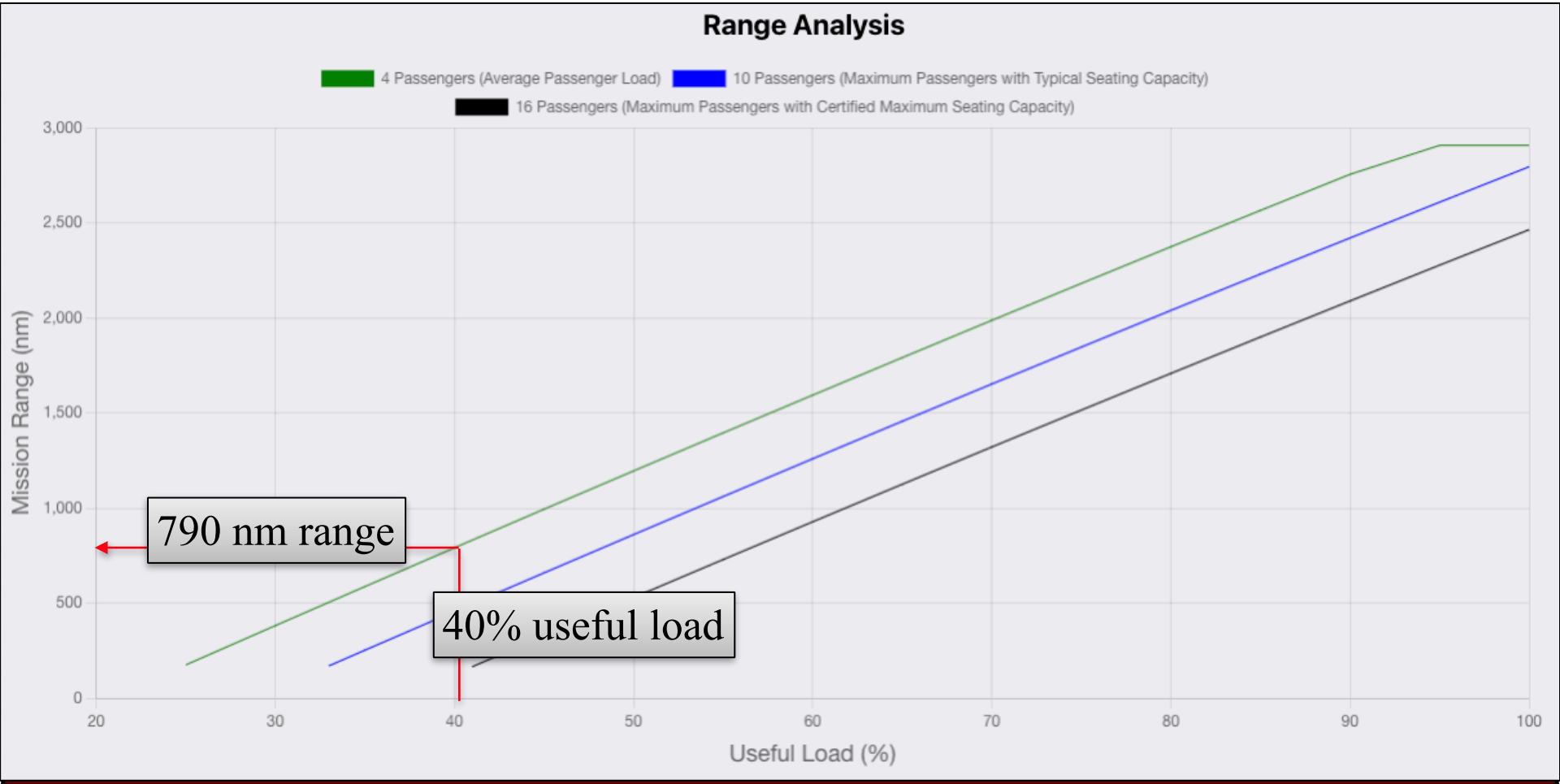

Notes About Runway Design

- For aircraft with a maximum takeoff weight below 12,500 lbs, we recommend using 100% useful load
  - Rationale: small aircraft carry few passengers, and operating at lower useful loads makes their use impractical
- For aircraft with a maximum takeoff weight at or above 12,500 lbs, the useful load value should be set in coordination with the FAA and the airport client to satisfy mission profiles flown by each aircraft
- **The FAA Airport Improvement Program (AIP) typically covers runway extensions using dry takeoff conditions and wet landing conditions**