



NextGen and the Single Pilot

Greg Potter

Ryan Z. Amick

Cessna Aircraft Company

Greg Potter...an introduction



Cessna 2007-Present

- Demonstration Pilot
- NextGen Team

Background

- USAF – Retired Lt Col
- FlightSafety International – Program Manager
- Aero Engr/MBA

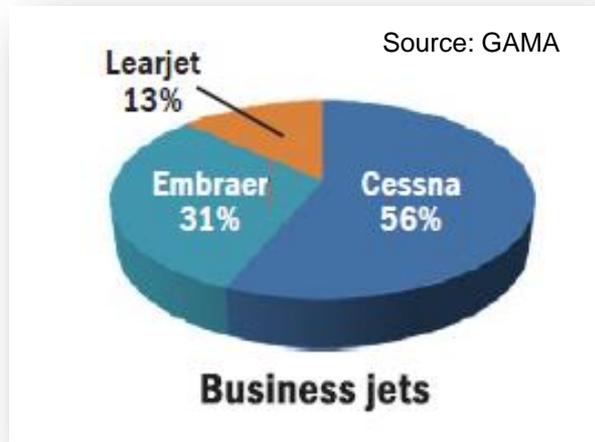
Single Pilot Operations

- A-10/T-37 Instructor Pilot
- CE 500 and 525 Demonstration Pilot

I'm a single pilot business aviation operator

Cessna at-a-glance

World Wide Business Jet Market



If you have flown a business jet, chances are greater than 50-50 that it was a Citation

Overview

- World's largest aircraft manufacturer based on unit sales with more than 192,500 aircraft delivered
- 6,100+ Citations are registered in more than 90 countries
- Largest fleet of business jets in the world

Single Pilot Business Jets

- First single pilot business jet certified in 1977
- Currently certified and produced over 3200 single pilot Citations

Single pilot Citations



- ## CE-510 Mustang / M2
- Cruise speed 340 - 400 kts
 - Range 1,150 - 1300 NM
 - Max altitude - 41,000 ft.
 - Garmin G1000 or G3000



- ## C525 A/B/C CJ series
- Cruise speed 418 - 435 kts
 - Range 1,613 - 1825 NM
 - Max altitude - 45000 ft.
 - Collins Pro Line 21

Who are single pilot operators?



MacNeil Automotive Products

- Produces custom-designed, precision-fit floor mats, cargo compartment liners and other products that are carefully crafted for specific makes and models.
- Company uses sophisticated tools to capture data and reverse-engineer complex vehicle geometry

CJ single pilot operator

- "Because we have our own airplanes, we don't have to worry about what the airline schedule is and transporting our very expensive technical equipment on a commercial flight"
- "Our planes get us in front of our customers, eye-to-eye"



"[Our CJ] has been a significant factor in the growth of our company."

Quotes are from the founder, David MacNeil

The single pilot question

What is the priority of single pilot research in an era of shrinking budgets?



What is the path for viable single pilot operations in NextGen?



First, what is NextGen



NextGen is the FAA concept for the redesign of the national airspace structure (NAS).

- The goal is to safely accommodate a 3x increase in air traffic
- Replace the antiquated ground-based navigation system
- Reduce FAA air traffic control manpower requirements
- Harmonization with international airspace designs



The FAA's focus is on increased through-put primarily at the nations busiest commercial airports

- Emphasis is placed on High Performance Airspace (>FL340), High Density Airspace/Taxi, and the Oceanic Tracks
- Reduce weather impact - 60-80% of delays are due to weather
- All weather “visual” operations with decreased separation requirements thru increased automation

How do you certify single pilot operations in this environment?

Access to FL340 and above

2010 NG Mid-Term ConOps, V2

- High Performance Airspace (HPA) (>FL340) is “exclusively” for high-performance users who are required to have ... Data Comm.
- Data Comm equipped aircraft will be priority in High Density Airspace (HDA) during high traffic workloads

Consider a Line of Thunderstorms

- How will single pilot operator perform the in-flight re-route changes in a timely and safe manner?
- Will the Air Traffic Manager be able to tolerate the challenges of a highly tasked single pilot?



Let's avoid this!

Access denied!

During non-normal, stressful scenarios, how can a single pilot aircraft and a reduced controller cadre safely manage separation?

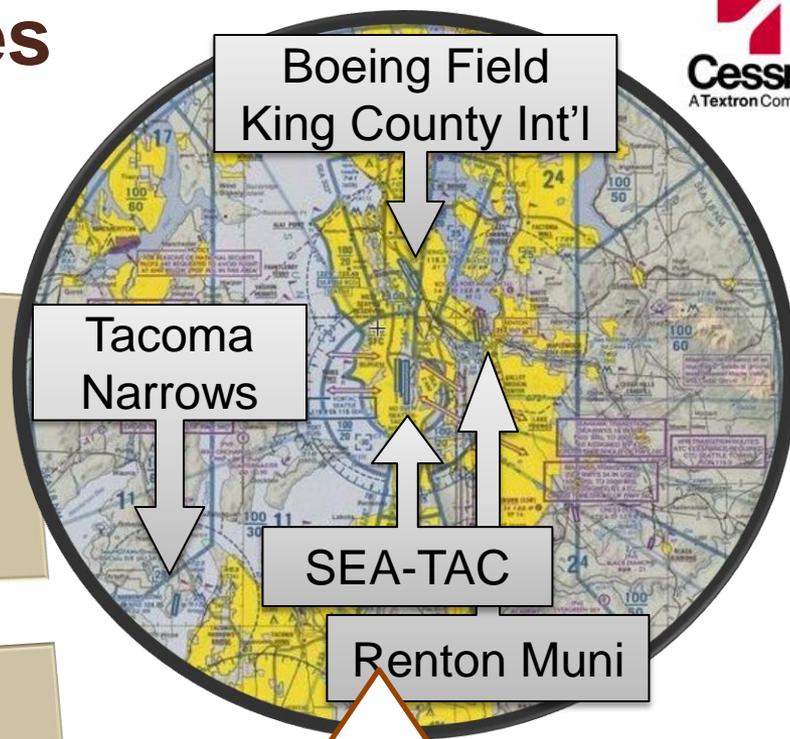
Access to the metro-plexes

SEATAC

- Ongoing Optimized Profile Descent (OPD) research will be a nationwide model for metro-plexes
- Access will be granted based upon equipage

Consider the single pilot

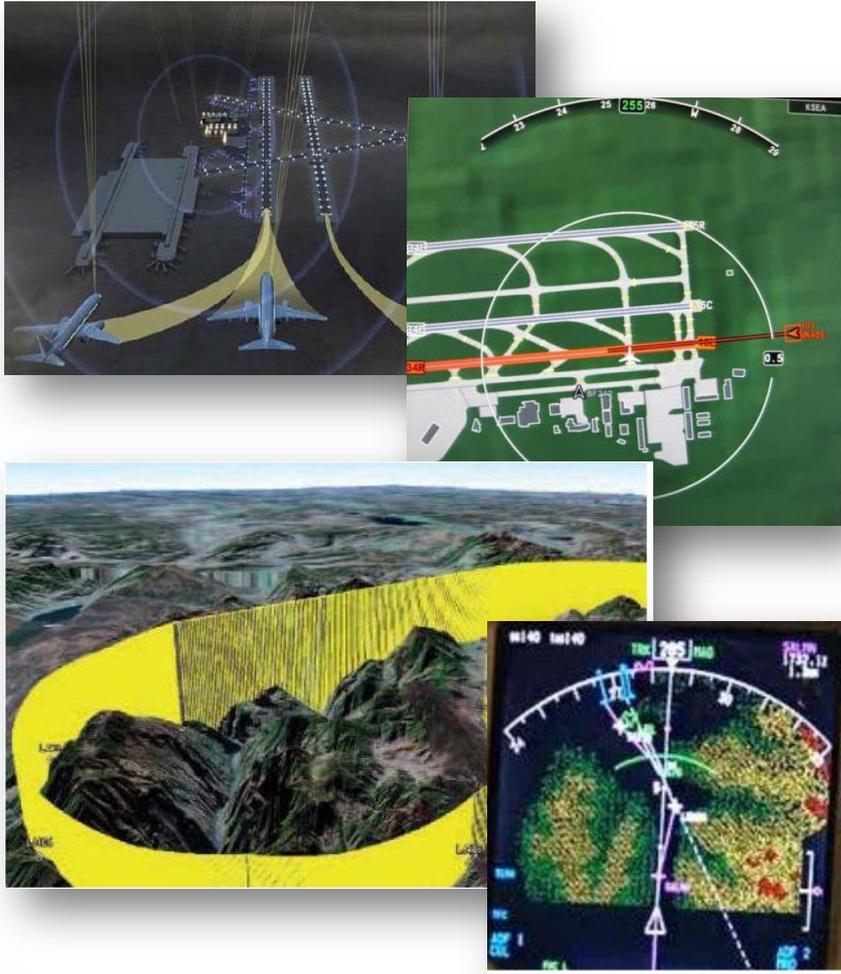
- In the event of system failure, what is the impact of reverting to reduced automation?



In 2010, transient general aviation accounted for 24% of the traffic to these four airfields

During poor weather and high airline pushes, how can the single pilot and controller safely maintain separation in the metro-plexes?

NextGen Single Pilot Challenge



Big question

- During non-normal scenarios, how drastic is the transition from high automation to a reduced level of automation?

Some example scenarios...

- What will alert the pilot of a missed or non-complied with message?
- When the ANP exceeds the RNP, what alerting and monitoring features are necessary for single pilot operations?
- During delegated or reduced separation procedures, can a single pilot recognize and safely resolve a system failure?

How will a single pilot safely recognize and resolve system failures?

Cessna's Perspective

The Affirmative Solution

- All NextGen research scenarios should include single pilot operations
- Focus on non-normal, reduced automation scenarios
- How many “clicks” to get to information or system controls



Let's make the transition



Our observations on single-pilot certification

Single pilot certification guidance



FAA guidance is dated

- AC 23.1523 (Jan 2005) “Minimum Flight Crew”
- AC 25.1523 (Feb 1993) “Minimum Flight Crew”



The Nature of the Guidance

- Presumes that modern avionics add complexity and increase workload
- Presumes pilot/crew workload of a Part 25 aircraft is more complex than a Part 23

In application, we found the guidance to not be excessively burdensome

Single Pilot Certification Evolution

In the past...

- The challenge was space allocation
- What is essential?
- Essential avionics and systems controls must be reachable and in the pilot's field of vision

Now...

- Display technology reduces space allocation challenges
- New challenge: how many pilot actions are required to present required information or access controls
- Emphasis is on non-normal scenarios

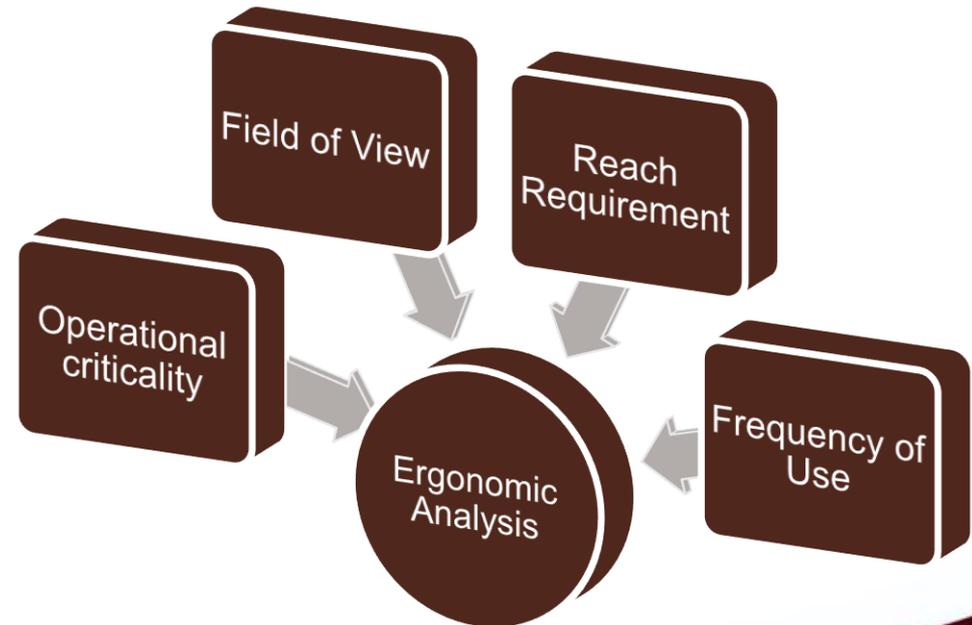


How many “clicks” does it take to get to the required information?

Cessna Single Pilot Design Approach

Human Factors is Center Stage

- Human factors planning begins at design conception and drives decisions at each phase through Type Certification (TC)
- Every system, display, control, etc... is planned and scrutinized
- How are the rules being addressed (design, flight test, etc...)



Cessna Single Pilot Design Approach

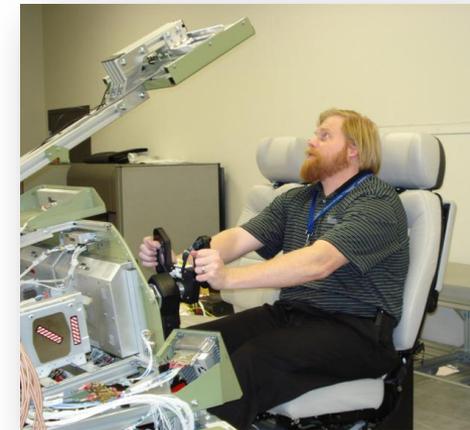
Cockpit design summary

- Explains design decision for placement of all controls and displays
- Cross cockpit comparisons



Task/Error analysis

- AFM checklist (abnormal procedures)
- Separate system induced errors vs random errors
- Human response (type of failure)
- SHERPA method



Does it make sense?

NextGen and single pilot operations

Perspective

- NextGen procedures and associated avionics should be designed with less complexity not more
- If two pilots are required for operations, have we made the system better? Have we made it safer?

On-going research

- Single pilot operators fly in HPA and the metroplexes (HDA) along-side crewed aircraft
- Single pilot operators must be able to perform the procedures or risk losing access
- Researchers should ask the single pilot question first, not as an afterthought



In-Trail Procedures



Sequencing and Merging



CDTI



Single pilot simplicity will enhance NextGen safety

Questions?

