



# Automation in Aviation

November 8, 2017



*AgustaWestland Products*

## **James Krueger**

jim.krueger@leonardocompany.com  
3050 Red Lion Road  
Philadelphia, Pennsylvania 19114  
267-467-5465

### **Prior Experience**

U.S. Army - November 1984 to October 2014  
U.S. Army Flight School - July 1988

### **Production Test Pilot / Instructor Pilot**

Leonardo Helicopters - December 2014 to Present

### **Total Flight Time: 5000+ Hours**

FAA License: CFI, CFII, ATP Helicopters  
FAA Type: AB139, AW139, BV234

### **Current in the Following Helicopters:**

AW109 E/S	AW119 Ke/Kx
AW139	AW169

# Automation in Aviation

Legacy to Modern Cockpits

Automation Challenges

Automation Advantages

Accident

South America



# Legacy Cockpits

**TH-55**



**UH-1H**



**CH-47D**



# Modern Cockpits

CH-47F

AW109S



AW139



# Modern Cockpits

**AW169**



# Automation Challenges

Acceptance

Training

Flight Skills



# Automation Challenges - Acceptance

I don't trust it  
because it's new!

I can't even figure out  
how to change  
the altimeter!

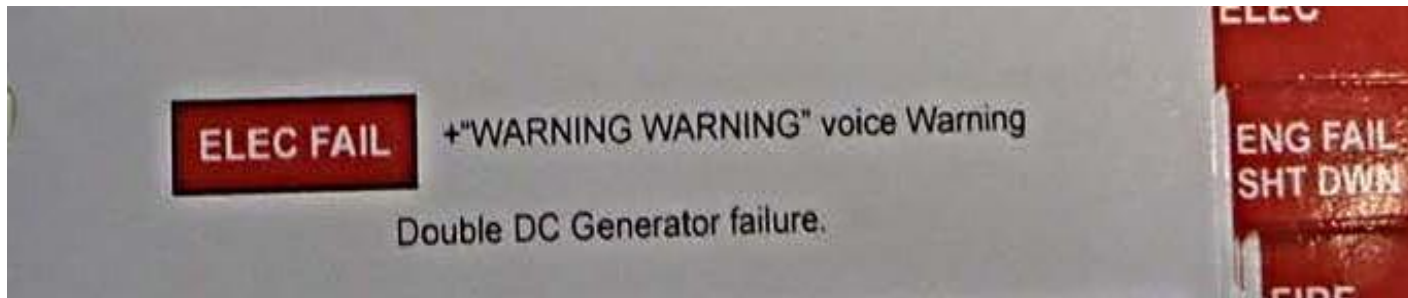




# Automation Challenges - Training

*Do you have a complete understanding  
of the system you're flying?*

**“WARNING”**



Land as soon as possible.

# Automation Challenges - Training

*Do you have a complete understanding of the system you're flying?*

**“CAUTION”**

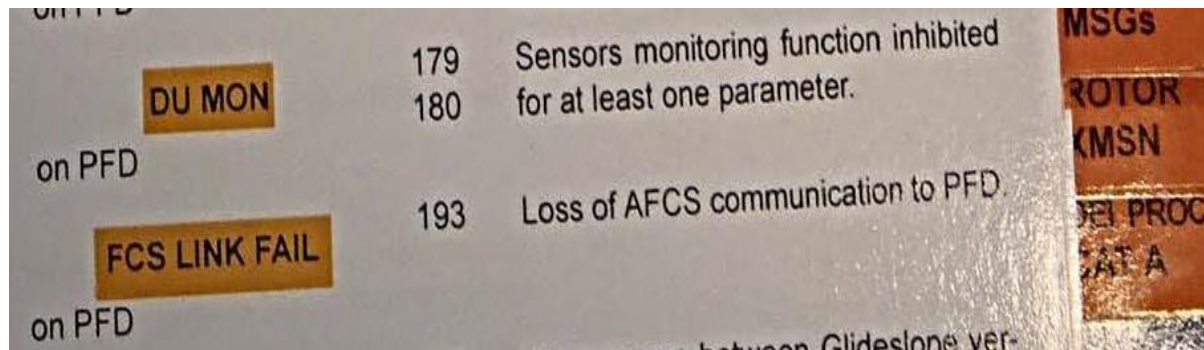
CAUTION MSGs	ROTOR BRK INHB	198	Criteria for rotor brake application not met.
	SNSR DORMANT FAIL	158	Failure of at least one transmission and/or hydraulic system monitoring-sensors (caution only active on ground with both engines OFF)
	TGB OIL TEMP	205	Tail gearbox oil overtemp (greater than 109° C).

Shutdown aircraft.

# Automation Challenges - Training

*Do you have a complete understanding  
of the system you're flying?*

## “MESSAGES”



Continue flight.

# Automation Challenges – Training

Flight skills are perishable!

Fly hands-on.

Complex system failures!

**FCS LINK FAIL**

Note: SAS, ATT, WLVL, HDG, HOV, IAS, ALT, ALTA, VS, RHT, NAV, VOR, VAPP, OS, LOC, GS, ALVL, GA – captions are not available.



# Automation Advantages

Situational Awareness

Workload Reduction



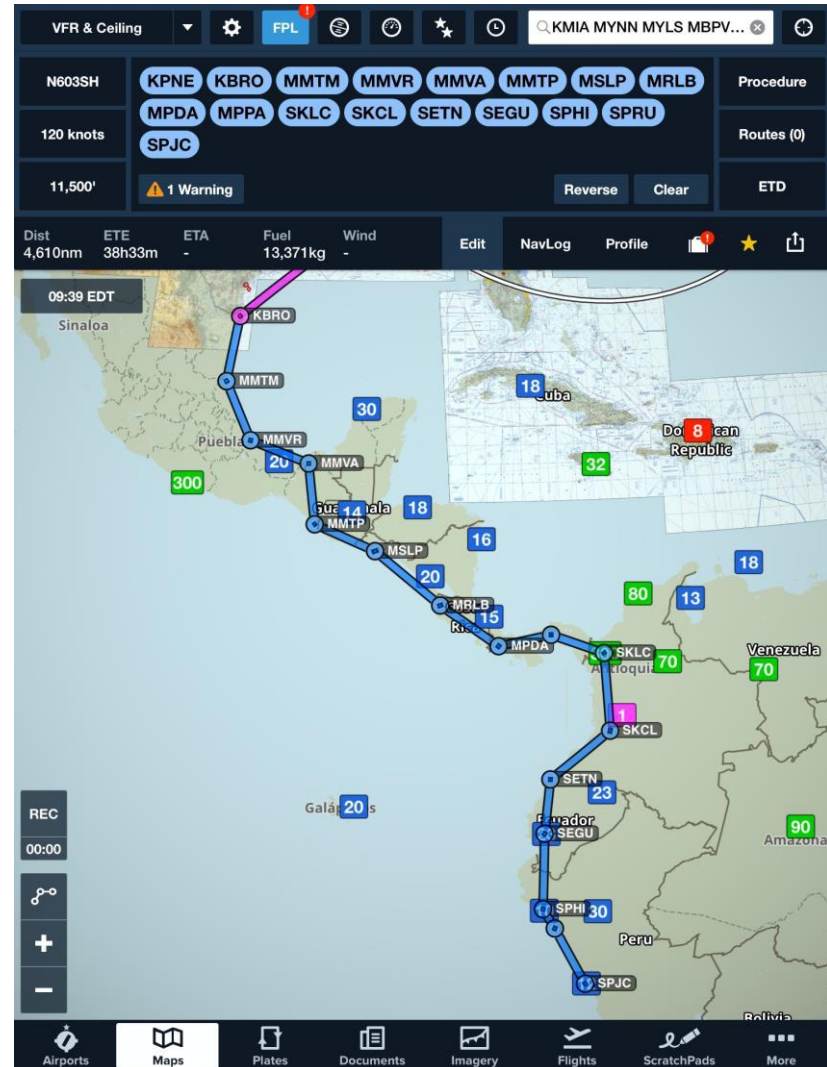
# Automation Advantages – Workload Reduction

Time, distance and heading

Navigation Improvements:

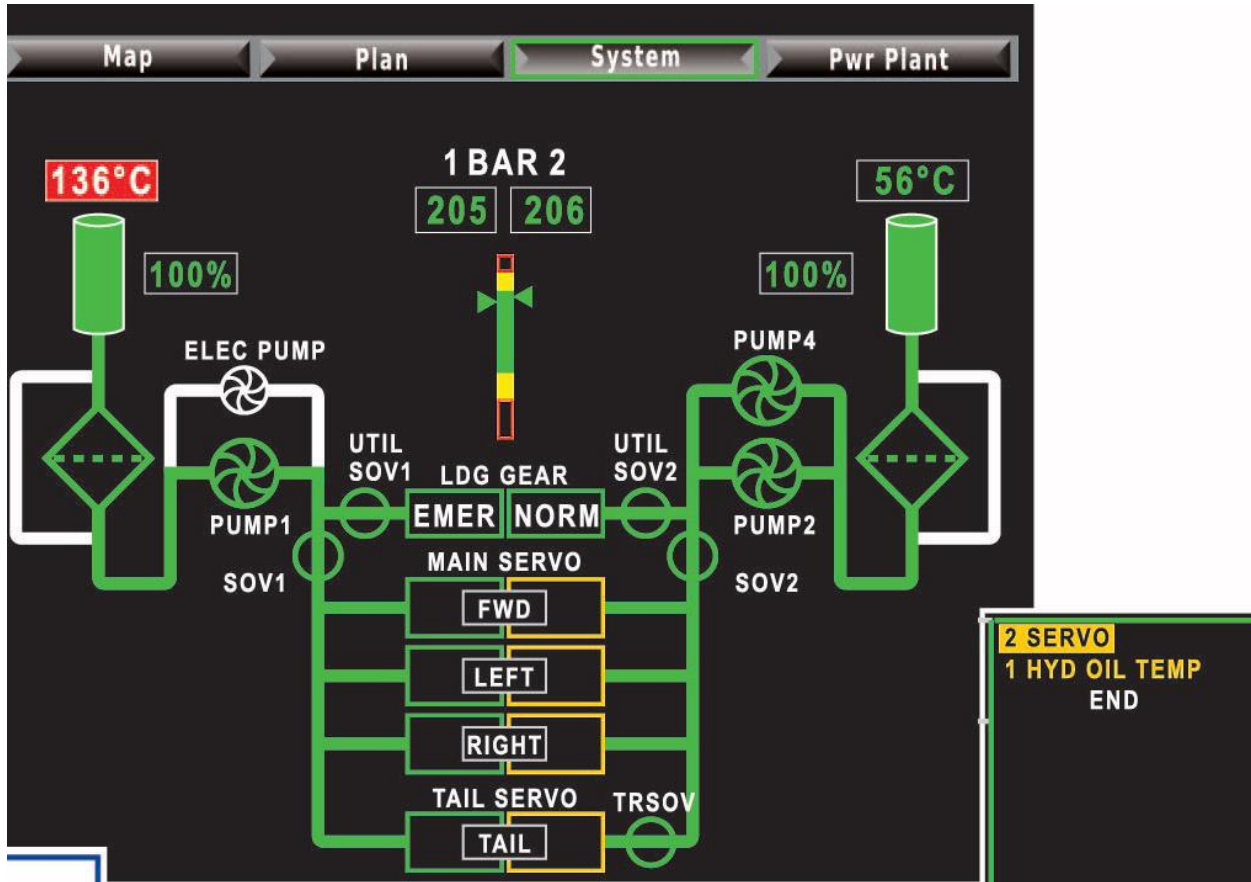
IFR

VFR



# Automation Advantages – Workload Reduction

## System Monitoring



Over Torque

Over Temp

Over Speed

# Automation Advantages – Situational Awareness

Weather Radar

Enhanced Ground Proximity Warning System (EGPWS)

Traffic Collision and Alert System (TCAS)

Obstacle Proximity Lidar System





# Accident

Aviation accidents  
provide us with the opportunity to question ourselves!



# Automation

## Kenya flight 5Y-NPS

On September 8<sup>th</sup>, 2016 at 13:15 hours,  
aircraft 5Y-NPS crash-landed.

At 13:14 hours, the helicopter was at a stable  
OGE hover within the aircraft performance capabilities.

(Aircraft was being flown hands-on with ALT Hold and  
Torque Limiter engaged.)

# Automation

## Kenya flight 5Y-NPS

At 13:14:49, the following chain of events occurred:

The pilot significantly increased the collective.

The torque limiter logic prevented the engines from exceeding 110% torque.

The Nr drooped to 96% with the “ROTOR LOW” Aural Warning.

The pilot compensated for the right yaw with left pedal.

# Automation

At 13:14:49, the following chain of events occurred:

The pilot lowered the collective 20% in about 2.5s.

Nr returned to 100%, descent rate increased, and the aircraft started to yaw left.

Aircraft reached 20° nose-down, 4000ft vertical speed, and 60kts ground speed.

## Automation

At 13:15:03, the following occurred:

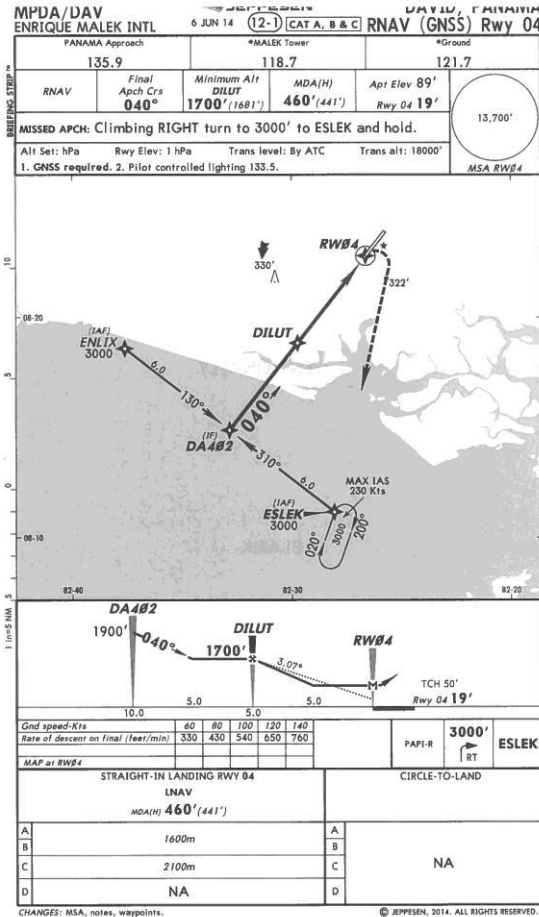
A sudden rise in collective input without any pedal compensation; the yaw rate increased.

The aircraft crashed with a spiraling motion.



**Make sure you understand the automation you're using!**

# South America Decision Making



Violent Storm

Altitude Hold  
Decoupled

ELT Going Off

No EGPWS

Tower's  
Comments



# Automation in Aviation

Legacy to Modern Cockpits

Automation Challenges

Automation Advantages

Accident

South America



# Questions?





**OBRIGADO!**



*AgustaWestland Products*