Automation Airmanship
Meeting the Challenges of 21st Century Aviation with Discipline, Skill and Purpose

Captain Chris Lutat
Convergent Performance, LLC
Contemporary Challenges Facing All Aircrews

• UA/GA complications
• “De-skilling” of pilots’ flying abilities
• Increasing demands on reduced-size crews
• ReCat/Next Gen separation standards
• New Technologies: EFB/Tablets, HUD/EFVS/SVS, PB Nav
• The “Totally Integrated Aircraft” of the (near) future
The state of Automation Airmanship, 2013:

Are these and other accidents like them simply part of a contemporary landscape?
To leave this landscape behind we can...

• Stop “doing what we’ve been doing” for decades in training and evaluation of advanced aircraft

• Adopt a disciplined, reliable, understandable approach to improving the level of integration between the operators and the equipment

• Adopt specific, routine practice that emphasizes proficiency with and without autoflight and flight guidance
8 Primary Factors for Adopting Advanced Technology*

1. Available technology
2. Concern for safety
3. Economy of operations
4. Workload reduction, and the crew complement issue
5. More precise flight maneuvers and navigation
6. Display flexibility
7. Economy of cockpit space
8. Special requirements of military missions

* Dr. Earl Weiner, NASA/University of Miami
“The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency.”

Bill Gates, CEO and founder, Microsoft
The real legacy of AF447

4 Very Similar Incidents between May and October, 2009

✓ A330s
✓ Operated by 4 separate flag carriers
✓ At cruise altitude (FL390, FL350, FL370, FL390)
✓ Night-time (3), turbulence, icing & IMC (all 4)
✓ Airspeed and other anomalies after entering IMC (pitot tubes blocked with ice crystals)
✓ 3 recovered in “Alternate Law” using manufacturer and company procedures, one fatal crash (AF447)
Northwest 8: A330-323 23 June 2009 (near Kagoshima)

JetStar 12: A330-202 28 October 2009 (near Guam)

TAM 8091: A330-233 21 May 2009 (near Haiti)
What do they all have in common?

• Unanticipated loss of flight data, disconnect of autopilot and autothrottles
• Initial altitude excursions
• Other critical systems were working: IRUs, powerplants (just as in the case of AF 447)
• **ALL REQUIRED THE CREW TO MANUALLY MANIPULATE THE AIRCRAFT CONTROLS WITHOUT ALTITUDE AND AIRSPEED REFERENCE**…
• And… after flight path stabilization, *follow the written procedure.*
How many pilots know these facts about their own aircraft?

- The autopilot/autothrottle disconnect logic
- The flight control laws on which the aircraft’s automatic flight depend upon
- What information on the PFD/HUD will remain reliable with a complete loss of Air Data
- What information on the PFD/HUD will remain reliable with a complete loss of Platform Data
- How the aircraft’s standby instruments work in contrast to normal PFD/HUD indications
“Experts Have all the Time in the World”
–Sir Frederick C. Bartlett, 1958

- An examination of accidents and incidents can tell us a lot about what *not* to do
- Study of the “Experts” gives us insight into what the best among us are doing when engaged in successful accomplishment
- Current methods have shown us the ways in which expert flight crews excel, and fall short
- An “index of expertise” can help guide our professional development as pilots of Automated Aircraft

The best glass cockpit pilots guide and organize the details of flight deck processes with “unencumbered elegance” – the foundation of which are skills associated with the efficient management and control of information
The “Knight’s Tour”
“Experts... have mental models of their equipment. They are not just pressing buttons and receiving messages.”

-- Gary Klein, 1998
The Irony in Adopting Advanced Aircraft

• Automation has taken some risk out of aviation
• Automation has added some risk to aviation
• Advanced aircraft require a high level of proficiency with the automated systems to produce good results
• Advanced aircraft require a high level of proficiency without automated systems to produce good results.
The 9 Principles of Automation
Airmanship®

- Planning
- Briefing and Debriefing
- Data Entry
- Communicating
- Monitoring
- Situational and Mode Awareness
- Workload Management
- Positive Flight Path Control
- Logic Knowledge
AUTOMATION AIRMANSHIP IS –

“The understanding and application of automation to airmanship, to ensure balanced situational and mode awareness and crew workload through the full realm of automation, from no automation to fully coupled, in order to provide for the safest and most efficient flight.”

From the Preface of Automation Airmanship (McGraw-Hill) 2013
10 Years of Field Work & Adapting

- Multiple projects with diverse organizations to field dramatically advanced new fleets of aircraft
- Multi-discipline approach to expert performance across the world of high-risk/high reliability domains
- Rigorous methods producing consistent results
- Organizational practices that have remained durable in the face of constant change
What it looks like, “under the hood”
Early Adopters of Automation Airmanship

- LMAS C-130J operators: USAF, USCG, USMC
- Bombardier (Leading Edge)
- Canadian Air Force
- USAF C27J
- Royal New Zealand Air Force
To leave the current landscape behind we must...

- Learn and apply the foundational strengths of both systems: “The Wetware” and the “Hardware/Software”
- Ensure that Basic Airmanship is *not degraded* by automation, but *enhanced* as a result of its integration
- Replace the current approach to performance on the flight deck with a new operating system: one that stresses competent autonomy, professional mastery and unparalleled purpose.

Value the strengths of the “Wetware” in close integration with the Software and hardware in a more resilient and trainable context.
Automation Wisdom

“Man is not as good as the black box for certain specific things, however, he is more flexible and reliable. He is easily maintained and can be reproduced by relatively unskilled labor.”

- Wing Commander H. P. Ruffel Smith, RAF
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