Maintaining basic skills while managing change

by Captain David McKenney

We have all experienced the feeling of being "rusty" on knowledge and skills that we have not used recently or maybe were never properly developed in the first place. When I read stories that pilots and controllers are losing their skills because of over reliance on automated systems, I smile and reflect on how easy it is to concentrate on writing a good story, but in doing so, make assumptions and forget the facts.

Our Navigation System failed so I had to revert to the old manual methods and being a little "rusty" we drifted slightly to the North...

So ask yourself, "Are pilots and controllers losing their skills because of automated systems, or is it really a lack of practice?" I believe a major reason for skill degradation occurs because of the emphasis and often-times required use of automated systems that prevents the pilot from practicing manual handling operations. In some cases, the lack of practice is critical because the knowledge and skills may not have been properly developed initially due to many reasons. Some reasons may include inadequate training methods, inadequate training devices, inexperienced instructors, or not providing the required repetitions to fully develop the skill.

While knowledge and skills are developed by repetition over time, it is important to remember that knowledge and skills are perishable. Manual handling skills, both motor and cognitive, must be fully developed during initial training so they become ingrained and allow for skill degradation that normally occurs between practice opportunities. Degradation of knowledge and skills can and do occur over time due to lack of practice. If humans don't routinely practice knowledge and skills, they can become rusty and lose expertise.

Evolving flight deck equipment, operations, and airspace design requires a corresponding evolution in pilot and controller knowledge and skills. Over time, the scope of operations, together with the complexity of airspace, procedures, and automated tools on the flight decks has evolved. This has resulted in a corresponding increase in the set of required skills and knowledge that pilots need for flight path and energy management for today's complex aircraft and airspace. Just because we automate something does not relieve the pilot of the requirement to maintain the knowledge and skills of how to accomplish a task when the automated systems are not available.

The same is true for air traffic control functions. A controller is expected to be able to provide traffic guidance

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and separation with and without the use of automated systems in a constantly changing airspace system with new procedures. Like pilots, controllers also need to maintain recency of experience and have the knowledge and skills for the evolving technology as well as maintain the knowledge and skills for basic and reversionary operations.

Complexity in airspace operations is increasing. As the need for flexibility increases, as enabled by future changes, so does the complexity and potential for unexpected events. Air traffic controllers and pilots must be prepared for dealing with unexpected events, and the equipment design, training, and procedures and operations must enable them to do so.

So how can we maintain required skills while managing change? Some important considerations for achieving this goal can be found in the 2013 report from the international Flight Deck Automation Working Group (FltDAWG)[44] titled: The Operational Use of Flight Path Management Systems. This report addresses safety and efficiency of modern flight deck systems for flight path management, including energy-state management, in both modern and future airspace. This report includes 28 findings and 18 recommendations regarding the use of flight path management systems for flight path and energy management, including manual flight operations, autoflight mode confusion, task/workload management, and monitoring of autoflight systems. A few items related to maintaining basic skills are discussed below.

The report's first finding states, "Pilots mitigate safety and operational risks on a frequent basis, and the aviation system is designed to rely on that mitigation." While controllers were not the main focus of this particular study, a similar study for controllers would undoubtedly include a similar finding. In fact, the aviation system relies on humans in many roles working individually and together for mitigating risk.

Since the aviation system relies on humans as a mitigation strategy, we need to ensure that human capabilities are taken into account for the design, implementation, and operation of the system. Before such technology is designed and implemented, industry and government must consider and incorporate measures to ensure that a human-centered design approach is used to develop the future aviation system and provide the necessary training. Such an approach takes into account human, aircraft, and airspace capabilities and limitations that allow the human operators to have the knowledge, skills, recency of experience through practice, and flexibility to manage the operation or intervene when required.

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The FltDAWG report findings show that in managing this change, the system still has vulnerabilities in such things as:

- Pilot knowledge and skills for manual flight operations,
- Pilot use of, and interaction with, automated systems,
- Pilot skills to most efficiently and effectively accomplish the desired flight path management related task, and
- Communication and coordination between pilots and controllers.

As pointed out in the FltDAWG report, because of the changes in aircraft equipment and in flight operations, there has been a corresponding change (and increase) in needed pilot knowledge and skills. It also became apparent that the definition of "normal" pilot skills is changing over time, and pilot skills that were once thought of as "typical" are now thought of as "basic or reversionary". Figure 1 shows this in a notional manner.

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44- http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/parc/parc_reco/media/2013/130908_PARC_FltDAWG_Final_Report_Recommendations.pdf

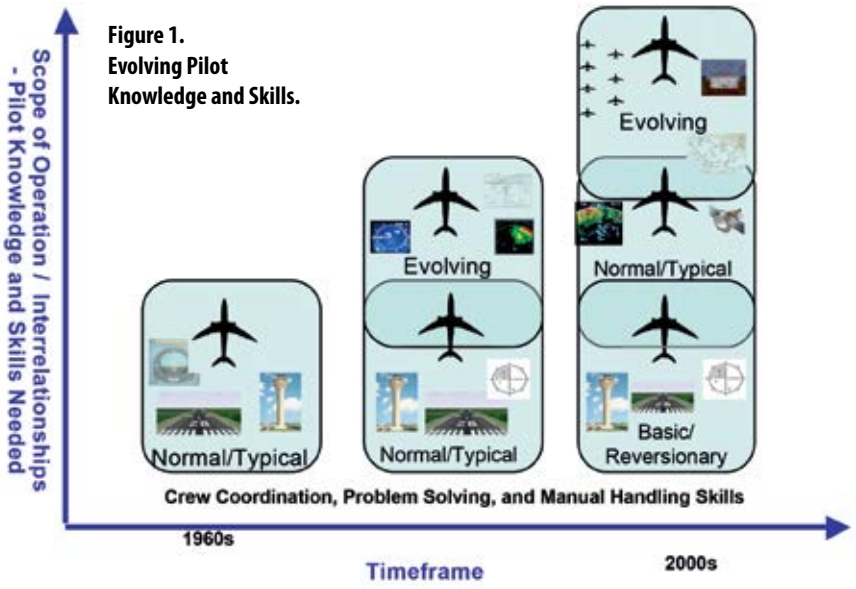

Figure 1.
Evolving Pilot Knowledge and Skills.

Figure 1 is equally applicable to controllers, as the role and requirements for air traffic controller knowledge and skills, like the pilot, has also not diminished as a result of automated systems and the evolving airspace and procedure design for airspace modernization. Several of the FltDAWG findings and recommendations address pilot skills as well as air traffic and airspace considerations. Successful flight path management is done within the context of the airspace system, so airspace and air traffic integration is an important consideration.

Continued evolution of the airline industry and international/national airspace systems incorporates new technology and procedures. **Changing technology requires us to change the way we train and maintain skills.** One of the human challenges while managing change is maintaining skills that are critical, but seldom used. The operator is challenged by providing the necessary training and opportunities for pilots to develop and practice required skills, while controlling costs.

The FltDAWG report suggests that an operator's initial and recurrent training program cannot be the sole means for pilots to maintain manual flying skills. Training programs must be supplemented by encouraging pilots to manually fly the aircraft during line operations and reinforced through the airlines developing policies and cultures that encourage manual flying while providing appropriate opportunities to exercise manual flying during normal flight operations. The report describes this as "Manual Handling Operations" and makes the following recommendation:

FltDAWG Recommendation 1 – Manual Flight Operations.

Develop and implement standards and guidance for maintaining and improving knowledge and skills for manual flight operations that include the following:

- Pilots must be provided with opportunities to refine this knowledge and practice the skills;
- Training and checking should directly address this topic; and
- Operators' policies for flight path management must support and be consistent with the training and practice in the aircraft type.

As part of achieving the list of items above, the term "manual flying skills" and the associated knowledge and skills should be agreed upon. It involves more than "stick and rudder" skills. It also involves cognitive skills and knowledge on how to handle situations that arise and how to keep the pilot engaged with the flight path management operation and ready to take over manually. It also includes basic airmanship qualities including decision making, situation awareness, and good judgment.

Based on the FltDAWG results, the FAA issued Safety Alert for Operators (SAFO) 13002 on Manual Handling Operations in January 2013. In SAFO 13002, the FAA recognized that manual flying skills should be exercised to maintain pilot proficiency and recommended that carriers adopt an integrated approach by incorporating emphasis of manual flight operations into both line operations and training. This includes incorporating manual flying into initial, upgrade, and recurrent training as well as encouraging pilots to take opportunities to manually fly the aircraft when automated flight is not required by safety considerations, regulations, operations specifications, or company standard operating procedures (SOPs).

EASA also issued Safety Information Bulletin (SIB) 2013-05 on 23 April 2013 on Manual Flight Training and Operations. This SIB similarly encourages operator's to incorporate emphasis of manual flight operations as a means of maintaining basic flying skills into training and line operations.

Similarly, air traffic controllers should have opportunities outside of required annual recurrent training to exercise and maintain proficiency in all required skills for all operations, both manually and using automated systems. Successful flight path management is a joint responsibility of the pilot and air traffic controller, done within the context of the airspace system, and requires all parties to be well trained and ready to handle routine, non-normal, and unexpected events with or without the use of automated systems.