Why pilots don't follow procedures

Airline operators and airframe manufacturers express frustration with flight crews who do not follow established procedures. In order to address the question of why crews sometimes do not follow procedures, it is useful to begin with a small set of axioms, or 'rules of the game.'

One cannot assume that actors, pilots, designers, managers, etc are perfect. Nor can one assume that they necessarily act rationally in terms of economic criteria or other measures of material utility. So, I do not aim to compare observed behaviors with normative descriptions. Rather, I assume that all actors attempt to render their behavior culturally meaningful. Of course, if the actors recognize economic rationality as a culturally appropriate goal, then they may attempt to act rationally from that point of view. This means that the job of analysis is not to assign blame, fault, or limitations on rationality to anyone, but instead to understand the cultural context of behavior.

Posing the question in the terms "Why pilots do not follow procedures" focuses our attention on the behavior of pilots, and moves our attention away from the people and processes by which equipment is designed, and procedure are created, communicated, and enforced. It is likely that in some cases the reason pilots do not follow procedures has more to do with these other systems than with properties of pilots themselves.

There may be many reasons for pilots to deviate from procedures. In some cases pilots may deviate from procedures without intending to do so. Perhaps the pilot does not know the procedure, or has not yet established a smooth behavioral pattern. This is a concern frequently expressed by pilots who are new to an airplane. They say that one of the things that is learned with experience flying on the line is the ability to follow established procedures smoothly enough to "conduct business in an orderly manner." Procedures can be interrupted by other activities. Procedures may be difficult to perform correctly if they impose excessive cognitive demands. Procedures may be poorly constructed. (See Riesbeck and Hutchins, 1980, Principles of procedures composition). There may be interference between different procedures that share sub-sequences of steps. Or procedures may be designed such that the sequence of actions might not make sense to the pilot.

Another reason is that the pilots are not sure what the procedure or policy is.

Perhaps the most important reason for a pilot to willfully deviate from a procedure is that the procedure does not make sense to the pilot. Again, sense making always proceeds by employing cultural resources, so we must understand what makes sense to the pilots and why things mean what they mean.

Knowing what the procedure or policy is and finding it meaningful are, of course, related to each other. If the procedure or policy seems ambiguous to the pilot then the pilot may deliberately behave in a way that he thinks is in accord with the procedure but others regard as a violation of the procedure.

To illustrate some of the issues, let's consider the case of the autothrust usage policy of a major airline.

The airline in question introduced the Airbus A319/A320/A321 into its fleet late in 1998.

Since July of 1999, I have been interviewing pilots about their use of automation in that airplane. One of the principal findings of the study is that the autothrust system is sometimes mysterious to the pilots. They report wanting to try to fly using manual thrust because they are not sure they will be able to control the airplane effectively if the Autothrust system should fail, or if it becomes necessary to disconnect it.

I recently had dinner with a Senior Check Airman for the Airbus fleet of that airline. We had a long discussion about the A/THR policy. The Check Airman says that about a year ago he wrote two Crew Broadcast System (CBS) messages on autothrust. He admits the first message was too strong. It stated a company policy of keeping Autothrust engaged at all times. A second message was sent to the fleet a few days later attempting to clarify the policy. These messages are part of the efforts by the flight manager's office to communicate a policy to the pilots.

Let's look at the situation first from the point of view of the line pilot.

Line pilots, believe that their skills as pilots are kept current by practice. They worry that if they are required to exhibit skills that they do not practice, they may be unable to perform adequately. When these ideas are applied to the use of manual thrust, they result in a desire on the part of the pilots to practice the use of manual thrust. They suggest that they could do so in conditions in which other risk factors are low, for example, on a daylight visual approach in good weather.

They say of manual control of thrust, "We don't practice it enough in the simulator." One way to control overall risk is to have a highly qualified pilot with them, for example in their IOE, thus, "We should be allowed to try it in IOE." Some pilots said they have tried manual control of thrust just to see what it is like. Others say they have not because they are worried that the FOQA data could be traced back to them and they don't want to be caught violating company policy, "We want to, but we don't want to get in trouble." So the pilots use a very widespread cultural model to make sense of the autothrust usage policy. Many pilots find the policy to contradict their interpretation of their responsibility as pilots. They apply common-sense understandings of the relationship of experience to skill in the context of flying and feel frustrated by the company prohibition on experimentation with manual control of thrust.

Let's now look from the perspective of the flight managers. It appears that there are two main reasons behind the decision to encourage A/THR usage so strongly.

First, says a flight manager, "We don't want our pilots to **have** to go with A/THR inoperative. Don't want them to have to go without A/THR or Autopilot all the way across the country. That's a big increase in workload." The pilot explicitly states that increases in workload increase risk.

Second, when A/THR is disconnected, some important automatic **protections** are lost. Flap relief, alpha floor.

The flight managers are positioned between the line pilots and management. They have a different view when they look up and down.

Looking down to the line pilots:

They know that pilots express a desire to practice the use of manual thrust.

The flight manager's worry is that if pilots are allowed to disconnect A/THR, for the purposes of acquiring and maintaining skills in manual thrust management, they will make it a routine practice to do so. When they disconnect A/THR, they loose many protective features of the automated systems. Looking at the fleet overall the managers see greater risk. More flight hours lacking those protections looks like more risk. And considering the range of ability of pilots it is a bad deal. The management pilots estimate that the benefit of permitting pilots to practice manual manipulation of thrust is not nearly equal to the increase in risk due to the loss of protections. There may be an elaborate model here based on a distribution of abilities among pilots. Excellent pilots probably do not need the practice and will not benefit from it. Mediocre pilots may benefit from trying manual thrust control, but at some additional risk. Poor pilots may benefit little from the experience while exposing themselves and their airplane to considerable risk.

If a pilot says, "Hey, I've got 20,000 flight hours, I don't need those protections." The management pilot's answer is, "Well, if you have that much time you will now what to do when you need to do it. And with that much time, why don't you just set the altitude alerter to 0 and remember when to level off. Just as the altitude alerter provides an extra margin of safety, so does the A/THR system. Sure, you are capable of flying without either one, but what should the fleet policy be?"

Having paid for a system with extra safety features, the flight managers want their pilots to make the most of those features.

So how can the flight managers communicate this policy to the pilots? In training, in the pilot handbook, in line checks (current problems) and in CBS messages. But communicating to pilots can be a tricky problem.

In May of 2000, a CBS message went out to the fleet saying that A/THR should be used at all times. A few days later, the following CBS message was issued.

"We have received some questions from our line crews requesting clarification of the auto-thrust policy discussed in a previous CBS message. Use of the auto-thrust system, as well as other automated systems, is discussed in the Pilot's Handbook, Chapter 18.1.2 "Use of Automated Systems". This section states: "To reduce pilot workload and improve safety, use the full capability of Autoflight, ATS and FMS whenever possible."[1] This philosophy is consistent with the design of the aircraft, its certification and our training program. However, we do recognize that there exist rare situations in which pilot intervention in the automated operation of the ATS is necessary. Examples may include system malfunctions or extreme environmental conditions when auto-thrust is not performing adequately. Understanding the ATS system, its function and the protections

[1] Much of the industry is moving toward a policy encouraging the use of the "appropriate level" of automation. However, it is not clear, what the distinguishable levels are, or how pilots should identify the levels, or how they should decide which level is appropriate for which situations. This sort of policy effort seems blissfully ignorant of the cognitive difficulties involved in making the necessary judgments and putting them into action. (See the work on "living in the blend".)

it provides is key to safe flight operations. Please accept my apology for the confusion. Should you have further questions, please contact the Senior Check Airmen or myself." This message was signed by the Captain who is flight manager for the fleet.

The problem with this statement for the pilots is that they must still decide what qualifies as one of these "rare situations in which pilot intervention in the automated operation of the ATS is necessary." There is some ambiguity here.

Flight managers realize that there is a loose coupling between management policy statements and what pilots understand. This is mediated by "ops room banter". For example, on a line check, a check airman tells a particular pilot not to fly with A/THR disconnected in some context. This is passed on to other pilots as a strict prohibition in all contexts. It is difficult to communicate the reasons behind policy decisions to line pilots. Sometimes there is a sort of adversarial relationship between line pilots and the check airmen.

The flight managers decided to encourage the use of the automation for the reasons given in the CBS message. The decision to develop a separate Master Equipment List (MEL) is part of this. Under the original certification MEL for the Airbus, dispatch with A/THR inoperative is allowed. However, the flight managers for this airplane at this airline have chosen to work from a more restrictive MEL under which dispatch with A/THR inoperative is not approved. This is a decision that they must justify to higher management. Management would prefer to operate under the more liberal provisions of the original MEL. The check airman gave the example. Suppose one of our Airbus airplanes is at the gate with A/THR inop. We cannot go. At the next gate sits an Airbus belonging to one of our competitors. A/THR is inop on that airplane too, but they can go. When that happens, we lose to our competitor. (Is there a contradiction between this worry and the claim the pilot made about the reliability of autothrust systems below?)

Looking up toward higher management, the flight managers have another reason for not wanting pilots to experiment with using manual thrust. This is tied to this need to justify operational policies to upper management. If pilots routinely fly with manual thrust, this will appear in Flight Operations Quality Assurance (FOQA, pronounced foqua) data[2]. Management could easily look at such data and say, "Why do we cripple ourselves by not permitting dispatch with A/THR inoperative when we have data showing that our pilots are routinely using manual thrust without any problems?" So, pilots experimenting with manual thrust could undermine the flight management office's justification of the policy.

And consider the consequences of approving dispatch with A/THR inoperative. If this were allowed, it would not be possible to insist on a policy of A/THR use. It is one thing to respond to the need to control thrust manually when the A/THR system fails in flight. It is a different situation to push back and takeoff with this system inoperative.

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[2] By law, all new airplanes in part 121 operations are equipped with Digital Flight Data Recorders (DFDR). Fifty of the 200 Airbus airplanes in this fleet are also equipped with FOQA recorders. The FOQA recorder captures similar data to what is captured by the DFDR. The FOQA data is de-identified and used by management to detect operational problems. The DFDR is the armored "black box" which can be accessed, but normally is not accessed unless there is an accident.

Making it official policy (no pilot discretion) to ground the airplane when A/THR is inoperative makes a strong statement to the pilots. And if it is true that A/THR virtually never fails, this measure is of little direct operational consequence. Its primary effect on operations is symbolic by highlighting to pilots the perceived importance of the use of the A/THR system.

There is a complex set of risk management relations here. What seems best for the individual pilot may not be best for the fleet. Or, put more accurately, the tradeoff for the individual pilot between the benefits of practicing manual thrust operations and the costs of not knowing what to expect if A/THR fails seem, from the individual pilot's point of view, to favor disconnecting A/THR occasionally. From the flight manager's point of view, the tradeoff between the risk of having many flight hours flown lacking the basic protections of the autothrust system and the benefit of a pilot being a bit more comfortable in the extremely unlikely event of a failure of the system, seems to favor a prohibition on use of manual thrust. The check airman to whom I spoke said that A/THR systems are very reliable. He said that in 8 years as a senior check airman on the Fokker program, he never heard of a failure of the autothrust system.

Conflicts between individual and group rationality are commonplace, of course. But this game is much more complex than the paradox of the commons or an N-player prisoner's dilemma. The question is not who has the authority to represent risk, it is who has the authority to bring the representation of risk to bear on operational policy. The flight managers see themselves as the responsible parties here. They must set the policies that must work for all the pilots.

Summary:

The pilots who violate the policy are acting in a "sensible" way to ensure their own safety and the safety of the flights they conduct. The flight managers are also acting in a "sensible" way when they strongly encourage the use of the autothrust system at all times. The disagreement between them is not a result of irrational behavior or any cognitive failure. It is a result of differing representations of the role of the pilot, the value of experience to skill, and the consequences of particular courses of action on the safety of flight.

If one would like to say that one of these views is better than the other (given yet another representational system) and would therefore like to change one to conform to the other, the problematic should be seen in terms of the cultural assumptions of the two groups. The question then becomes, how can this policy be made culturally meaningful for the pilots? Or, how can a meaningful policy that will produce the desired behavior be communicated to the pilots? There are two issues here. One is the meaning of the policy as constructed by the pilots in the context of their work. The other is the relation between the constructed meaning of the policy and the behavior of pilots. That is, under what conditions will they use the procedure or policy as a resource in the construction of a course of action?

An interesting aspect of cultural assumptions is that, to the extent they are noticed, each person tends to take his own assumptions as fact or knowledge, while those of others are taken to be "beliefs".