

# *Judgment-- Can It Be Taught?*

*A collection of opinions and ideas attempting to answer this question. These were submitted by members of the Industry CRM Developers forum during the month of June 2004.*



## *ABOUT THE INDUSTRY CRM DEVELOPERS GROUP*

The Industry Crew Resource Management (CRM) Developers Group is a forum to identify needs, coordinate processes, and facilitate development of aviation CRM and Human Factors (HF) resources and products. It accomplishes these goals through meetings, workshops, and online communications. It maintains a site on the Internet's World Wide Web and an Internet mailing list.

## JUDGMENT-CAN IT BE TAUGHT?

Sun 5/23/2004 10:07 PM  
Gary Hook [gthook@shaw.ca]

I had a very interesting conversation last week with one of our senior trainers. He was of the opinion that if an ab-initio pilot did not meet the standard due to poor/lack of judgment, then regardless of what the individual did, he should not be allowed back into the pilot training program. I have been pondering this for the last few days and have come to the conclusion that I disagree. In other words I believe judgment can be developed through proper training for most candidates.

I strongly believe that leadership skills can be developed so why not judgment. The counter argument then that in aviation there is only a unique subset of carbon based life forms that inherently possess the requisite level of judgment; thus if one is assessed as not meeting the standard, then regardless of what training he or she undertakes, they will always be a risk. The result then is that they never be allowed back into the pilot training system.

So what thinks ye sage and ever so wise gathering. Can judgment be developed or....

Gary T Hook  
[gthook@shaw.ca](mailto:gthook@shaw.ca)

Sun 5/23/2004 11:19 PM  
Peter Simpson [peter\_simpson@cathaypacific.com]

for a classic paper, see Jensen's 'creating a 1000hr pilot from a 300hr pilot' - or a title that that effect. His study shows judgment and DM can be taught.

peter

Mon 5/24/2004 2:03 AM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Gary  
I 'would like' judgment to be able to be taught, but judgment, DM and other cognitive human works are not so

easy to learn. Difficulties may reside in that knowledge and skills obtained in the simulated environment experience may always be "mentally compartmentalized" in a different way from real world experience and knowledge. Hence, the question is raised, "Is there any training or educational methodology with which knowledges gained through simulation of events going to be "shared" with the part of the brain that is used when the same, or similar case, occurs in reality?

This must be our next challenge to make CRM more practical and proactive. My answer to your question is "conditionally YES." Hide Sakuma

Mon 5/24/2004 2:50 AM  
[norman.macleod@btconnect.com](mailto:norman.macleod@btconnect.com)

Gary,

When I worked in Officer Training, "Common Sense" was one of the criteria we were supposed to use to judge officer candidates. I suggest that "common sense" like your colleague's "Judgment" resides in the eye of the beholder.

By bringing Judgment into the plethora of terms applied to evaluating performance are we not just clouding the issue? Most models of decision-making require options to be evaluated against criteria for success. If I can reveal the criteria used I can estimate the effectiveness of the decision-making process. I can determine the range criteria applied and their suitability in the decision-making situation.

Including "Judgment" in the debate probably adds little value to the concept and process of decision-making.

Cheers,  
Norman

Mon 5/24/2004 3:41 AM  
Raúl Sosa [rsosa@telefonica.net]

Dear colleagues:

I have been visiting this forum for some time and the most of it I read and learn from your contributions. I hesitate in writing since I don't have the required command of English usage to express ideas at your level. However the issue raised on this string on judgment teaching interest

me a lot. I am not sure if those high level cognitive skills can be taught or trained in a classical training environment. I understand that when we talk about CRM and its components we are talking in some way of remedial actions. We decided in the 80s go for CRM when we discovered in some accident analysis that our crews lack something not provided by previous training: human factors resources and conducts adequate for the demands on real life exposure. But we cannot be permanent in the "remedial" side of this issue, "improving the patch". We should thing a step forward in designing the future. I believe that the big question here is what we call in Spanish "the competence" of the crew. Competence can be understood as "proficiency" and includes: knowledge, skills, attitudes and experience. A person is competent when the required resources to match the work demands are in place. Good judgment, whatever we understand by that, is a clear competence trait for a pilot. Part of the competence complex can be trained, of course, and part is reliant on our own natural skills and predispositions. Therefore, to come to an end, part of the problem is also with proper selection of flight crews. We have mentioned several times here and in other forums that it is not enough to handle technically an aeroplane for the pilot, but to operate it with the other non technical skill required. I know that in a big part of the world pilots are screening through different methods, but real selection by competences is not in place, the reason varies for that, but mainly is because this kind of "personality checks" or deeper psychological checks are not well understood or accepted.

Thanks for reading me, regards  
Capt. Raul Sosa (Iberia)

Mon 5/24/2004 5:48 AM  
RHorn [rhorn@hixnet.co.za]

Greetings Group,  
I believe "Judgment" in initial training used to be called "Airmanship" and it was definitely taught. (In fact, it was a part of the syllabus that the student had to pass to obtain a licence.) Later in ones career, "Judgment" becomes part of experience. As our mental models grow, we (in theory) should make better judgments. Comments?

Regards Rob [rhorn@hixnet.co.za](mailto:rhorn@hixnet.co.za)

Mon 5/24/2004 6:31 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,  
I've got a problem with your statement:

"Difficulties may reside in that knowledge and skills obtained in the simulated environment experience may always be "mentally compartmentalized" in a different way from real world experience and knowledge."

If that were true then simulators would serve absolutely no purpose since none of the knowledge gained would ever translate to the actual cockpit. If you took that same idea even further then classroom teaching would wind up being compartmentalized in a way that would only make it relevant when you're sitting in a classroom.

Information, skills, knowledge, judgment, whatever you want to call it gained in one environment is not useable only in that environment. It may not be "exactly" reproduced in a different environment, but it is and can be reproduced and then becomes experience gained in that new environment. In other words, knowledge gained in one environment IS shared with the parts of the brain that hold knowledge gained in other environments, that's what "learning" is all about.

Jeff Weber

Mon 5/24/2004 5:58 AM  
Morne Wiid [mwiid@thoughtprocess.com.au]

Hi Gary,

I am sure that Mary-Ann would be able to add some value and input to this posting. Pilot judgment does not automatically come with the qualification of an aircrew license or rating, but it is rather dynamic process that starts with that very first flight. It seems like a fairly obvious statement, but there are indeed many factors that may impact on pilot judgment training and personal development.

All of us (excluding the aces) can most probably remember how poor our judgment (skills and knowledge) were during the first few hours before going solo, in fact years would go by where this development process of judgment would

continue. Our instructor's guidance and experience provided us with the initial foundation blocks to develop not only the art of flying, but also with all the other airmanship skills aviators require to become a well balanced and disciplined pilot.

My experience with pilot judgment is that this process heavily depends on the training system and the behavioural and personality styles of instructors. In Australia, and I am sure the rest of the world, most instructors have qualified from a couple of cross country navigational exercises with endless amounts of circuit training. I do believe that, if pilots gained their commercial license and went and did some operational flying away from the circuit environment and then returned to instruct, that the quality of instruction will greatly be improved.

More to follow.....off flying!

Regards,  
Morne Wiid

Mon 5/24/2004 6:24 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Thanks,  
You provided the answer I would have in much better words.

Jeff Weber

Mon 5/24/2004 8:12 AM  
Gary Hook [gthook@shaw.ca]

Having read through the various posts I wish to thank everyone for the initial round of contributions to the discussion. Judgment, SA, decision making etc they all get clouded and used interchangeably. It would be interesting to sit down a bunch of instructors and get them to write out a definition for each. Anyway, I digress!

In reading through Jeff's question back to Hide, he hit upon what I feel is the crux of the matter. Specifically the ability to transpose (think laterally or transfer) knowledge from one environment or situation to another. There are some that seem to have a natural ability to make the immediate link whereas there are there are others who just don't get it. At least not at the outset. All formal

training systems have to identify the "cost benefit analysis" point where a student who cannot make those links, has to be let go. The old adage if I had enough hours I could get my grandmother to solo.

So far everyone appears to agree that judgment is a skill that can be developed (notwithstanding the challenge of muddying the waters as Norman suggests :-). The consistent thread appears to be the context of the training which will lead us to Raul's observation on the proper selection of aircrew.

Peter - thanks, I went and dug out my copy of Dick's book "Pilot Judgment".

Cheers  
Gary

Mon 5/24/2004 4:31 PM  
Wilson, Brian T [Brian.T.Wilson@delta.com]

For an excellent discussion on this see the papers of Dr. Marvin Cohen of Cognitive Technologies [www.cog-tech.com](http://www.cog-tech.com), and the Foundation for Critical Thinking Skills [www.criticalthinking.org](http://www.criticalthinking.org), WTRI (Dr, Lia DeBiello) [www.wtri.com](http://www.wtri.com), and SA Technologies (Dr. Mica Endsley) [www.satechnologies.com](http://www.satechnologies.com)

Regarding judgment - especially critical thinking skills, one must ask the question: Are critical thinking skills general in nature and thus can be transferred across domains or are critical thinking skills domain specific? I think the answer to this is - its both. There are certain critical thinking skills of a general nature - these mostly being of a format or checklist nature: (What is the problem? What are the characteristics of the problem environment? How is it changing and what is the rate of change etc.). Critical thinking skills are also domain dependant. One cannot expect an expert doctor with no flight experience to make good decisions in a flight simulation problem requiring knowledge of the flight environment.

Domain dependant critical thinking skills are based on several cognitive abilities. One is the ability to recognize familiar patterns in the environment. A familiar pattern suggests a finite set of available options. The

options themselves are often a recognizable pattern which suggests the relative level of risk in that option. Another domain-dependant critical thinking skill is that of cause and effect knowledge (which could arguably also be a function of pattern recognition). For instance knowing that a radar picture of a thunderstorm showing a wedge-shaped cell with notches and a precipitation heights of over 30,000 ft indicates a dangerous cell even though you do not have personal experience flying through such a cell is an example of judgment relying on domain-dependant knowledge. Fly through that cell and you will get hammered - cause and effect.

Ultimately, good judgment depends on building in ones mind an accurate mental model of the flight environment. This model would explain most all of what is going on in a rational context, identify the viable options, the relative risks of those options, and also simulate potential future flight states based on exercising those options. Thus I believe we cannot divorce judgment from a discussion of situational awareness and its cognitive building blocks.

There must be two criteria in Gary's scenario regarding the decision to accept the student back into the program in the future. The first is to determine if the student has basic reasoning skills. Can the student see basic relationships between simple bits of data and simple flight situations? If the student can exercise basic reasoning skills then the issue is one of experience. Then how does the student get that experience? If the function of an instructor is not to convey "experience" by pointing out the relationships between disparate facts, actions and conditions, what is an instructor for? The student can either get experience and develop judgment on their own by trial and error (often with tragic results) or the instructor or more experienced airman can convey experience at an accelerated rate through mentoring.

Brian Wilson

Mon 5/24/2004 7:32 PM

[jbeelersr@comcast.net](mailto:jbeelersr@comcast.net)

Not trying to wade into deep water with such a shallow mind, but judgment is based on knowledge? If this is acceptable, then possibly critical judgment should be based on critical knowledge? If this is acceptable, then is

critical knowledge provided? If critical knowledge is provided, then in what dosage?

Not sure about the rest of the list, but I did not learn to eat with utensils the first time my parents placed them on my tray (not so very long ago I would add.) Yeah, right! Still, it is through continued issue that we learn some things. Rarely is this the first time (experience speaking so mine may differ from yours.)

Having developed training while serving and as a contractor, there are instances where the training is all about doing things right without a measure of failure built in. Not necessarily human error, although that can erupt from a number of areas, but equipment failure. With today's treasures of technology, we sure allow a large amount of trash to use as "trainers" then base that as the measure of the user.

With all of the flight tales and war stories, we surely can develop trainers that allow the user to test their skills against external barriers. Again, just my experience.

Jim

Mon 5/24/2004 8:33 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

Thank you for your frank criticism on my idea. I have just thrown a small stone in the water to make a small wave. You took it as a big stone which may make a big wave disturbing current movements. I do not say all of class room educations and simulator trainings are meaningless and less valued. I just hate the complacency that people expect most of educations and trainings would directly contribute to effective judgment in emergency situations.

There is a fact that I myself knew from the recent TV program in Japan. It was ironically reported that a girl who won a world championship in riding a monocycle proved herself not able to ride a bicycle at all.

This is not necessarily surprising since the brain compartment containing necessary memories and schema is completely different between two kinds of riding performances which seem to be similar to each other. I can find many other evidences to support it in actual CVR

records of past accidents. We have long believed that class room educations and simulators trainings would be of some value in extremely critical conditions as well but I do not know any data and documents to prove that. What we have to deal with in accident prevention is pilots performance and behaviors in abnormal situations like decompressions, loss of controls, duration of constant "G", etc. not in "comfortable" classrooms and simulators. In other words, we must dialog with the "unconscious" part of the brain. I do not think paper tests and simulator checking could properly assess such human potential abilities which are truly useful in such unknown, inexperienced extreme conditions. We have many things to do to further improve cognitive trainings before starting CRM assessments. I am deeply concerned that currently prevailing SOP mindness may degrade pilots' cognitive capabilities. This may be one of reasons why people feel current CRM is less effective in preventing actual accidents and incidents.

Hide Sakuma

Mon 5/24/2004 8:58 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Rob

Thank you for your good comment, but I feel even well experienced pilots are still "beginners" as far as inexperienced, unknown emergency conditions are concerned. The problem is, how we could apply knowledge and skills gained through our experiences to unknown emergency situations.

Hide Sakuma

Mon 5/24/2004 9:24 PM  
Alan Benn [alan.benn@flyingdoctor.net]

Not completely true Morne. Many instructors enter flight training with minimal flight experience but bring with them an inherent natural ability to teach. Whereas others become instructors after gaining their operational experience, and with no aptitude for teaching are almost completely unable to impart their knowledge. While flight instructors need to be good pilots it is difficult for a flying school to teach then to be good teachers, a supportive flying school can however make them good pilots. Only someone with good judgment and teaching skills can

teach the judgment required of a pilot. Rarely have I seen an experienced pilot with no teaching background make an effective flight instructor, but I have in many individuals seen excellent teachers of flying despite their youthful experience. You are absolutely right to say teaching judgment is dependent on behavioural and personality styles, but in my opinion this is more important than flying time. Remember that in Australian general aviation low time commercial pilots gaining experience will do it with minimal supervision and often be taught their lessons by the people who do not have their interests in mind, and then you think they should become instructors of other people?

Alan B

Mon 5/24/2004 9:25 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jim

Well said!

Judgment is neither knowledge nor skills.

I think judgment is one of high level human behaviors that could solve inexperienced problems with better use of available knowledge and skills. The way of judging something may vary with individuals and cannot be taught completely. We, however, could provide people with some helpful hints for better judgments which are available not only in aviation fields but in anywhere on our usual life. CRM starts not at the entrance of simulators but when leaving home or getting up in the morning.

Hide Sakuma

Tue 5/25/2004 6:30 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

Your small stone has generated some very large responses so it must have been a good one to throw.

A point of contention however: "We have long believed that class room educations and simulators trainings would be of some value in extremely critical conditions as well but I do not know any data and documents to prove that."

In order to get documentation of this you need to figure our how to document when accidents don't happen. As far as

I know there's no way to do that right now. I DO know however, that the ever present Emergency Procedure simulators I went through while I was in the Navy DID have a direct impact on my ability to avoid trouble by reacting immediately to certain, critical situations in the airplane. These were situations I had never encountered outside the simulator, but the reactions I had learned first in the classroom and then practiced in the simulator applied directly to the behavior (and dare I say judgment) I used when an emergency arose in the air. Since there was no accident however (phew) this is not recorded as evidence to support or contradict a theory.

Personally, I was uncomfortable in every emergency procedure or instrument check simulator I ever flew. A lot less comfortable than I was in the cockpit at times (did I just say that out loud?). Maybe that's part of the issue, the only time the simulator should be a comfortable environment is when the instructor is setting you up with a false sense of security before hitting you with a compound emergency.

Jeff Weber

Wed 5/26/2004 8:43 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

I fully understand your reaction against my saying "Simulator trainings are comfortable". This may be again a small stone I have unintentionally thrown to the forum. I suppose you have had uncomfortable experiences in simulators trainings mainly because you felt the treat not of death but of "check fail" or something. As well as perceivable threats of death, human brains variously react to any small change in environments which we may encounter just before accidents. I have heard some comments on similarities between JAL 747 accident in Japan and UAL DC10 accident at Sioux City, both of which involved total loss of flight control hydraulic powers. We, however, should not disregard a remarkable difference between the two accidents. That is to say, JAL pilots were, due to exploded aft pressure bulkhead, exposed in an extremely adverse condition which were quite different from normal decompression and have never been experienced in human histories. It is not suspicious that pilot's brains were not able to exhibit their full capability. Simulators could

not provide pilots with such an extreme condition or even lower air density conditions which pilots experience in routine flights. One of remarkable differences between pilots and other operators like fire fighters and medical doctors is that pilots may make errors in lower air density conditions. I've never seen researches and studies that dealt with the effect of air density on probability of errors. I would insist that CRM should take into account such differences in environments between simulators and actual flights including low air density, radiations at higher altitude, frequent change in G (not necessarily simulated by simulators), etc. I said "Simulator trainings are comfortable" from the viewpoint stated above.

Hide Sakuma

Thu 5/27/2004 2:26 AM  
SB [sdb@bigpond.net.au]

Hide,  
In reference to:

"I've never seen researches and studies that dealt with the effect of air density on probability of errors. I would insist that CRM should take into account such differences in environments between simulators and actual flights including low air density, radiations at higher altitude, frequent change in G (not necessarily simulated by simulators), etc."

There are literally hundreds of studies surrounding this from military, non-government contractors to the military, NASA, Farnborough and many other sources that have studied this to death (no pun intended).

"I suppose you have had uncomfortable experiences in simulators trainings mainly because you felt the treat not of death but of "check fail" or something. As well as perceivable threats of death, human brains variously react to any small change in environments which we may encounter just before accidents."

The processes involved in the perception of imminent death or injury, are complex to say the least. However, there is considerable evidence to support the notion of sensory overload (much like your first few parachute descents),

that evolves from the heightened awareness (understatement). It is not reasonable or ethical to take subjects to this point in any training environment; it is possible to cause serious harm to people if it were attempted (as it was in past world conflicts by unethical and brutal military sponsored experiments).

Steve

Thu 5/27/2004 7:25 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

I guess my problem is that while I understand the concept that the brain stores information (learning/experience/etc.) from different situations in different ways, I can't grasp the idea that the brain is not capable of translating that to other situations. If that were true, the only way we would be able to effectively react to a life and death situation was if we had been in a life and death situation before and somehow survived it. Not to mention, the situations would have to be extremely similar. Simulation is the closest we can get to the real situations without actually exposing ourselves to them and while the fear may be of "check fail" or even just loss of pride by not properly reacting to an emergency in the simulator, it still makes the physical body react in a similar way which I believe helps the brain then react properly to the situation.

This is probably another small stone but;

"It is not suspicious that pilot's brains were not able to exhibit their full capability."

Looking at your example/comparison, it implies that there is never a way for pilots to exhibit their full capability in an emergency because every emergency is different and without having had experience with that exact situation then they will not know how to react. I would argue that the use of simulators and flight training provides that experience (at least as closely as we can get today) and allows them to react to the "best" of their capabilities in an emergency and that's about all we can ever ask. As trainers, the best we can hope to do is expose pilots to as many different situations as we can and assist them in

developing the correct methods to respond so that in the real world they at least have some experience to draw from and hopefully have learned some "judgment skills". Which I obviously believe can be taught (well, in most cases though I have seen some who appear hopeless).

Jeff Weber

Thu 5/27/2004 7:47 AM  
Wilson, Brian T [Brian.T.Wilson@delta.com]

Jeff;

I would agree with your perspective. Some critical thinking and judgment skills ARE transferable to other situations - we do not need to experience every potential situation. All we need to do is to experience situations of a type - as an example engine failures. Every engine failure is different but the basic response to every engine failure is essentially the same - fly the aircraft first - then run the checklist or memory items. All that is required is that we recognize the basic type - engine failure, respond with the basic management skills, and then modify our response to meet the particulars of the situation. We do not need to actually experience every iteration of an engine failure. This pattern of recognition/ assessment, judgment and action / modification of action has been studied extensively in Naturalistic Decision Making research and has been modeled by Dr. Gary Klein. This model is well accepted in research circles. Furthermore, it explains a number of identifiable characteristics of expert decision makers and as such is worthy of a look.

I would also argue that we do not have to experience every iteration in the simulator - we can "experience" it in our minds through mental simulation. As a military man, you should be well acquainted with this process - mission briefing. An in-depth mission briefing essentially allows the combat team to simulate the mission in their mind, finding the obstacles, threats, bottlenecks (the fog of war) and develop strategies to manage that fog. The most extreme example of where this is routinely used is the pre-show briefing by the Blue Angels. They sit around a conference table with access to aerial photos, eyes closed and literally fly the show in their mind before going out to the airplanes. A well cited study by R. Amalberti and F. Deblon (1989) which studied expert F-16 pilots noted one striking difference between them and novice F-16 pilots.

This difference was that the experts mentally simulated the mission, identifying threats, and rehearsing responses to those threats. In essence - they "experienced" the mission prior to actually flying it. In mentally rehearsing their responses to contingencies, they were able to respond more rapidly and appropriately to those contingencies than the newer F-16 pilots.

I would be happy to share any of the above cited research or give you sources for it.

Cheers  
Brian

Thu 5/27/2004 7:44 AM  
Norman MacLeod [norman.macleod@btconnect.com]

Jeff,

The literature on problem-solving has many examples of poor application of knowledge across different domains. Here's an example from Psych 101. 2 simple games - Towers of Hanoi (or maybe Saigon) and Missionaries and Cannibals. The first involves rearranging blocks and the second involves shifting people over a river. Success in one does not guarantee success in the other game even though the principle is the same. Application of the same principle across 2 apparently different games just doesn't happen. the issue is the difference between surface features and underlying principles. People tend to start at the surface features rather than look for the principles.

I have just been working with a group who dismissed a case study on the grounds that the aircraft was different model (same type) and had a different colour scheme. The fact that what the crew did had been replicated many times within the airline in question counted for nothing - surface features and underlying principles again.

Norm

Thu 5/27/2004 8:02 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norm,

Okay, rearranging blocks and shifting people across a river is not in the same realm as losing an engine in the

simulator and losing an engine in the air. While the situations are not exactly the same, the similarities, surface features and underlying principals are so much closer that they "do" tend to translate from one to the other. Now, if the only emergency you practice in the sim was an engine failure of course that wouldn't help you deal with a loss of cabin pressure. That's not what I've been saying. My problem is that Hide's original theory sounded to me like you cannot translate what you have learned in one situation to another. Everyday life shows us however that that is not correct. While your example shows that you may not translate the knowledge or experience directly, I'd be willing to bet you the study shows there is "some" translation. Did they by any chance measure the ability to move people across the river by those who have not first rearranged the boxes (I'm assuming that "something" between these two skills is similar.) and compared that to those who first did rearrange boxes?

Bottom line: If we could not learn from one experience and then translate at least something of what we had learned there into other, different situations then mankind would have died out a long time ago. This is a basic survival skill. The closer the two situations are of course the more experience translates.

Jeff Weber

Thu 5/27/2004 8:05 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Brian,

Once again you are able to illustrate my point much better than I can myself. Thanks.

Jeff Weber

Thu 5/27/2004 8:59 AM  
Peter J. Wolfe [pjwolfe@earthlink.net]

Norman -

Due to time and other constraints, most training programs are likely to try using a single, well-developed example (good or bad) to present one or more principles "in action". The expected outcome is that the audience is supposed to be able to transfer/adapt those principles for

application in all relevant settings that they encounter from then on.

As a process this approach is just randomly successful.

Although I did my best to study the SOPs (policies and procedures) that our company developed for operations, I did not always recognize some of the ways that those SOPs might be applied. Then, when I sought counsel (from my fellow pilot or a supervisor) about how to deal with a specific situation, I would discover that the SOP had an application I'd never before seen.

So, part of the training formula must always be to show: (1) how the principle applies to local operations (Norman's point), and (2) how the principle applies to other situations that may NOT be readily apparent at first glance.

Pete

Thu 5/27/2004 9:26 AM  
Norman MacLeod [norman.macleod@btconnect.com]

Pete,

I think you have got to the heart of the problem. I'm not saying (as Jeff seems to have inferred) that learning doesn't transfer - just that it doesn't always transfer easily. Needless to say, in my undergrad example, subjects were allowed to play one game until they were successful and then given the second game to try. If transfer was efficient then they should have been successful in the second game in less tries than in the first. They weren't - hence my comments.

In Brian's message he refers to expert/novice differences. Another difference is that novices seek to map canned solutions onto surface features of problems while experts decompose the problem first and then look for solutions. So, transfer will be inefficient if all they are doing is treating symptoms based on limited prior experience.

Of course, we cannot expose people to all known conditions (a weakness of naturalistic decision-making training?) so we need to train better diagnostic skills.

And then we come to your comments. So summarise the problem in your first paragraph and you comment about random success is probably not too much off the mark. How many times have people learnt the wrong lessons in the sim? I know of one serviceable EMB-120 that was parked in a field because the captain applied what he'd (actually 'she'd) just learnt in the sim. Same symptom - different system. Your last paragraph should be etched on the wall of every briefing room.

Cheers,  
Norm

Thu 5/27/2004 10:06 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norman,

Just a clarification: I'm arguing FOR the idea that learning DOES transfer, not trying to infer that it does not. The original posts by Hide seemed (to me at least) to indicate that he did not feel learning transferred which is what got me started replying to this thread in the first place.

Jeff Weber

Thu 5/27/2004 10:22 AM  
Wilson, Brian T [Brian.T.Wilson@delta.com]

Norm

You are right - experts do decompose the problem but I would like to clarify one point the research makes on this issue:

Experts to a great extent decompose the problem prior to the actual occurrence of the problem. There are two main vehicles for this - prior experience (and thinking about those experiences) and scenario-based learning, whether that is manifest in deep briefing and planning behaviors or in classroom / simulator based scenarios.

In decomposing problems ahead of time in this manner, experts can use recognitional processes, and thus acquire SA faster, identify options sooner, and react faster with accuracy. If the expert has not decomposed the problem ahead of time, (the situation is new to them in all

aspects) the research shows they perform very similar to new pilots - they have to work methodically through the problem to acquire SA, identify and evaluate options and plan methodically. Difficult to do well at 8 miles per minute in many situations.

As we say - "experience counts" whether obtained through live flights or scenario-based training.

Brian

Thu 5/27/2004 10:27 AM  
Norman MacLeod [norman.macleod@btconnect.com]

Brian,  
How does the expert know what the problem will be ahead of time? If they could tell that, wouldn't they stay on the ground ;-)

Norm

Thu 5/27/2004 11:46 AM  
Wilson, Brian T [Brian.T.Wilson@delta.com]

Norm  
Like the F-16 experts - its all about planning behaviors, threat identification and error management.....and perhaps a call to the nearest palm reader ;-)

Brian

Thu 5/27/2004 8:56 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

All  
We would like to believe that knowledges stored in different domains of brain could transfer since, if not, simulators trainings would be of less meaning in preparing for accidents. We, however, have had learnt many lessons from past accidents that incorrect application of knowledges had directly led to an accident.  
For example, pilots gain knowledge from normal flight experiences, regardless of using simulators or actual airplanes, that they should pull the control column to recover when they perceive unintentional loss of altitude. If pilots apply this knowledge to the case where an

airplane is losing altitude due to stall, then the airplane never fail to fall into the deeper stall.

The problem is that skills for recovery from actual stalls never be obtained from either simulator trainings or trainings using real airplanes. This is why automated stall recovery systems such as alpha protection on A320, C\*U law on 777 and stick nudger on 767 were equipped with to prevent such accidents. Bad news is that these automations have produced new types of accidents due to fighting between human pilots and automated systems. As far as this specific example is concerned, simulator trainings are not only less effective but rather have adverse effects on pilot judgment and behavior in split time.

In concluding, knowledges are transferable in some cases but not in all cases. Whether pilots could expand their capability to transfer knowledges or not would be up to not existing type of educations and trainings but their own efforts to build up necessary schema in their own brain. My motto for good judgment is, as I said before, "Listening to One, then knowing Ten."

This kind of competency can be gained through careful observation on everyday things. Stall recovery theory and technique can be obtained with experiences of driving a car on the slippery road. Hide Sakuma

Thu 5/27/2004 11:29 PM  
SB [sdb@bigpond.net.au]

Hide,

I simply cannot agree with any of that; although I have sympathy for the example of stall recovery, it too can be overcome or reversed in a pilots mind. I cannot imagine a pilot being allowed near anything sophisticated or heavy without having this most basic of skills, yet I have found them.

I have some experience with teaching ab-intio sequences albeit somewhat differently to the traditional approach. The following was a technique we used to deal with the stalled flight.

All our ab-intio pilots were taught to loop and roll (not with any precision) from their first flight. We allowed them to take the aircraft through to the uncommanded departure and instructed them to simply centralise the stick if the aircraft started to do anything they didn't ask it to do; then roll the aircraft upright or to the

nearest horizon. There was some considerable briefing, and, as I said earlier, no precision was called for. It was treated as an exercise that had no negative aspects, instructors laughed with students and no-one had a problem when it came on to the formal stalling routines.

The stalling routines (across the course) include stalling across the top of a loop, on the vertical up and down line, and during max performance turns. We introduced level 1 g stalls during an additional exercise on flying the drag curve, by then it was real yawn.

We gave the students a fundamental tool to start flying the aircraft by judgment; visual and physical judgment with only occasional reference to engine instruments. The airspeed indicator was only referenced for manoeuvre entry speeds when they wanted to add some grace or precision to their manoeuvres. The "tool" was stick position.

For light aircraft flying generally below 180 Kts, there are no compressibility issues (of any note) and hence no significant movements in pitching moments. It can be demonstrated that for these light aircraft the stall stick position is very similar in all regimes; gear down/up, flap down/up and across the weight range. The differences are very small indeed. In fact one can mark the dynamic stall stick position on control column type light aircraft with a felt tip pen. If one doesn't see the mark, one cannot be stalled. That simple.

While there is a bit more to this than I'm explaining here, we found students flying their aircraft to up to and around the stall buffet (when there was any) and holding this stick position in conditions of low 'g' low speed e.g. at the top of a very exaggerated wing over. They controlled the AOA without even thinking about it.

They learnt this judgment in an aircraft, by watching, doing and controlling. So I find it difficult to accept your overall argument on the evidence you have cited.

Steve

Fri 5/28/2004 1:29 AM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Steve

Although you might have provided ab-nitio pilots with such knowledge and techniques about stall recovery, they have no chance to verify them at actual stall speed (FAA stall speed) or even at lg stall speed because it is in fact so dangerous. You are missing some important thing that pilots behave almost INSTINCTIVELY rather than according to theory and rules when they encounter with abrupt entry into stall, i.e., stall during takeoff climb with failed flaps and stats. Except CFIT accidents, almost all accidents are attributed to such failures in recovering from deep stalling. Sprit time judgment and DM for stall recovery, therefore, must be the most important subject in CRM training, but could not be included in simulator trainings since current simulators do not simulate any actual stalling situation.

Hide Sakuma

Fri 5/28/2004 1:51 AM  
SB [sdb@bigpond.net.au]

Hide,

There are circumstances in any aircraft when stalling can be lethal. However, I'm sincerely shocked to hear any professional say stalling "...is in fact so dangerous." It's another flight regime and that's all.

If you read and understood my earlier post you would recognised that the students I was refereeing to DID fly the aircraft instinctively. The fact that they could position an aircraft, on altitude, on speed, in the right attitude and in the appropriate alignment, almost without thinking, means that the process is largely instinctive both from a motor and cognitive point of view. This is not a bad thing.

The students had adopted a mental model of AOA control and the knowledge (for want of better expression) became an ingrained way of dealing with a system and \*any of its variations\* without giving rise to heart palpitations or dragging out a pencil and paper. They had a sense or judgment that enabled them fly rings around most line jocks.

However, the example was provided to show that some instincts can be healthy and that judgment can be learnt.

Steve

Fri 5/28/2004 2:36 AM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Steve

You have posed an important point of discussion for developing effective CRM training. As you say, stall characteristics varies among types of airplanes, especially between small aircrafts and large civil commercial airplanes.

Older airplanes like DC-8 had natural tendency of nose down accompanied by natural warning (wing vibration) when entering stall.

Latest commercial airplanes, however, sacrificed such good characteristics to improve cruising performance incorporating relatively small size of tail and subsonic wing airfoils. This is the very reason why automated stall recovery systems became necessary to meet with FAR requirements. I, therefore, said that training for stall recovery is DANGEROUS on these airplanes not on small aircrafts. Airline pilots never experience even lg stalling in flight trainings using actual airplanes. I do not think current flight trainings effectively cover instinctive area of pilot behavior especially under highly distracted conditions.

I would say again people should place special emphasis on difficulties in recovering from actual stall on current high technology aircrafts.

Hide Sakuma

Fri 5/28/2004 3:16 AM  
SB [sdb@bigpond.net.au]

Hide,

Ok you have put a different contextual emphasis on the discussion. The factors that are leading to the stall event are the obvious candidates for review. Which is, in essence what you are driving at.

One can go on with this but it's not the question that was first put i.e. can judgment be learnt. Poor instruction or training is another matter.

Next time you get to Oz, I'll be by lunch...:)

Steve

Fri 5/28/2004 4:00 AM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Steve

I would like to teach judgment or other cognitive skills if possible, but find many difficulties in doing so.

I believe my disclosing historical background of design certification for stall characteristics would be of any help to motivate individual pilot to think about interfaces between human pilots and automated stall recovery systems on high technology aircraft.

Judgment training should start with positive pilot involvement and open-minded discussions among relevant people including designers and regulators.

I love to take lunch with you when you come to Tokyo.

Hide Sakuma

Fri 5/28/2004 6:27 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

First, your example about stalls: "skills for recovery from actual stalls never be obtained from either simulator trainings or trainings using real airplanes" ... They are first learned from classroom teaching (one part of the brain) then translated into the simulator (another part of the brain) and finally into the airplane (another part of the brain) and I would love to have you find me one professional pilot who admits they don't know the basic steps for a stall recovery in their airplane and how to apply them.

However: "Stall recovery theory and technique can be obtained with experiences of driving a car on the slippery road" I doubt you will find many people who have only driven cars on slippery roads who will be able to translate that directly to stall recovery in an airplane.

I guess my point in debating this is that I see there is always SOME transfer of learning from one situation to another. The greater the difference between two experiences though, the less the amount of learning that will transfer since less of it applies to the situation.

You are not going to transfer a lot of learning from learning how to chop wood to dancing as a ballerina but there is SOME transfer even then (muscle movement, stretching, etc.). Hence the whole reason simulators exist, to bring the experience as close as possible to what the person will actually be doing. Of course it's not perfect, but I'll bet you that after ten or fifteen engine shut downs in a simulator a complete novice could shut down the engine on an aircraft in flight even if they didn't know what made the airplane go up or down.

Jeff Weber

Fri 5/28/2004 7:38 AM  
[jbeelersr@comcast.net](mailto:jbeelersr@comcast.net)

Transferring knowledge is not so difficult to understand. What is difficult is when to apply what is relevant at the moment. Is it so difficult to understand the concept of tying our shoes to tying a bow on a present? What about eating with a fork and using a pitchfork in the garden? Riding a bike on ice to driving on ice?

There are a great number of transfers that take place daily, for example searching on this box is not far from searching in a library. Spelling words here is akin to spelling words in hand-writing skills.

It is a matter of relevance and timing, and having the previous experience. We can say that should be transferable, but without the experience what is transferred?

Jim

Sun 5/30/2004 8:38 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

I may have caused you to misunderstand my saying "Stall recovery theory and technique can be obtained with experiences of driving a car on the slippery road" because of being short of my explanation.

I just wanted to say that skills to transfer knowledge could be gained through everyday effort and attitude to find commonalities between appearingly different things. Aerodynamic stall of wings is very similar to lateral skid

characteristics of tires on ground vehicles including cars and aircraft.

In simulator trainings, trainees should put themselves in virtual mental state as if they are in actual emergency situations, which must be one of original objectives of developing expensive high fidelity simulators.

The fact, however, is that the main goal of current simulator trainings for most pilots is passing flight checks.

If we adopt assessments for CRM LOFT, pilots would be more inclined to success in checks instead of seeking original goals.

CRM LOFT must be so designed to help pilots to gain skills to transfer knowledge more easily and more automatically to different situations. This is the reason why I stand against assessing the effectiveness of CRM trainings. How to effectively transfer knowledge must be one of core elements of CRM/LOFT.

Hide Sakuma

Sun 5/30/2004 9:01 PM

[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jim

Yes, how to accumulate knowledge and experiences is essential to be able to transfer knowledge more easily and more automatically. I believe Top-down (Conceptual-driven) Thinking is one of ways which meet this requirement. There may be many other ways for pilots to be able to retrieve necessary knowledge out of different boxes when encountering emergency situations. Pilots should find them BY THEMSELVES not with assistances by other persons including trainers and facilitators. Generally speaking, knowledge and information which are accumulated by oneselves are easier to retrieve. Hide Sakuma

Tue 6/1/2004 7:01 AM

Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

If your whole point was to say that bad training will often transfer bad skills/knowledge, then I agree with you 100%. If you train the student poorly you can only expect to have a poor pilot at the end of the process and there will be those who look at that pilot and say "He's not trainable" or "He's got poor judgment", etc.

Jeff Weber

Wed 6/2/2004 10:01 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

You are exactly right. Every person can walk and run. Walking and running need very complex brain information processes, which could never be replaced by any digital computer.

Every pilot candidate is trainable if training method is proper and appropriate well taking into account Human Factors concepts and practices. I believe bad skills/knowledge (ex. SOP mindness) is worse than nothing. In fact, it was recently reported by news papers that an airplane of some airline returned to the original airport to exchange wrong flight log book with correct one in order to comply with the regulation that flight log book should be equipped with on every flight. I wonder if the captain considered bad effects of fuel dumping on surrounding environments and/or risks of over weight landing. The regulations never require turn back of flight which have once departed unknowingly of wrong flight log book. The mind of compliance with regulations seems to be excessive to the extent that pilots cannot make flexible and optimum judgment.

Hide Sakuma

Tue 6/8/2004 8:46 AM  
[sqrhead@aol.com](mailto:sqrhead@aol.com)

This is a fascinating series of posts. As a Coast Guard Helo Instructor, I always try and identify new ways to evaluate judgment. But to say, "Can it be taught?" I think the answer is yes and no. There are some parts of judgment that fall into each type of learning. You all have all mentioned Transfer of Knowledge and Application throughout the posts. I agree with the way you use them, but for this topic I feel you have to get more specific as to which form of learning transfers.

In one of our Methods of Instruction classes we talk about Rote, Understanding, Application, and Correlation as 4 different levels of knowledge. Rote could be memorizing an emergency procedure. Understanding is knowing why the steps are in a certain order and how each step effects the system. Application could be performing those steps during a real or simulated emergency. Now, this is where it gets interesting. Correlation, which seems to be something

every experienced pilot wants to pass on to new pilots, might be experiencing a problem not covered in the emergency procedures section; realizing the similarities between two different systems and then applying the steps from one procedure to the system in which the procedure is not defined. I believe the comparison of the Towers of Hanoi and the Cannibals and Missionaries is a lower level of Correlation.

As instructors and course developers, we want to achieve the highest level of efficiency for instruction passed on relative to the time it takes to pass that instruction on. We often get excited when there is a student that "Gets it" faster than others. That person just seems to get through these 4 levels faster than others. Naturally, you want to get everyone to learn that fast and wonder if it can be taught. Great question, but very difficult to do to a defined standard. (One other obstacle to overcome is an instructor inherently trying to get a student to a level higher than the defined standard.)

In order to teach judgment you have to define prerequisite skills that demonstrate the ability of a student to learn, relate, apply, and possibly correlate. For example spatial aptitude tests, psychological profiling, etc. Then you have a set list of skills they need to demonstrate to a defined level. All along, hoping you develop their judgment to a level where they can now safely go out and learn even more on their own through experience. At some point, you have to say, "This student is good enough to solo" and let them go.

As instructors, when we finally upgrade helicopter pilots to Aircraft Commander (or Mission Commander) after 2-3 years, we often say, "Well, they are going to make some mistakes, and they'll learn from them, but we are pretty sure none of those mistakes will be critical to flight safety." That is a tough thing to do when you know that on their first duty night as the Aircraft Commander they could have to respond to a search for 3 people in the water after a boat capsized with less than 1/4 mile visibility and zero illumination. You have to trust that you evaluated their skill level and their judgment level so they can at least get the mission done.

So what sets good pilots apart from great pilots? In addition to good application of CRM skills, an ability to

excel at this Correlation thing. To mission plan and anticipate; or to use "What if" scenarios. To place yourself in situations you have never experienced so you can see what actions you might take, or what additional information you might need before you can make a good decision.

I have seen very junior and inexperienced pilots with a fantastic ability to do this. They might not be one of the best at this time, but I know they will grow to be better than most and at a faster rate. I have also seen a few pilots that are satisfied with their ability and show no effort to get better or to grow because they think their skill set or judgment base is sufficient. Many of those folks have been in so long they rely on experience of having been in most of the situations so they feel they don't need to mentally anticipate new and different situations. In the end, there are two qualified pilots; one that relies on experience to serve as judgment, and the other that compensates for lack of experience by anticipating and trying to draw correlations so he or she can be as good as the other and ultimately much better.

I think there are some forms of judgment that you can teach. I think there are some forms of judgment that are above the minimum level required to be a pilot that some people possess more than others. I also feel there are people that lack sufficient judgment to be a pilot, or even drive a car for that matter. In the end you have to rely on the instructor using your syllabus to determine whether this person is safe to fly. There will be some that take longer than others and some that will never get it. The conundrum is there will be great pilots that were once categorized as someone who "Just didn't get it" but eventually did.

I enjoyed reading all of your posts. This is a very fascinating topic for me.

Joe

Wed 6/9/2004 9:13 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Joe

I have one question on your posting.

You mentioned "We often get excited when there is a student that "Gets it" faster than others. That person just seems to get through these 4 levels faster than others."

Do you really believe such stuff could effectively behave to avoid accidents in actually distracted situations?

There have been many accidents and serious incidents in which training instructor and managing pilots were involved. All of these pilots must have gained a good score in their past training and educational careers to be selected as a remarkable pilot.

I think there must be other competencies that are essential for managing risks and avoiding accidents in real stressful environments. These competencies, however, but are hard to assess with existing assessing skills and technologies.

We had discussed to know that assessment in class room could never be applied to real cases because of difficulty in transferring knowledge.

Hide Sakuma

Wed 6/9/2004 9:42 PM

Corbett, Mark MR [Mark.Corbett@defence.gov.au]

It was once put to me by a flying instructor that he would prefer to work with the pilot that had struggled all of the way, than with the one who seemed to "breeze through training".

His argument was that the struggler had found his limits and learned how to work with them, in order to achieve the flight. The other person has never met their limits, so is more likely to fail when they finally meet them.

Unfortunately, this is likely to occur in real-life, instead of within a training environment.

IMHO

Corbz

Thu 6/10/2004 6:16 AM

Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

Actually I thought the discussion had settled on the idea that "relevant" knowledge "can" be transferred. So even though you have never actually seen one of your engines on fire in flight, your training in the classroom and in the sim have prepared you to deal with it effectively in the air and people do so on a regular basis.

Jeff Weber

Thu 6/10/2004 10:35 AM  
Wilson, Brian T [Brian.T.Wilson@delta.com]

Hide;

Remember also that a lot depends on the regulatory philosophy under which that pilot is qualified. Here in the United States, we have a regulatory process for licensing pilots that concentrates almost exclusively on the acquisition of technical skill. There is no in-depth guidance in Part 61 for qualifying pilots with regards to their flight management skills. It has only been since 1999 that our Aviation Instructors Handbook has addressed the issue of decision making in any detail and what little detail that is!

Here in the United States it is possible for a pilot to score well on their academics and have golden hands with regards to the ability to make the aircraft go where they want it to go, but have terrible judgment and flight management skills. Thus the attainment of a position with a major airline here in the United States does not necessarily mean the pilot has excellent judgment.

One reason for this omission in our licensing process may be that which you stated - how do you measure and thus evaluate such behavior? You hit the nail on the head - there are no objective criteria currently in use (that I know of) that provide for this. My studies have convinced me however that we can do a much better job than we currently do and that ability is currently within our reach.

Regards  
Brian

Thu 6/10/2004 8:10 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

I agree or at least hope that "relevant" knowledge "can" be transferred. But how could we do that? The fact is that we can do nothing other than being based upon information and memories stored in our own long-term.

Your example is merely one of many possibilities we may encounter in our actual operations. More difficult problems would need more complex combination (schema) of information and memories. What we should do now is to develop the way of gathering necessary knowledge in relatively short time

to get optimum solutions for difficult problems under distracted conditions.

Do you remember Alaska Airlines MD-83 accident on Jan.31, 2000 in which the jackscrew assy of the horizontal stabilizer was broken in flight? The only chance for this airplane to survive was then considered to make decision to divert to the nearest airport (ex. LAX) as early as possible. It is needless to say that the pilot flying this airplane had successfully passed existing training and education, and even in-house CRM. Do you think current training and education including CRM could save such a difficult situation as Alaska case? We have a lot of things to do to make CRM more effective and practical. We should not easily stay at current level of CRM.

Hide Sakuma

Thu 6/10/2004 9:01 PM

[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Brian

I can agree with you more than hundred percent.

I just would like to recommend pilots to go back to the basic of flight. We should not forget that Wright brothers were not only pilots but designers and mechanics. They knew everything about airplane and flying in the sky (still close to the ground?). Going back to Alaska Airlines MD-83 accident, I regret that if the pilots were informed of unique feature (no redundancy) of horizontal stabilizer jackscrew design of MD-80(DC-9) series, they might have been able to know that the cause of jammed stabilizer may be broken jackscrew which is very hard to recover with pilots actions made in flight. Such knowledge might have urged them to decide to make diversion to the nearest airport. In general, people in our aviation systems seem not like to know wider areas of aircraft operations and design in regard to philosophy basis. Regulations do not require them to acquire a lot of relevant knowledge and skills probably because aviation systems have become more complex and sophisticated. Thus people became more SOP minded. More communication (not a superficial one) is needed fore pilots to communicate with other people in aviation systems including designers and regulators to be able to cope with many difficulties in actual operations. Regulations should also be flexibly changed to tolerate rapid expansion of aviation industry. I believe CRM is only tool available for us to go back to the basic flight.

Hide Sakuma

Thu 6/10/2004 11:05 PM  
[sqrhead@aol.com](mailto:sqrhead@aol.com)

Hide,

What you seem to be talking about is a hazardous thought pattern in Decision Making called macho or invulnerability. Where a pilot overestimates his or her ability during their assessment of risk. I agree with you that sometimes people who go unchallenged might have a higher potential for human error when they are in a challenging situation. However, a person that can make correlations sooner than others is not necessarily one who overestimates their abilities. Anyway, I was actually trying to make a different point when I mentioned that in the previous post.

When I said Instructors get excited when they are with a student that "Gets it." I was trying to say that the 4th level of knowledge (correlation) is not something intentionally taught in a flight syllabus, rather acquired over time with experience. How much time depends on how fast the student "Gets it." In the paragraph, I was discussing a negative consequence when an energetic instructor is with a student that seems to have a better understanding of the systems, a better situational awareness picture, a strength for applying things faster. The negative consequence is that the instructor feels like it is their obligation to try and teach this student by over burdening them situationally to challenge them.

I see it more often in new instructors. They think the most important thing they can teach a student is what it feels like to have 75 emergencies going on at the same time and still maintain a perfect situational picture. When that instructor should just be running them through the steps of each one of the emergencies separately. The task saturation lesson will come later in the syllabus. When instructors start trying to teach better ways to maintain situational awareness too early, what gets sacrificed is the foundational procedural training that was supposed to be getting done on that flight.

Ultimately, when I said students that "Get it," I wasn't referring to Stick and Rudder skills, rather at their ability to comprehend the big picture faster than others. These pilots seem to "What if" more situations, which give them a slight edge in the decision-making process (Assuming that their assumptions are correct in the what-if scenario...)

I also agree with you that existing technologies are very limited in their accurate predictability of a person's Rate of Correlation, or Ability to apply knowledge. I was trying to think of a way you could evaluate automobile drivers by looking at specific things in a simulator. For example, put a driver in heavy traffic on a fast-moving highway. Then have the brake lights illuminate 4 cars ahead, then after 2 seconds, 3 cars ahead, then another 2 seconds and the car 2 places in front of them puts on the brakes. I want to see when the driver of the simulator puts on the brakes. If this person relies on the car in front of them to stop in time, they are more likely to get into an accident than this next subject. The next driver anticipates what happens when things stop fast on a highway and looks several cars ahead. When brake lights start to appear, he or she thinks, "I should start slowing now, in case the person in front of me is not paying attention." My whole point about correlation and application is that this skill (or judgment) is usually found in an experienced driver, but can be sometimes found in a new driver. Also, there are experienced drivers that never think beyond the front end of their car!

Experience doesn't guarantee your ability to correlate and apply knowledge. Yet, experience does help. You can teach someone this specific skill by saying put on the brakes then the 4th car in front of you does. You haven't taught the person better situational awareness, you have merely proceduralized that one piece of situational awareness.

I don't think we will ever have an accurate test that measures a person's ability to correlate or apply knowledge, because it is related to their motivation level. Your motivation or interest is why you might spend more time thinking about something. Motivation is the key to correlation. Having the desire to learn several systems to compare them and look for differences/similarities. Again, an experienced pilot who has happened to be in several aircraft has an edge on correlating various systems. Then again, I have known a few pilots that had motivation, but not the skill to back it up. Though I would rather train a motivated pilot with stick and rudder problems, that a pilot with great stick and rudder skills and no motivation.

I guess if the solution were easy, we would have found it years ago.

Joe

Fri 6/11/2004 5:33 AM  
Jeff Brown [jeffbrown3@adelphia.net]

Have followed this discussion with interest. Manoj Patankar and Jim Taylor describe methodology for improving decision-making under varying degrees of uncertainty--referred to as the Concept Alignment Process--in their book "Risk Management and Error Reduction in Aviation Maintenance", (Ashgate) beginning on page 79. The methodology was first utilized in flightdeck management and has since been adapted to decision-making in aviation maintenance and other flight department roles. Bob and Skip Mudge have developed and refined this behavior-based methodology over the past twenty-four years. The methodology has also been part of the curricular fabric of undergraduate pilot and air traffic controller education at Daniel Webster College in Nashua, NH (USA) for many years. For those medical community members on the listserv, a parallel form of this methodology evolved in a natural experiment in the post-surgical care of open heart surgery patients (reference listed below).

Jeff Brown

Sun 6/13/2004 8:26 AM  
[jbeelersr@comcast.net](mailto:jbeelersr@comcast.net)

I agree or at least hope that "relevant" knowledge "can" be transferred.

I am somewhat out of my league in this conversation, so I will steer clear of the technical postings. There is one thing about this statement that caused some whiplash in that "all" knowledge, not just relevant knowledge should be transferred.

Sometimes we focus on learning particular items, and decide that some are seemingly not relevant, yet carry enormous external weight. While something may feel irrelevant, having that knowledge to mix in with what others deem relevant is critical to all decision making. (Or is this all relevant...;))

Sun 6/13/2004 9:09 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Joe

I asked you in my previous input as "Do you really believe such stuff could effectively behave to avoid accidents in

actually distracted situations?", because I thought correlation and application skills which were proven in the class room drills and tests could hardly be exhibited in real distracted situations.

To be regret, there still is a gap that remains unburied between the results of academic way of assessing human performances and the reality. You are right in saying "if the solution were easy, we would have found it years ago". Though there are many people have enough skills for correlation, application and even prediction, they are not so smart to be able to effectively use them as necessary in actual situations. We are aware of that with information obtained from the results of many accident investigations. Transferring knowledge as correlation and application is necessary not only for pilots but other personnel like mechanics and engineers.

It is reported in the accident investigation report that maintenance people in Alaska Airlines failed to correctly lubricate the horizontal stabilizer jackscrew and the acme nut of the sad MD-83. They probably know well that the jackscrew is made of steel and the nut is of bronze alloy, as knowledge obtained from class room educations and/or study guide books, but they had neglected the importance of correct and frequent lubrication of metal to metal contact area of both parts. I, however, suspect if they knew know why rival aircraft manufacturers have adopted ball screw type contact between jackscrew and nut instead of direct metal to metal contact. In other words, why did rival manufacturers select the other type of the design of jackscrew assy? I also suspect if they knew softer bronze material was intentionally adopted not to damage harder steel jackscrew based upon "Damage Tolerance Design" concept like pantographs of the train. Everybody knows that pantographs are made of softer materials not to sustain electric wires running over trains. I believe accidents could possibly be avoided by correlation and application of knowledge gained through everyday life, not necessarily by academic training and educations.

What we can do for trainee is to motivate them to make better use of knowledge gained through everyday life. I am not a "macho" but just a man with common sense.

Hide Sakuma

Mon 6/14/2004 3:18 PM  
alf5071h [alf5071h@hotmail.com]

Whilst knowledge can be taught, it may not be possible to relate `teaching' to judgment in the same way. I consider knowledge to be an entity, whereas judgment is a process, which can either act on or use the knowledge entity.

As an example, pilots are taught about a specific aircraft's hydraulic system, but few of us would remember or be able to recall every detail of the system in the event of a malfunction- one reason that we have abnormal checklists and diagrammatic aid memoirs (knowledge reminders). Judgment in this instance is necessary for the assessment of the abnormality, the choice of correct drill, and the subsequent action - divert, reduce speed, etc. Thus in this example, it is the overall process of diagnosis (perception), choice of checklist, and following the procedure that is taught.

For more extreme conditions, where no procedure or checklist exists; then judgment is the culmination of a decision making process. Previous discussions reviewed the use of formal processes in making decisions; a critical part of the process is to form options on which judgment can be made, but to do this well there also has to be good background knowledge. As an extreme example of this, but a real life emergency: the captain of the Sioux City DC10 without controls had sufficient knowledge to both form options and exercise judgment on which option to use. An inexperienced captain may not have had sufficient knowledge of how a DC10 would respond to thrust alone, and may not have had time or finesse in the circumstances to gain this knowledge. Therefore, in order to exercise judgment, experience is also required. However experience is a form of knowledge that is rarely taught - it is usually gained by being in an appropriate situation or having developed a good feel for an aircraft over many flights. It is this aspect of a judgment process that may not be able to be taught.

Fortunately, Sioux City conditions are rarely encountered, although lesser situations that require judgment (thought) are more common. Thus the teaching of an appropriate decision making process (knowledge), and the experience gained during training (skill) should be sufficient to counter most foreseeable threats in operation.

ALF

Mon 6/14/2004 8:43 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

ALF

You said that knowledge is an entity.

You cited knowledge for aircraft hydraulic systems as an example. As you know, 3000psi is universally selected as internal pressure for most of aircraft hydraulic systems. Pilots do not necessarily know why 3000psi was selected for standard value of aircraft hydraulic systems.

They do not know that 3000psi has both merit and demerit. They do not know that 3000psi, which is extremely high and rarely encountered in our daily life, may cause frequent outer and internal leakages in the system.

They do not know there may actually be no less possibilities of total hydraulic loss in spite of system redundancies incorporated in the system.

Are these knowledges not necessary for pilot's judgment and DM in case of emergency? Since entry of SBO into 747 operation and maintenance, pilot's knowledges were divided into roughly two categories, "Need to know" and "Nice to know", and the latter has been excluded from the pilot education. Since then, pilots became more SOP minded. I do not think current educations effectively provide pilots with sufficient knowledge as an entity to make good judgment and DM. Behavior of the captain of the Sioux City DC10 is considered as a remote case. Before discussing judgment and DM, we should change pilots' education to provide pilots with every knowledge, including merit and demerit (light and a shadow), of technologies.

This should be the very objective of CRM. We could teach knowledge but not teach how to judge since formulation of schema (a group of knowledge) could only be realized with individuals own efforts. Effective accident prevention needs more profound judgment and DM of not only pilots but other personnel in the aviation system.

Hide Sakuma

Tue 6/15/2004 1:24 AM  
Norman MacLeod [norman.macleod@btconnect.com]

Hide and ALF,

One view is that knowledge is compiled data - it's a run-time code. The implication of this is that knowledge exists in context. If the situation is wrong, the code is wrong. Hide says that we should "provide pilots with every knowledge including merit and demerit (...) of

technologies". Of course, in an ideal world, we would have, first, the resources to do this and, second, pilots with memories sufficient to recall the information at the appropriate time. Training is a compromise. The "need to know/nice to know" heuristic is a way of allocating resources. Who remembers "if you cannot touch it you don't need to know it"?

More recent approaches to aviation training design have typically erred on the side of economy. Systems Approaches, recently reinvented as AQP, offer ways to better map data requirements onto knowledge creation. Unfortunately, they cost money to implement.

Judgment is the act of choosing between options. It's the bit that comes after "strengths and weaknesses of each option" in the decision-making model. Perfect judgment requires perfect knowledge of all possible outcomes. That's why it works better in hindsight. Sioux City being an example.

So, complete systems knowledge and perfect knowledge of outcomes is the goal but, maybe, a little unrealistic?

Better training design, rooted in process failure in normal operations, is the answer. However, we need methods of analysis that get at cause and not simple categorisation of outcomes. For example, CFIT is an outcome, not a cause.

Once I have the answer to all of this I'm going to offer it to the England Football (or soccer to the non-native English speakers) Team. Just Joking!

Cheers,  
Norm

Tue 6/15/2004 2:02 AM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Norm

I am much impressed with your saying "The 'need to know/nice to know' heuristic is a way of allocating resources". Most people including me may have thought that it must be for saving cost of pilot training. Heuristic is necessary not only for allocating resources, need to know/nice to know, but for identifying whether input information is correct or not. As you say, complete systems

knowledge and perfect knowledge of may be a little unrealistic, but we could depart from a bad habit that we only teach good news excluding bad news of aviation systems. Bad news may help pilots in making good judgment in emergency situations. There are a lot of factors which prevent relevant people from disclosing the fact and the truth for pilots. I am very glad to hear very recently that our soccer champions have drawn game with powerful England football team.

Hide Sakuma

Tue 6/15/2004 2:34 AM

Norman MacLeod [norman.macleod@btconnect.com]

Hide,

My grandmother - if she was still alive - could probably get in the team. Even dead she could still make the substitutes bench.

For "Bad news" do you mean better knowledge of adverse outcomes?

For example, in October 2003 an SAS A330 nearly ran out of fuel en route to Stockholm Arlanda from Chicago O'Hare. It landed at Helsinki with 1800Kg in the tanks having failed to get in to Arlanda and with insufficient fuel to get to its alternate, Gothenburg. The incident report made comments about spending more time evaluating likely traffic conditions at destination airfields etc and that SAS should "order flight crews to make the fuels checks on the last part of the flight, enter the checks in the OFPs and check and mark the remaining block fuel or the total fuel consumed on every flight appropriately".

Fifteen years ago I remember military C-130s in the UK that only just made landfall across the Atlantic (or didn't get across Germany to the UK in one case) because the navigator took the BA computer-generated fuel plan at face value. The thing had a habit of missing out segments between way-points.

So, the "bad news" would be....

I chose this example because it comprises both technical flight planning skills and non-technical, attitudinal, CRMmy-like, splodgy skills. Need both if we are to be successful.

Luckily Japan didn't make the European Cup Finals although the way the EU is expanding it might just qualify in 4 years when the next one comes around!

Norm

Tue 6/15/2004 6:18 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

Two issues with your post.

First: The way you are talking here suggests that pilots need to be taught virtually everything about anything in, on or around the airplane because there is always the possibility that anything could fail at some point or have an effect on an emergency situation. Personally I don't think we need to spend a lot of time teaching pilots that there is a possibility, no matter how slim, that a tire could blow and if it blows in just the right way it might sever an electrical line which might then come into contact with a hydraulic line which because it is under 3,000 psi then just may split which could then result in a fire that would not only affect controls but also has the possibility of melting tires which might just blow in the exact way needed to... see what I mean? If you try to teach a pilot everything about anything that "could" go wrong you will never graduate a pilot.

Second: Considering one of your main points is that knowledge does NOT transfer, what would be the point of teaching a pilot any of this stuff since (based on your arguments) the knowledge would not transfer to an in-flight, highly stressful, emergency situation anyway?

Jeff Weber

Tue 6/15/2004 6:51 AM  
james wood [james\_c\_wood@yahoo.com]

I sure agree with Jeff on this. It's the same as a car. How many of us know every little detail of how our cars work? We probably all know the basics, several of us probably know quite a bit, and maybe some of us can rebuild the silly computer that controls everything, but do we need to be able to rebuild the computer to drive the car safely and effectively? Of course not. Same with airplanes. I'll

continue an analogy that has already been used. It was numerous years into my flying before I had an engine fire light, yet thanks to simulator training, I had seen this before and it was a "no-brainer". It was easy, because I had practiced the procedure numerous times already. Now, if the procedure I had been taught didn't work, I may have had problems. But maybe not, because I had been taught an in-depth level of knowledge. I will say, doing the procedure in the sim, I learned it well, but I can see and have seen that if the procedure doesn't work the first try, people tend to freeze. If we in training end the problem as soon as the first steps are accomplished, people tend to believe that this will happen in the real thing, so I always try to at least once in a training session carry the problem out further. The engine fire light again, the first extinguisher doesn't put it out, so the procedure must be continued. Then later if it happens again, the student isn't likely to freeze when it doesn't work "as advertised". They can think their way out of the problem. I think in this transfer of learning thing, knowledge is good, but a bigger and more pertinent problem is, how much to teach? As Hide alluded to, do we teach crews everything about every system? All the whys, and wherefores? I sure don't think so. As I stated about the car, we all use them and probably none of us can figure out the computer in them. Same with the plane. Knowing why 3000 psi hydraulic systems are used vs. maybe a 1000 psi system falls into "nice to know" but certainly not "need to know". Knowing that 3000 psi can cut the guts out of anything it hits and maybe having an idea of where lines run and what might be affected if a line breaks is very important.

Jim Wood

Tue 6/15/2004 7:22 AM

Norman MacLeod [norman.macleod@btconnect.com]

Jim and Jeff,

On the one hand, we have had failures that propagate the way Jeff has described and, on the other hand, things don't always have the happy ending as Jim described.

I think Hide is simply saying (and he can answer much better for himself) that the gap between these 2 positions is ill-defined. In fact, we don't really know how fragile training systems might be. Infrequent incorrect response is no measure of training robustness in the same way that no accidents is no measure of safety. If I follow Hide's

thinking, he would like to see a better analysis of depth of knowledge required coupled with better training of the contextual clues that allow stored knowledge to be transferred to the current problem.

In a recent paper on LOSA (Thomas, Int. J of Av Psych Vol 14, No2) Captains were responsible for over three quarters of observed errors. Half of errors remained undetected by the crew. First Officers spot more errors than Captains and ATC spotted a significant number of errors before the crew did. The most common error management response was a failure to respond to errors. Given that no aircraft were harmed in the making of this study, maybe we should crew aircraft exclusively with FOs, tell them not to touch anything but follow instructions from ATC. I reckon we could really slash the training bill.

Just Joking!  
Norm

Tue 6/15/2004 7:43 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norm,  
Obviously there is a middle ground since I think we both tried to use more extreme examples to illustrate the point. The gap is ill-defined however because it changes based on what you are flying, how you are flying it, even where you are flying. A combat pilot needs different training than a puddle jumper pilot who needs different training than a trans-oceanic heavy pilot who needs different training than a bush pilot. Each training system needs to (and they already do in most cases) determine how much of each type of training their pilots require.

I guess my major issue with Hide's posts are their attempt to place some very specific items into a very general context. If your aircraft type has never had a hydraulic problem in 20 years, the amount of time spent training on how it works, why it has a certain pressure, etc. probably doesn't need to be as much as you need to spend on that pesky engine problem that crops up every couple of flights and occasionally results in a flame out. Combine that with his argument that what is taught in the classroom doesn't translate to an emergency situation the cockpit and I wind up typing my little fingers off. :-)

Tue 6/15/2004 8:00 AM  
Norman MacLeod [norman.macleod@btconnect.com]

Jeff

"The gap is ill-defined however because it changes based on what you are flying, how you are flying it, even where you are flying. A combat pilot needs different training than a puddle jumper pilot who needs different training than a trans-oceanic heavy pilot who needs different training than a bush pilot"

2 different things - the needs differ but the gap remains. Again, I think Hide is just saying lets identify the gap.

"If your aircraft type has never had a hydraulic problem in 20 years, the amount of time spent training on how it works, why it has a certain pressure, etc. probably doesn't need to be as much as you need to spend on that pesky engine problem that crops up every couple of flights and occasionally results in a flame out"

Of course, "never has had" is not the same as "never will". The issue, again, is resource allocation. I think a part of Hide's message is to do with management of outcomes - his transferability of knowledge. We spot transfer failures most readily when the outcome is not as planned. Historical models are maybe not reliable. If you look at helicopter accidents, it's not the malfunction than causes the crash; it's the landing after autorotation. Maybe we should forget systems knowledge for helicopter guys and just make sure they are damned good at forced landings.

Norm

Tue 6/15/2004 8:24 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norm,

I would disagree that these are two different things. They are actually intricately linked. You cannot define "the" gap because it is different for each person, aircraft, and situation. What trainers need to do is figure out what their specific gap is and then determine what needs to be done to fill it in. How much "other" training needs to be done and in what areas. This is not a new or novel concept

and I believe that in most cases the trainers are already working on this and refining their approaches.

"'Never has had' is not the same as 'never will'" and that is the problem. If you try to cover everything that falls under "never will" you will never finish. As for "his transferability of knowledge", that's the issue that started all of this. Hide seems to have been arguing that there IS NO transfer of knowledge and I have been arguing all along that there is. While historical models may not be the most accurate, they are a source of information. They should not be the sole source; nothing should be the sole source of data in this realm. If you're not using multiple means and methods to look at what is going on in when you develop your training program you are going to miss some very important stuff.

Of course, if you are flying helicopters, then you really "should" spend more time practicing forced landings because we all know that helicopters are unnatural.

Jeff Weber

Tue 6/15/2004 8:41 AM

Norman MacLeod [norman.macleod@btconnect.com]

Jeff,

I read your message as being set in training analysis terms and your "gap" is the one between entry level and graduation standard (and I could be reading it wrong, of course). I'm really talking about the gap between graduation standard and mastery. Graduation standard we can establish using the sorts of thinking you allude to. No problems with that. However, I'm not convinced that existing "rules" for establishing graduation standard continue to meet our needs.

As for transfer, I don't believe Hide is really saying there is NO transfer, more that there is poor transfer under certain circumstances and between domains. After all, how did he type on a keyboard successfully? He was taught to write at school. Did he have to go on a completely different course to learn to "write" on a keyboard? If he genuinely thinks that there is no transfer at all then every moment at the computer must be a source of wonderment for him - or maybe they do go to "keyboard" school in Japan.

Transfer is key to bridging the gap between graduation and mastery.

Here is an example of transfer at work. Senior airline captain (chief pilot, in fact) doing type conversion to regional jet in UK reports a hydraulic malfunction after landing. "What was the problem?" asks the maintenance guy. "Couldn't move the elevators," says the pilot. "Elevators are cable-operated," says the maintenance guy. I did mean to check what score the guy got on his ground school systems exam but thought I might be pushing it a bit...

Norm

Tue 6/15/2004 9:09 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norm,

Ah, but now you have to try and define what "mastery" is, which again is different for different types of aircraft, flying, etc. The gap you refer to there also would need to be defined for separate situations (vice a universal definition) and so the definition changes, i.e. the "rules" change and they should. I would hardly like to apply the standards for a pilot flying a route from Albany NY to Syracuse NY as I would to one flying from an aircraft carrier into combat and back again.

As for the no transfer issue...you make the same point I have been making since I first jumped in on this thread, you just used another fine example.

Jeff Weber

Tue 6/15/2004 9:20 AM  
Norman MacLeod [norman.macleod@btconnect.com]

OK, so mastery is probably the point at which your drills become compiled generic problem-solving solutions. The point at which you achieve efficient training transfer into novel situations. The point at which constraints on transfer imposed by existing training systems (Hide's point, I think) have been overcome. Clearly transfer does occur but the question is more one of do we understand how? And why should the standards between your 2 pilots be different? The task is the same but the constraints

differ. However, the solution to the problem of safe and efficient aviation is probably derived from a common core of skills.

Tue 6/15/2004 10:03 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norm,

OK, point taken. I agree the question should be can we determine "how" knowledge is transferred and by doing so develop better tools and methods for a) transferring knowledge and b) determining what knowledge is best to transfer (we can't teach everyone everything after all). If you come up with a way to do either or both please remember that it was this discussion that helped you become rich and famous and cut me in for a small percentage okay?

As for the different standards...true, a common basic core is required. Pull back and the houses get smaller, keep pulling back long enough and the houses will get bigger again. However, a shuttle run pilot does not need all of the same skills that a carrier pilot does. As far as I know the runway at Albany never moves and you don't have to worry about your tail hook when you land. However, as a carrier pilot you better have a core set of skills that deal with that or you will end up being an oceanic environmental impact statement.

Jeff Weber

Tue 6/15/2004 10:00 AM  
Peter J. Wolfe [pjwolfe@earthlink.net]

Good point, Norm -

This thread has been enormously valuable and thanks to all who have contributed.

I'm part of team that is working to identify the very sort of "universal" knowledge and capabilities that pilots who (seek to) pursue professional careers in commercial aviation need to acquire, maintain and enhance. Because the industry is evolving, we anticipate that this effort will be in a constant state of developmental updating.

In addition to aiding pilot-practitioners in the pursuit of their personal career development goals, the list of

attributes will be of equal value to those engaged in the teaching of piloting skills.

As you can tell from the above, I'm in the camp that believes that the learning and adaptation features of the human mind are the very capabilities that enable us to "transfer" the lessons learned in one setting to applications in a variety of others.

If it weren't for that, we'd be wasting our time examining "universal" attributes.

Pete

Tue 6/15/2004 10:33 AM  
Norman MacLeod [norman.macleod@btconnect.com]

Jeff,

This is aviation - get rich??? I was trying to break into medical error and some doctor, who was also a pilot, just laughed at my stupidity. Who wants to move from an industry with no money to an industry with less money.

As for runways that don't move - if your point of touchdown is a variable, isn't it the same thing? You could probably teach deck landings by examining runway over-runs.

Norm

Tue 6/15/2004 10:44 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Norm,

Well, when you pinpoint how knowledge is transferred and develop new tools to take advantage of that discovery you just need to remember to patent it and then you can sell it to everybody and make mucho bucks.

As for the point of touchdown changing, that's VERY different than the entire runway moving away from you at an angle as you approach, not to mention up and down and side to side. The ability to transfer knowledge about runway overruns and apply them to carrier landings is one of those points where transfer would be minimal since they really are not closely related.

Jeff Weber

Tue 6/15/2004 11:03 AM  
Norman MacLeod [norman.macleod@btconnect.com]

"As for the point of touchdown changing, that's VERY different than the entire runway moving away from you at an angle as you approach, not to mention up and down and side to side. The ability to transfer knowledge about runway overruns and apply them to carrier landings is one of those points where transfer would be minimal since they really are not closely related"

Wanna bet?

Tue 6/15/2004 11:07 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Yup. Runway overrun on a carrier deck means either you just "landed" in either a stack of airplanes or in the water; you don't "over run" the runway.

Jeff Weber  
Tue 6/15/2004 11:06 AM  
Sax, Harry [Harry\_Sax@URMC.Rochester.edu]

Norm  
You're not stupid; you're ahead of the curve. Flying is optional, being a patient is not. There is a huge demand for medical folks to learn from aviation. (And even though I'm a surgeon, I don't have a Bonanza...) Harry

Tue 6/15/2004 11:49 AM  
Norman MacLeod [norman.macleod@btconnect.com]

I'm thinking that this is an isomorphic problem.

First, the technique of touchdown and the technology associated with smacking into the deck are a little different, so we can accept that a carrier aircraft is optimised for firm arrivals. Set that on one side.

Second, where you end up if you get it wrong is simply an outcome and should be considered irrelevant at this stage. Southwest nearly hit a filling station at Burbank, other aircraft have ended up on public roads and so on.

Next, a runway is fixed in relation to the surrounding terrain whereas a carrier deck moves in pitch, heave and

roll. However, both (runway and deck) move in the same relation to the approaching aircraft although the degree to which they move, rate etc is greater and more variable with the carrier. So the task can have added complexity in the case of the carrier.

Then, the first order problem is one of geometry - getting the approach path right. Runway over-runs are often the result of being kept too high for too long or intercepting the centreline too close in. The net result is the same - too steep an angle.

The next order problem is aircraft speed control. This can be a result of insufficient time to configure or insufficient space to slow down - or both. Speed translates into flare.

The final order of problem is decision-making. When are you satisfied that everything is still OK and when do you throw it away? At this stage we need to ask 'are things like DH, MAP and stabilised approach points gates we pass through or states of mind?' We may know that the parameters are not met now but could be convinced that we can still meet the required parameters at some point before arriving at terra firma. Lots of runway over-runs result from this willingness to believe in your own ability to get things under control.

That's the basis of my case for saying that there could be lessons for deck landings contained in an examination of runway over-runs.

Your turn :-)

Tue 6/15/2004 12:51 PM  
alf5071h [alf5071h@hotmail.com]

Norm, your "Couldn't move the elevators' says the pilot" story, which I can vouch as being correct except my version originated in the US and it was before flight when taxiing in a strong tailwind. However, the point is that the particular operator had instructed the manufacturer not to teach his pilots too much. The fear was that the FAA would examine the crews on that knowledge; whereby the authority and airline management had set an unrealistic (and costly) 'nice to know' boundary; these are the people who require judgment training.

As has been discussed, the goal of total knowledge transfer is unrealistic, but the limit of where to set the 'need to know' boundary is difficult to determine. There are variables from both the aircraft type and operation: In a long haul aircraft there may be time to refer to detailed manuals for additional information, but in a short haul aircraft (or fuel/time limited fast jet) the immediate level of knowledge required may be higher or the operation supplemented by more extensive SOPs. Unfortunately the civil industry tends to group all pilots and aircraft types into the same category so there will always be some circumstances where there is a lack of knowledge. Other problems stem from the mechanism of memorizing knowledge; long term memory is used for the storage of information about meaning and about specific events; the latter is subject to bias, particularly in expectation where we tend to store what we expected or wished to happen rather than the facts. False memory can lead to error; good training is an antidote. Then having transferred the necessary knowledge, it has to be recalled in the correct circumstances. Most crews suffer a degree of stress in abnormal operations, this usually affects the ability to recall information.

Thus my line of discussion leads to indefinable boundaries for the knowledge gap; one solution is CRM. We teach how to manage stress, how to seek additional knowledge from others, follow procedures, and how to formulate options. We then use judgment as part of the decision making process, but what is judgment - the FAA define it thus: "Pilot judgment is the process of recognizing and analyzing all available information about oneself, the aircraft, and the flying environment followed by the rational evaluation of alternatives to implement a timely decision which maximizes safety. Pilot judgment thus involves one's attitude toward risk-taking and one's ability to evaluate risks and make decisions based upon one's knowledge, skills, and experience. A judgment decision always involves a problem or choice, an unknown element, usually a time constraint, and stress."

Can judgment be taught? From the above; can we train personal attitude, the ability to evaluate risk, or make decisions? For some of these issues, yes, but not all of them. Many of the elements in judgment bring together and use all components of airmanship. The process of analysis requires the use of mental skills and knowledge,

particularly of the situation - situation awareness. Making a judgment is often a balance of risks, thus an individual's attitude to risk is a key element. Therefore, the question could be restated; can we train airmanship? We certainly attempt to, but as many people have stated before me, airmanship has to be developed; it is that indefinable something that separates the superior person from the average, thus if we can teach that, then we teach judgment.

Tue 6/15/2004 1:10 PM

Norman MacLeod [norman.macleod@btconnect.com]

My story comes from the manufacturer's customer support facility. I was there at the time. Interestingly, there was a political dimension. The location was seeking approval to offer its own type rating training. The authority was reluctant to agree on the grounds that commercial imperatives might overcome objective evaluation. The pilot concerned represented a large contract in a new emerging market. You can see the dilemma.

I've got to say, and I have no wish to offend, that the FAA definition of pilot judgment has got to take the gobbledygook prize. It doesn't even warrant examination. Would reviving 'airmanship' add value to the debate?

Hey, we just lost the football to FRANCE of all countries so I'm just cranky.

Norm

Tue 6/15/2004 1:53 PM

john wiley [jwiley@mindspring.com]

"Infrequent incorrect response is no measure of training robustness in the same way that no accidents is no measure of safety."

Now that is a sentence worthy of using more than once.

In a recent paper on LOSA (Thomas, Int. J of Av Psych Vol 14, No2) Captains were responsible for over three quarters of observed errors. Half of errors remained undetected by the crew. First Officers spot more errors than Captains and ATC spotted a significant number of errors before the crew did. The most common error management response was a failure to respond to errors.

Given that no aircraft were harmed in the making of this study, maybe we should crew aircraft exclusively with FOs, tell them not to touch anything but follow instructions from ATC. I reckon we could really slash the training bill.

Likewise, most accidents occurred with white male Captains at the helm. The solution is obvious.

Reminds me of the experiment where the investigators clapped loudly in front of a winged bug and the bug flew off. They then pulled the bug's wings off and repeated the experiment. The bug remained in place. The investigators concluded that pulling the wings off made the bug deaf.

Tue 6/15/2004 3:31 PM  
Wilson, Brian T [Brian.T.Wilson@delta.com]

Jeff

Good point - so I have a question. Most articles that I have read argue that expertise is domain-specific. Are you arguing that expertise is not only domain-specific but also specific to the sub-domains (crop-duster vs. fighter pilot vs. airline pilot)? Could judgment expertise even be specific to aircraft type?

If so, how would this affect judgment and situation assessment training generally? How much knowledge and judgment skill transfers across sub-domains? As a trainer, what can you count on to transfer?

Furthermore, how do the procedures used in each sub-domain either contribute to or inhibit situation assessment skills and judgment skills when the pilot transfers across sub-domains? In other words, is judgment dependent in part on the characteristics of the procedures one is taught to use and how those procedures are executed? Do the procedures expand situational awareness (and therefore improve judgment) or narrow situational awareness? Do they contribute to distributed team members communicating important information or do they tend to stifle communication?

Does a pilot who is an expert decision maker in a single pilot background suddenly become (relatively) handicapped when they find themselves in a multi-crew / dispatcher

environment due to poor resource management skills as compared to a pilot with extensive experience in that type of environment?

The summmary question is: How DO we define judgment expertise? Is it simply a superior ability to reason - or is judgment expertise influenced by many, many variables that are to a great extent dependent on: the sub-domain one finds oneself in, the procedures one has to use, the company policies one is constrained by, the resources one has available to them and thus does it defy a blanket definition?

Brian

Wed 6/16/2004 7:01 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Brain,  
The quick answer is Yes.

I've seen some very good and very senior single seat aircraft pilots come into the multi-pilot simulator and just look like total idiots exactly because they have little to no multi-pilot CRM skills. Oh, they handle their side of the cockpit very well at first, but then they get so busy trying to reach over and do things the right seater should handle that the airplane gets away from them with predictable results.

You can break down anything into almost unlimited sub-domains (people have been paid a lot of money over the years to do just that) but you will find that there is a single, general rule of thumb...the more closely related the two sub-domains the more knowledge will "usually" transfer across them. You could study this problem for a lifetime and I suspect there are those who have. Until someone comes up with some kind of slide tab A into slot B approach to this that works however we remain reliant on the basics of experience and feedback to determine what is working and what is not. While we all hope to get tools better than that, until that happens we need to keep working at refining what we have learned from others and applying it to our situations.

The original question: Can Judgment Be Taught, in my opinion can be answered with somewhat. You can teach

people the skills for flying their airplane, show them examples of problems that others have encountered thus giving them more skills/expertise and you can teach them the tools that other pilots have found useful to troubleshoot problems. You need to have all of those things in order to be "capable" of having good judgment. However, you cannot make people "use" the knowledge and skills that you have given them and that is the other component. We have all seen people who are extremely good at doing their jobs until a problem arises and then they go into brain lock. It is likely they have all of the knowledge, skills, experience and tools they need to resolve the issue but they can't take the next step of applying them in a situation that is new to them.

As to your summary question... There's two things here. Judgment and Judgment Expertise are not the same thing. Judgment is simply (chuckle) the ability to make correct decisions at the right time (extremely simplified) while Judgment Expertise sounds like it refers to levels of judgment, something I think we all agree exists even if you can't quantify it.

Jeff Weber

Wed 6/16/2004 2:05 PM  
alf5071h [alf5071h@hotmail.com]

Jeff, Brian,

You have been discussing some very interesting aspects of judgment. From this and my own experience, I question whether there may be two or more forms of judgment. First, that judgment associated with activities that may progress to automatic activity, i.e eye to hand or to foot (for Norm) co-ordination. These judgment activities, normally referred to as skills, progress with practice to become a routine - landing the aircraft, judgment of when to flare. This judgment can be transferred to other aircraft as the principles (mental process) remain the same. An analogy would be having the same equation for landing, but the factors change between aircraft types, which are learnt during type conversion.

The second judgment (judgment expertise?) could have more involvement with risk assessment, knowing when and where to draw the line on a problem. For those who are unable to make good judgments then helpful guides to decision making

may assist them until with experience they can "self start".

However, neither form of judgment can be "taught" in a conventional sense. How does an instructor teach a pilot to land an aircraft? More often than not, it is by demonstration, not by verbal or graphical description. Similarly how is decision making / risk assessment taught? A risk is usually seen in proportion to the circumstance that it is encountered, thus unless an instructor is with the student in exactly the same circumstances then the teaching is only by demonstration or analogy. This takes account of simulation where the student knows that the simulator does not pose the same risk as an aircraft operation.

Therefore, there is a gap in the teaching of judgment between demonstrations and reality; experience fills the gap. Perhaps this is one reason why military training has more 'experience' flight time and more 'experience' situations. In the civil world, pilots are expected to gain experience as first officers, but now days there may be fewer "risk" situations to learn from or fewer opportunities for Captains to demonstrate the judgment process - a clear argument for good debriefing - "why did you do that Captain?".

Norm, if the FAA definition of judgment is so poor, then what is judgment? I may have missed a definition in earlier posts, but before we can consider if we can teach something surly we have to know what 'it' is.

ALF

Wed 6/16/2004 2:16 PM  
Delex Cherry Point [delexnkt@gsiwave.com]

Alf,  
All points well put, especially the final one about defining judgment. I think you brought the discussion back to the original question very nicely. Now here's a corollary: If something can be "learned" (i.e. through experience, etc.) then should we be "able" to teach it? (He said and then quickly ducked.)  
Jeff Weber

Wed 6/16/2004 2:25 PM

Norman MacLeod [norman.macleod@btconnect.com]

Alf,

I have an aversion to jargon proliferation. I once saw a list of over a dozen "types" of "situational awareness" presented on a CRM course. If I trip over a step have I lost distal limb SA? How about if I break wind in public - loss of visceral SA?

In the case of judgment go back to the dictionary (Shorter Oxford in this case). It's all about selecting between options. It sits within the process of making decisions. It suffers from hindsight bias in that a judgment can be judged in the light of outcomes.

How do you distinguish between the judgment required to flare at the correct point and the judgment involved in risk assessment and knowing when to draw the line on a problem?

The choice to be made will vary between situations (when to flare, when to walk away from trouble in a bar, when not to wear your wife's underwear to work) but the act of choosing is still the exercise of judgment.

I couldn't make any sense of the FAA definition. All it lacked was something about catching bullets in teeth and leaping tall buildings.

England against Switzerland tomorrow. SWITZERLAND for heavens sake. They refused to join the EU so why are we letting them play in our footie competition!!

Norm

Wed 6/16/2004 4:08 PM

Binnema, Gerry [binnemg@tc.gc.ca]

"How do you distinguish between the judgment required to flare at the correct point and the judgment involved in risk assessment and knowing when to draw the line on a problem?"

I think this is a critical distinction in this discussion. The distinction, in my mind, is the amount of conscious processing that we use for the task. For instance a study

was done asking pilots what references they used to decide when to flare, and few pilots really understood exactly what visual references they used. The task is so automatic that we are no longer aware of the inputs we use for a decision that we are not consciously aware of. Obviously we can teach this kind of judgment because we have successfully trained pilots for many years. But the really interesting part of the question is the second kind of judgment. The kind that involves using higher levels of conscious processing, of applying various bits of knowledge, combining them with practical insights, and arriving at a good decision. I had a student once who was very competent, picked up the flying quickly, and was quite intelligent. Yet he frequently showed surprisingly poor judgment in various decisions, from the choice of a car, to the choice of a route for a cross-country. He had the knowledge, but seemed to lack discernment. As a joke, he once wanted to dump a pail of water on me. There was a blue barrel nearby, with a spigot on it, so he filled a pail with the clear liquid from the blue barrel and dumped it on me. Ha ha, very funny. It was concentrated aircraft soap. I asked him (the next day, after I was sufficiently calm) how he could have overlooked the labels, the difference in viscosity, and the odour. He simply hadn't noticed. Perhaps the question I would ask is "Can discernment be taught."

Gerry

Wed 6/16/2004 4:52 PM  
Gary Hook [gthook@shaw.ca]

That is a great story Gerry and the crux of my question when I first initiated this thread. Do you think your student, with time, could be brought about to learn to read the labels, pick better routes for a cross country or is he relegated to the category of "please find another profession"? From my perspective your first example is more one of a skill set that can be learned. I know in flying fighters in Basic Fighter Manoeuvres we used to use "the force". However over time, experience, and understanding we were able to take these "judgment" decisions and turn them into skill sets. So, do you think that say in X number of years, your erstwhile student will be able to develop the "judgment" to avoid dumping hazardous materials on his favourite flight instructor, or is that something that just can't be taught? Gary

Wed 6/16/2004 4:56 PM  
Gary Hook [gthook@shaw.ca]

Norm

I guess in keeping with the thread of discussion, one would have to acknowledge Switzerland's displayed judgment in not joining the EU. They get to play in the "footie" competition and not have to pay to learn the secret handshake! Sorry, couldn't resist. As a Canadian/North American who still hasn't fully bought into the concepts of sitting on the edge of my seat to watch 90 minutes of almost scoring..... :-) Can't wait to see the results of that 'lack of judgment'. Let the feeding frenzy begin!  
Gary

Wed 6/16/2004 9:50 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

Thank you for asking.

I visited a hospital yesterday to discuss with doctors and nurses regarding the merit and demerit of introducing 'Clinical Pathway(simple saying, standardization and automation of medical treatments )' into our country. Coming back to my office, I am much surprised that a lot of comments were input triggered by my posting. First of all, I would like to answer to your questions as follows. First: I do not think at all that pilots need to be taught virtually everything about anything in, on or around the airplane. I just selected '3000psi' to make analogy with the human blood pressure. Don't we need to have any knowledge for blood pressure in our usual life? Is this the matter that should be known only by doctors and nurses? Knowledge for blood pressure is necessary for us to communicate with doctors and patients and to judge by ourselves whether to visit a hospital or not.

In the same way, the value of hydraulic pressure would be one of essential knowledges that pilots need to have for better communications with mechanics and for pilots own judgments. There may be many other knowledges that are required for pilots but are not included in the current educations and trainings. What are important knowledges pilots may vary with situations and environments to which individual pilot belongs.

Second :

I did not necessarily say that knowledge does NOT transfer.

I only said knowledge does NOT transfer with (current type of) educations and trainings but is transferrable with trainees own efforts since transferring knowledges needs some kind of schema formulation within individuals brain. Pilots have many occasions for developing knowledge transfer skills in their everyday life. Any way, I believe knowledge transfer is a key to good judgment and successful problem solving in emergency situations.  
Hide Sakuma

Thu 6/17/2004 6:31 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Do the announcers ever yell "He shoots! He almost scores!"  
??

Jeff Weber

Thu 6/17/2004 6:43 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,

"> Any way, I believe knowledge transfer is a key to good judgment and successful problem solving in emergency situations."

Which is what I have been saying since the beginning!

As for the blood pressure analogy...actual I don't know what my blood pressure is and even though it's been checked at my annual physicals for more than twenty years I still don't know what normal is. So, I guess I don't need to know what it is to determine if I need to see the doctor. Of course he (as my body mechanic) obviously needs to know what it is.

"> There may be many other knowledges that are required for pilots but are not included in the current educations and trainings.

> What are important knowledges pilots may vary with situations and environments to which individual pilot belongs."

The problem is determining "what" knowledge needs to be taught and I believe that the current way of determining that is by getting feedback from students and former

students and by applying lessons learned from real world events and sometimes even from things people manage to get themselves into in the simulator.

Jeff Weber

Thu 6/17/2004 11:03 AM  
alf5071h [alf5071h@hotmail.com]

Jeff, addressing your statement "The problem is determining "what" knowledge needs to be taught". At least one response may stem from Gerry's story relating to student difficulties. First, I agree with Gary in that the student's difficulty may define the limiting requirement in judgment for being a pilot. Second, if we can determine which aspects of the student's deficiency in judgment were lacking, then we may have an alternative definition of judgment, but from an aspect that would allow us to teach it.

I suggest that judgments made in activities which have become automatic, are highly dependant on sensory perception. However, those judgments requiring deep conscious thought are made with a perception of the risks of the circumstance. Risk perception in this sense depends on having an appropriate mental model that in turn depends on many aspects of knowledge and teaching.

So if we teach Gerry's student knowledge of fluid viscosity, the characteristics of water (colorless), and necessity to read labels, would his judgment in using the barrel of soap have been better? I don't think so, because I suspect that student's problem was the inability to string the various inputs to the perception process together in order to form an adequate mental model. Therefore, the student's representation of the situation failed to indicate to him that it's not a good idea to dump soap on his instructor.

The student's failure to comprehend the risk could also have been biased by personal attitudes; impulsive, macho, etc. Therefore the training required is CRM:- make careful observation to understand the situation, form several options of action, do not rush, control personal attitudes, and consider all of the eventualities. The latter point includes discipline (an aspect of airmanship). If there was a rule (SOP) that students should not abuse instructors,

and the rule was enforced (by punishment if necessary), then knowledge of the rule and the consequences of violation may have added a further control aspect to the judgment process.

Therefore whilst judgment is not taught directly, focus on CRM and airmanship in addition to teaching the appropriate knowledge should improve judgment. However, if some people do not have the appropriate mental wiring then I doubt if any of the above will help.

ALF

Thu 6/17/2004 12:33 PM  
Delex Cherry Point [delexnkt@gsiwave.com]

ALF,

Let me summarize...I do not believe that judgment can be taught. I believe that you can teach people the methods used by those with good judgment, i.e. stop, look, listen, analyze. You can teach them how to use those methods/tools. But judgment is based on using those tools correctly and you cannot teach that. While I cannot give you a dictionary style definition of what judgment is, I do know that it is made up of skills, education/learning/knowledge, experience and the ability to use decision making tools in order to apply your skill, education/learning/knowledge and experience in a new situation.

We can teach pilots from here to doomsday every possible scenario they might possibly encounter in an airplane, but they must be able to transfer or apply that knowledge and experience to a similar situation in the air. "That" is using judgment and I don't see any way to "teach" that.

Jeff Weber

Thu 6/17/2004 12:53 PM  
Deen, Gregory C.

Folks,

I've been following this thread since it started, and submit it is the longest we've ever developed since the start of the CRM Developers Group. I've also been editing the postings into a MS-Word document; best paper I've ever written. :-). When it comes to a conclusion, I'd be happy to send it to our webmaster (Niel, are you there?) so it can be stored in the archive file for future reference and readers.

As for the answer to Gary's question of be able to teach judgment or not, I'm coming to the conclusion that we can NOT teach it to a reliable level of "professional standards." Yes this assumes a lot.

I think the water vs. soap story is an excellent example of the problem. In my fleet, we have aviators in every crew position that can learn the technical issues well, but routinely fail to apply them successfully in critical situations. How many of us admit that a particular pilot is "OK", but he's not the best choice for a high-risk mission, or he's not really ready for upgrade to PIC or instructor? In my limited work with the medical fields, I see the same dilemma among nurses and doctors; they all can do the basic caretaking job, but not all will rise to the pinnacle of the profession.

We seem to judge those who don't rise to some innocuous category of simply not having "it." Well what is "it?" Judgment, Situational Awareness, Airmanship, what? (Do doctors have a term that matches "airmanship"?)

Yes, we can also argue that everyone has judgment of some level. That they decided to join a high-risk profession, especially in some areas that will never pay them lots of money, was a decision that based more on emotion than knowledge; they WANT to be part of aviation, or medicine. The sad truth is that they may not succeed.

I believe we can develop, and actually improve, one's judgment with experience, training, and technical skills, but their improvement in judgment is more a product of the training of the technical skills. To reach a level of judgment that is reliable, consistent, and worthy of blind trust is probably more innate to the individual than a product of the training process.

Greg Deen

Thu 6/17/2004 1:05 PM  
alf5071h [alf5071h@hotmail.com]

Jeff, I think that we are in agreement, but if I may have one last clarification:- re your "If something can be "learned" (i.e. through experience, etc.) then should we be "able" to teach it?" I will stand by my example of teaching a student to land an aircraft. Until an instructor can comprehensively describe how to land an aircraft in a classroom, students will continue to learn from demonstrations. Furthermore, and as with judgment, landing

depends on the circumstances. i.e it is difficult to demonstrate a crosswind landing without a crosswind, but a student can use his knowledge of aircraft handling to fly crosswind landings when flying solo and develop his own experience without an instructor. There may be a few bumps along the way, but with good supervision the student should reach the required level of expertise when the task may become automatic. Similar with judgment; if first officers are empowered to make judgments in actual circumstances, i.e. the captain seeks the first officer's opinion; the first officer is then enabled to exercise his judgment in those circumstances.

Thus experience is gained from situations (circumstances) involving risk (in flight events), whereas learning, in this sense, is undertaken in situations without risk (class room, simulator).

My story, to add a military example to the above (no options for first officer experience), is when in single jet training (< 20 hrs) during an IFR approach, when the instructor closed the thrust lever and enquired of my next course of action. The judgment process was against previous VFR forced landing training and practices flown down to 100 ft, whether I would achieve VFR conditions in sufficient time for landing, or if at all, suitability of terrain that was not visible, etc. All that the instructor required was the decision to eject; yet the reality of the situation and pressure applied by the instructor gave far better judgment training than anything that could be achieved in simulation. Thus, good instructional technique can go along way towards creating the required circumstances in which to exercise judgment.

Another view of judgment comes from accidents where experienced pilots exercised poor judgment. Investigations concluded that the experienced pilots made novice like decisions due to their lack of exposure to challenging circumstances, typical of modern operations. Also, that they accepted more risky decisions based on their recent experience in normal operations; if a risky course of action resulted in a successful outcome it became the normal background on which to base future judgments. Thus experienced pilots made poor judgments due to a false background in a similar way to a novice pilot making a poor judgment due to a limited background (low experience). There are two lessons here, first that instructors should focus on positive examples to give an appropriate

background (avoid negative training), and second, experienced pilots should always debrief themselves, acknowledging that a risky decision with successful outcome is not good airmanship, thus resetting their background datum for future judgments.

ALF

Thu 6/17/2004 1:19 PM  
Delex Cherry Point [delexnkt@gsiwave.com]

ALF,  
I agree we agree. :-) People will have a better opportunity to successfully use good judgment when they have more experience, knowledge and learning under their belts. But you can't "teach" someone to use those things correctly. You can teach them how to react in countless, specific circumstances but they have to be able to adapt what becomes rote learning to a changed situation and again, you can only give them the tools to do that.

As for the humorously asked question of "if it can be learned can it be taught", to me the obvious answer is that one does not necessarily mean the other (hmmm my old logic class is coming back to me...shudder). Some things you learn only from experience and no matter how much teaching you get it isn't "real" until it's right there in your face.

Jeff Weber

Thu 6/17/2004 7:53 PM  
SB [sdb@bigpond.net.au]

I'm afraid I disagree with the consensus on teaching judgment, as part of teaching is the demonstrate, direct, and monitor cycle. The experience is gained with repeated application of the principle in different situations (I'm talking about air training).

As to the landing example; Flying training has moved on a lot from the traditional forties style military syllabus. Landing can be described quite precisely and students given very precise cues for landing location, flare and control through all speed and wind regimes. These are things that take the pain out the traditional "do it till you get it

right" pattern ... about as useful as telling someone to watch their airspeed...:)

It might pay to settle the issue of definition before deciding what can and what cannot be done.

Just one point of view.  
Steve Benier

Thu 6/17/2004 9:21 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Jeff

There still be a small cultural gap between us regarding insight into blood pressure, but I think it inevitable and acceptable. Most of Japanese are concerned not only with the values of their own blood pressure but with the physical meaning of it wishing to live as long as possible. As to your comment "The problem is determining "what" knowledge needs to be taught and I believe that the current way of determining that is by getting feedback from students and former students and by applying lessons learned from real world events and sometimes even from things people manage to get themselves into in the simulator.", I can mostly agree with you. I, however, would like to give an example to discuss about shortcomings of current way of pilots education you described.

I am not sure what type of airplane you are involved in with your class room education, unique configuration of 747 landing gears (totally 5 gears instead of 3 gears on other airplanes) has had important effects on the past accidents and serious incidents of this type of airplane on the ground regardless of whether it is the runway or the ramp. In general, minimum number of supports which are necessary to stabilize something on the ground is three (3) and no more required. Additional supports are not only "redundant" but may affect adversely in stabilizing something on the ground, which surprisingly have often caused accidents. Assuming that you are involved in education for 747 pilots, do you think such knowledge as I stated above is necessary to teach pilots?

If you think so, do you know that probably no 747 pilots' education on the globe is so far providing pilots with such specific information about uniqueness of 747 landing gears even if it deems so important to prevent accidents?

The relevant part of 747 Aircraft Maintenance Manual has only been revised to implicitly describe the risk of

unstabilized support when gears struts are improperly serviced with N2 gas. The uniqueness of gears configuration is not specific to 747 airplanes but is common with other transportation modes like trains and long trailers running on the freeway. I know no less train and trailer accidents with the same cause, but never heard that the root causes were highlighted. I just wanted to say that there may be many other knowledges about airplanes that pilots need to know but are not taught in the current education. The difference between us is very small.

Hide Sakuma

Thu 6/17/2004 11:04 PM  
[CharlieRU@aol.com](mailto:CharlieRU@aol.com)

"If something can be "learned" it can also be forgotten. Learning is dependent upon memory and practice (experience). Judgment/decision making is based upon a wide variety of variables that are unique to each situation. What is "taught" is the foundation of decision making. What is done is the result of training, experience and variables beyond definition unless listed in an accident report. Judgment is the result individual variability within a "taught" set of parameters.

Charlie Russell

Thu 6/17/2004 11:59 PM  
SB [sdb@bigpond.net.au]

Charlie,

I can agree with that to a point; that point being between the philosophical description of the act of judgment, or a practical analysis of a problem (a judgment).

We give students the standards of judgment i.e. the things they can hang their hat on (for example, nine standard attitudes etc) and then we exercise the student in achieving the standard. Both approaches are correct but it's a little academic, for all practical purposes, to distinguish at that level.

If one gives a student a set of standards and the method to achieve those standards without having to resort to that ethereal 'force' (and one never does) one has taught the

student to arrive at those judgments that are sort. Not a biggy really.

This applies at all levels (save the subconscious; and even that can be influenced) so there is no real need to make the distinction; but again that's just my judgment...:)

Steve Benier

Fri 6/18/2004 1:45 AM  
SB [sdb@bigpond.net.au]

On a final note with this judgment thread; it occurs to me that perhaps we should be looking more towards the key events that invoke the analytical or judgmental process or processes.

Just as one can deduct marks for spilling and grammar mistakes in email, one can forgive students for not being cued to exercise the higher functions for analysis in their everyday work. If one does not perceive a problem one may overlook the need for analysis in first place.

Naturally, I'm excusing my own bad habits in email but the point remains...:)

Steve Benier

Fri 6/18/2004 6:33 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Thank you Charlie, you summed up my usually verbose descriptions very nicely.

Jeff Weber

Fri 6/18/2004 6:32 AM  
Delex Cherry Point [delexnkt@gsiwave.com]

Hide,  
Your final line:

> I just wanted to say that there may be many other knowledges about airplanes that pilots need to know but are not taught in the current education.

Is the bottom line here? The question is still "what" and additionally I would say "how much" of that a pilot in

training should be taught. After all, as I said many times now, you cannot teach a pilot everything about everything so you have to trim that total body of knowledge down to something that is manageable. While you said you mostly agree with my view of how that is determined, your example doesn't really tell me another way of doing it.

Actually, in your example I would not be teaching this to student 747 pilots the way you describe it. Sure, I would point out the differences between landing with 5 and 3 gear are but the concentration of the class would be on the specifics of landing/taxiing with 5 vice 3 gear. The fact that their gear struts should be pressurized to xxx psi with N2 is beyond what I would teach unless you intend to give them a pressure gauge that they can use to go check the struts before taking out the airplane. At most I would give them an "eyeball" clue that they can use to visually check that the struts look to be pressurized and not underpressurized.

Finally, as to your statement:

> Additional supports are not only "redundant" but may affect adversely in stabilizing something on the ground, which surprisingly have often caused accidents.

I can just imagine putting a C-5 on only 3 landing struts. Or a U-2 or AV-8 with a wheel on only one wing. Sometimes the aircraft design "requires" more than 3 points of support. As far as I know, on the three aircraft I mention there is no unusual tendency to have accidents caused by the fact they have more than 3 supports/struts. I can't speak to the 747 on that issue. But "in general" aircraft designed for three gear only require that many and they usually don't put extra gear struts on unless they are needed.

Jeff Weber

Fri 6/18/2004 11:47 AM  
[CharlieRU@aol.com](mailto:CharlieRU@aol.com)

Hide,

Aircraft with more than three landing gear bogies usually ONLY have stabilization problems when the gear pod does not caster (rotate independently) in turns. The condition scuffs tires and causes unwanted side loads on the strut itself. And it can extend the turn radius. Other

than that C-5s and 747 have no problems with 28 tires on the ground. Usually the FE or FO monitors the castering gear position during turns and the "Caster" system and can manually (with hydraulic pressure) move the gear in the desired position if the gear fails to caster on its own.

Charlie Russell

Sun 6/20/2004 9:12 PM  
[hidetake.sakuma@jal.com](mailto:hidetake.sakuma@jal.com)

Charlie

Surprisingly, almost all pilots and mechanics of 747 airplanes do not know this kind of unique feature, which may appear in various forms in actual operations. I believe C-5s have similar problems which are not known by relevant people. Typical occurrence is the detachment of nose gears from the ground when airplanes are taxiing or running with relatively aft C.G. points. The airplanes can be supported and stabilized only by two wing gears and two body gears and do not need support by nose gears. This uniqueness has never been identified as a root cause in the investigations for past accidents and incidents. Typical cases as far as I know but not officially identified are:

1. Runway excursion during takeoff roll. (ex. South African 747SP?)
2. Loss of steering control on slippery taxiway. (JAL 747 at ANC?)
3. Inadvertent rotation (as much as 180 deg) during stay at the ramp.
4. So many high speed RTOs due to loss of steering control during takeoff rolls.

I know well such an unofficial statement may not be allowed in our community, but would like to break traditional taboos to prevent possible future accidents. I do hope all 747 pilots and mechanics will be informed of the reality of 747 unique designs and difficulty of maintaining proper level of strut N2 pressure for their good judgments and decision makings. Breaking taboos would often be required in making good judgments.

Hide Sakuma

Fri 6/18/2004 3:00 PM  
alf5071h [alf5071h@hotmail.com]

Following my post on experienced pilots making novice like decisions due to their lack of exposure to challenging circumstances, I have located the paper that proposes and supports that view, and that also covers many of the issues

covered in the discussions on judgment. I found the first and last of the three sections the most interesting. Link: - [http://www.spatiald.wpafb.af.mil/2003/ISAP\\_162.pdf](http://www.spatiald.wpafb.af.mil/2003/ISAP_162.pdf) "How good pilots make bad decisions."

Steve, this document may help with your request to look for another definition of judgment and how it is, or is not taught. ALF

Sun 6/20/2004 4:46 AM  
alf5071h [alf5071h@hotmail.com]

Steve,  
Accdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mtttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a total mse and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe and the biran fguiers it out aynawy.

I would not go as far to say that good judgment could be achieved with only the first and last things, but I could ask is the result of the process more important than the method?

ALF :)

Sun 6/20/2004 6:30 AM  
SB [sdb@bigpond.net.au]

Nice... I admire the effort Alf. However, yes, the result is important; but neither you nor I can guarantee it.

As much as I admire our colleagues at Cambridge and Oxford I do not submit that their work is related here; that's just a tad over the top. The basic (complex) research is very removed from this little conversation.

However, I can say that unless one perceives a problem one is unable to deal with it; except by chance; the sad outcome of most training in aviation. Detect then solve, don't rely on some weird aspirations that aspire to neural networks of man/machine integration. That's so bizarre it's not worth dealing with here... sorry Hide.

In any case, it is worth the discussion.  
Steve

Sun 6/20/2004 2:56 PM  
[sqrhead@aol.com](mailto:sqrhead@aol.com)

In a message dated 6/17/2004 8:54:25 PM Eastern Daylight Time, [sdb@bigpond.net.au](mailto:sdb@bigpond.net.au) writes: e  
Steve,

I have to admit that I was frustrated by your post. After all the examples, after all of the previous instructors sharing their stories, yet to still say it can't be taught. Then you asked about a definition (which I think is actually a good idea, but it appears as if everyone has assumed that everyone else thought judgment was the same thing that they did.)

However, before I hit reply, I sat for about 10 minutes and thought about what you wrote. I wanted to see if there was a way I agreed with your statement and didn't get frustrated. I have to say, I thought about something in a way I hadn't considered before.

Maybe what someone referred to in one of the first posts on this topic, "When one student gets it faster than another," is relevant to what you are saying.

I still believe that you can teach judgment, but I concede this to you:

Let's say for a minute that judgment can't be taught. As you say, "You have to Demonstrate, Direct, and Monitor" for a student to "get" anything. Let's say that judgment then comes as a result of experiencing several evolutions or maneuvers, or repetitions. Let's also say that judgment is a curve or line made by connecting all of those experiences. This thing I am thinking of would then be better referred to as interpolation. Some instructors say that students have good judgment because they learn faster than others. Maybe what they should be saying is that they are better because they can interpolate faster than others (need less data points).

Then, for a pilot with little experience to be exceptional, they must have to make accurate assumptions about the few experiences they have, in order to make the judgment curve accurate.

The next logical question is then, how does a person get good at making accurate assumptions. You know, now this is starting to sound more like a "Which came first - chicken or egg" question. I just think that some people question, or evaluate, or bracket, more of their decisions in life than others. People that do it more often seem to be better at drawing the line between the points.

Anyway, I was glad I took a moment to think about it from another perspective. I'll have to think on it some more.

Joe

Sun 6/20/2004 8:36 PM  
SB [sdb@bigpond.net.au]

Joe,

I think we may have crossed a wire or two here. I support the notion that judgment can be taught, in practical terms.

I have just been considering a more relaxed interpretation of the term judgment i.e. not considering it as a discrete cognitive function that exists in a conceptual sense alone.

We give students performance and standards and conditions (preferably a range of conditions) that allow us to communicate and measure the required outcomes. The landing example is a good one as it has had traditional failings in instructional terms; but in recent years those traditional failings have been largely overcome by careful analysis and restructuring of the sequence e.g. see Capt. David Jacobson's interpretation of flare judgment (Jacobson's Flare should find it in Google) used by David for training conversions on the 737. There are several variations on this type of approach (no pun intended).

However, we should distinguish between judgment and readiness to judge i.e. has the student perceived the appropriate cues to bring their judgment into play. This is where most students fail (in my experience) as they have not developed a sensitive enough sense (poor expression) to detect when and where to exercise their judgment. We speed this learning process up when we offer very precise cues.

I guess I want to say that it is only when a student exercises some judgment that we can assess them properly. It may be that their motor skills are not to standard or

that when they do act on cues they don't perceive the situation in terms that allow them to act appropriately. This isn't splitting hairs and I think it is what you are addressing in your post. However, they must always be able to detect the need for analysis or judgment.

When students come to more exotic problems that require teamwork we are then left with a complex of interactions that can make interpretation quite demanding; but that's for another day...:)

Regards  
Steve

6/22/2004 10:14 AM  
Dan Boucher & Diana Nardelli [tashabones@sprint.ca]

Greetings all..this has been some thread...

If I could venture my '2 cents' into the foray...

From what I have seen, Judgment cannot be so much taught as it can be nurtured. When we all leave the 'nest', be it home or school, we have with us the capacity and/or mechanism already to judge certain actions or outcomes. We learned this through trial and error as we we're growing up, formulating our own unique viewpoints. How the mechanics of all this works, I'm not entirely sure. However, the reasoning process that is instilled in all of us, apparently occurs at a young age (I may be out on a limb here, but anyway....) They say that a child's brain is hardwired by the time they are 5 or 6 years old. Is the judgment process also hardwired at the same time?...I'm not sure. Having young children myself at home now, my Wife and I have found it critical to pay attention to this issue in the early stages. Judgment, given the right 'nurturing' can be influenced or developed. I'm not so sure it can be taught in the true sense or definition of the word....

JMHO  
regards,  
Dan Boucher

Wed 6/23/2004 9:46 AM

Douglas Hansell [douglas.hansell@childrenshc.org]

Not in any way believing that this is a final word on this topic, but I found a few appropriate quotes.

Success in life is the result of good judgment. Good judgment is usually the result of experience. Experience is usually the result of bad judgment. ~Anthony Robbins

Men of ill judgment oft ignore the good that lies within their hands, till they have lost it. ~Sophocles

I have made good judgments in the past. I have made good judgments in the future. ~Vice President Dan Quayle

Douglas R. Hansell, BS, RRT

Wed 6/23/2004 9:58 AM

Deen, Gregory C.

And on that note, I make a motion to close the discussion on Judgment, for the time being at least. As mentioned before, I've been saving all of this discussion into a word document that makes for a great teaching hand-out. It's a mere 77 pages!

IF our webmaster, Niel Krey, can post it on the site for download, I'll send it to him. If he can't, I could send it to individuals, via offline requests.

Greg Deen

Wed 6/23/2004 10:02 AM

Delex Cherry Point [delexnkt@gsiwave.com]

Having been all too much involved in this thread...I second the motion. (I need to get back to work.)

Jeff Weber

Ladies & Gentlemen of the Forum -

Neil and his bride are on their honeymoon at the moment. I'm sure he'll be delighted to post the document that Greg has collected for us when they return in a couple of weeks.

Pete

Wed 6/23/2004 9:07 PM  
Gary Hook [gthook@shaw.ca]

What a fine display of sound judgment Peter. I think my question has been addressed, the issue that remains with many of us is at to whether or not it has been answered; regardless though we are all a little wiser having had the tremendous opportunity to muse, read, ponder and heavens forbid, think.

As the initiator I accept Greg's motion, as seconded by Jeff. Closed!

Gary T Hook [gthook@shaw.ca](mailto:gthook@shaw.ca)