



WX Systems
PO Box 2652
Thun, CH-3601
Switzerland

Tel: +41 33 221 7910
Fax: +41 33 221 7912

Email: info@wx-systems.ch
Web: www.wx-systems.ch

Towards the future of procedure design training

By Beat Zimmermann, Training Director WX Systems

What is procedure design?

The design for instrument flight procedures in terminal airspace as well as en-route is one of the very special fields in aviation. All in all there are around 400 people worldwide only, sitting in their offices and creating approach and departure routes into and out of airports surrounded by more or less complex terrain. Although most of the procedure designers are extremely proficient and have a huge background of aviation and air traffic management, they certainly lack of recognition in most Civil Aviation Organisations or Air Navigation Service Providers.

The procedure designer

Most, if not all procedure designers have an aviation background. They usually are former Pilots, Navigators or Air Traffic Controllers. Only sometimes you might come across a Systems Engineer or a former AIS officer. Procedure design positions are usually filled upon need by somebody who volunteers to do so. As we all know, that the level of quality in aviation training differs extremely all over the world, it is easily seen that there is obviously no uniformity on the level of expertise BEFORE a future procedure designer is fully trained to do his job.



Responsibility and tasks

Procedure designers are facing more and more a series of challenges which are new and make the task much more complex than some 10 years ago,

Technology is evolving faster and faster, Air Navigation Systems and concepts get more advanced but also more complicated. All of a sudden the procedure designer needs to have knowledge about areas with no direct relationship to his work but if he doesn't have this knowledge, it makes his task only more complicated.

If we look at it carefully, the procedure specialist has a huge responsibility, very much equal to the responsibility of an Air Traffic Controller or a Pilot. With one very delicate difference: He is alone. While Controllers work in groups of two or even three at a sector and pilots in commercial air transport are also the two of them, the procedure specialist is basically on his own. "Wait a minute! ", you might say now. "I know organisations with teams of four and more procedure specialists!" True. But Air Traffic Control and flying aircraft are dynamic tasks, while procedure design is a static one. There is no immediate effect if the designer commits an error. The specialist might recognize his fault the next day or the next week. In fact there might never be an effect, because the error is never discovered and the airplanes flying the procedure are just lucky. But as there is no immediate effect, there is no need for permanent surveillance either. Example: If one pilot makes a mistake there might be an immediate result. But the second pilot identifies the error and nothing happens.

A procedure specialist might be working on a project alone for a month. A well-trained expert will issue a report with all the steps he made. If somebody were to crosscheck this work IN DETAIL, he would have to do exactly the same work from the beginning and it would take him another month. Most organisations will say that they cannot afford such a routine.

Therefore most organisations will limit a crosscheck to reading through reports, going through some calculation routines and trying to find obvious errors.

All this means, that the procedure specialist needs an extremely high level of knowledge and professional skill. The problem is that there are no uniform guidelines to define when the skills and knowledge of a procedure expert are sufficient to successfully perform his job duties.

Pilots and Air Traffic Controllers are subject to an ICAO license and STILL we have huge differences of proficiency all over the world.



Available guidelines and training

The most important document for a procedure design expert is the ICAO document 8168, aircraft operations also known as PANS-OPS. Most states develop procedures according to the criteria provided in this document. The criteria are periodically reviewed by the ICAO OCP (obstacle clearance panel). The United States use their own document developed by the FAA called TERPS.

There are other important publications implied such as ICAO Annex 14, Annex 10, and some other PANS documents. But the one containing the criteria is doc 8168.

The problem with 8168 is, that it has to meet certain uniformity. It is valid for all kinds of IFR operations: Air Line Transport, commercial and non-commercial. It is also valid for all kinds of pilots: Very experienced ATPL holders or a private pilot with a valid IFR extension, struggling to fulfil the minimum requirements to keep his IFR rating. 8168 addresses operations with clear and concise cockpit procedures as well as single man operations under time pressure.

Finally it deals with “the world” which means: different cultures, different infrastructures, different attitudes to what one is doing etc.

Another issue with the document is that it is based on probability and experience. There will always be the debate if a certain target level of safety (based on probability) is safe enough or not. Obviously this depends on the point of view. For example: If you had 9’999’999 successful departures on your departure procedure, you can actually shoot the next one down and still hit your target level of safety. Which means a target of 1×10^{-7} is sufficient. But I doubt that the passengers in this very plane would agree!

However, that’s what we have available. As it tries to meet this uniformity requirement, it can be inadequate for certain situations, like complex terrain. One could say, that PANS OPS provides criteria for the optimum parameters. But if you look at airports like the old Hong-Kong international (Kai-Tak), there is no such thing as optimum parameters. In fact I know quite a lot of airports in the world where there aren’t!

PANS-OPS copes with that by stipulating “although uniform application of the criteria provided is very desirable, latitude is permitted to meet local needs”. On other words: If the criteria don’t work, you are allowed to deviate from them. This is good news, bad news is though that nobody tells you where and how and how much.



The training for PANS-OPS specialists is available and I think it is good. There are not many PANS-OPS trainers around, in fact I know three: Ralph Sexton, Al MacKinnon and myself. But I see some lack of let's call it "quality assurance". Although the level of PANS-OPS training available is very good, there are a few drag-backs:

- The material is extremely complicated in some areas.
- The material gets bigger in quantity and complexity with the new technologies involved in procedure design such as P-RNAV, GNSS or Baro-VNAV.
- A six-week course is just about sufficient to cover all the criteria and to give the student a chance to do some exercises.
- Six weeks of learning complex material will result in a sensory overload of the student's brain. He will not be able to absorb all the information provided.
- Once he has completed his course, he might not use some of the criteria learnt in his daily work and therefore forget some of it.
- Students attend the course with totally different knowledge of air traffic management. Some of the students are actually not qualified to even attend the course.
- There is no ICAO license that entitles the student to perform his duties as a procedure designer, so if a state declares person XY a procedure specialist, XY is a procedure specialist.
- Many experts don't request a budget to go on refresher courses once a year.

An ICAO license – why?

If a procedure designer could only perform his tasks when holding a valid ICAO license, many issues would be addressed at the same time. For the PANS-OPS or procedure design instructors it would make life a lot easier, because the course could now have an official basic requirement to participate and the student would have to pass a final test in order to receive his license. This means that the instructor is in a position where he can decide whether a student is qualified to do the job or not (yet). Nowadays this is a very delicate issue: Normally the students receive a certificate, but this only confirms that they have passed the course. Obviously the instructor can express his concerns to the student's boss but most of the times this would be ignored or even used against the instructor ("We are afraid you didn't do your job right"). But there is nothing an instructor can do to stop a student from going home and creating IFR procedures.

With an ICAO license, the standard is set and there are no discussions. If the student passes his test, he gets his license. If he fails, he can try again 6 months later.



A second advantage would be the necessity to participate in refresher courses. Many design experts pass their basic training and then work for years, not using all of the provided criteria for long periods. They are poorly informed about other guidance material available, and sometimes are not even up to date with their PANS-OPS manual. It happened to me once, that I mentioned amendment 11 to PANS-OPS, which came out November 2001, and the students looked at me with pure astonishment. This course was in June 2002. Therefore they didn't know about the amendment even half a year later!

To keep the license active, the student would have to go to a refresher course at least once a year. This would avoid nasty things like the above story (which can be safety critical) and would keep the experts up to date worldwide.

Furthermore such a scheme would promote the exchange of ideas between experts from different countries worldwide, as they would gather for a week and learn to know each other. I was always promoting the communication between experts worldwide, we can learn so much from each other, but apart from some official international workgroups it still does not seem to work smoothly yet. But I'll keep trying!

Last but not least, an ICAO license would (finally) get the procedure design experts to the same level of acceptance within an organisation as the Air Traffic Controllers. As it is a little bit of a special field of expertise, many people do not know how complex this work really is. The responsibility of a procedure specialist is so high that it is actually safety critical to let somebody do this job without a proper authorisation from an independent entity.

As we all can read after an aviation accident: it was a series of errors and a chain of unfortunate events that lead to this tragic accident. Procedure design can be one of those, if it is done incompetently!