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SINGLE-PILOT IFR FLIGHTS AND OPERATIONS

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* Opinions expressed in this document reflect essentially the personal views of the author

1– INTRODUCTION

The IFR certification of an aircraft materializes its ability to fly according to the instrument flight rules and to be operated by a crew qualified for this type of flight.

Though the helicopter seemed initially devoted to the visual flight conditions, flying in IFR conditions has been felt as a must for the last twenty years. A few small helicopters' manufacturers excepted, all of them offer an IFR option to their basic aircraft version ; on the large size aircraft, this option proved so indispensable that it is already incorporated in the basic version.

Regardless of the specific military roles, this option became necessary primarily for Air Transport (Offshore, corporate, ...) more than for Aerial Work.

I know that every operator has his own view of his IFR aircraft and that he would like, very often, to be provided with an option consistent with the way he achieves the IFR flight ; as a matter of fact there is a great difference between :

- air service across the airports of capitals such as Paris or London
- offshore service
- corporate service, on request, within known or less known uneven high ground areas.

The airworthiness and operational regulations specific to every country but generally very close to one another should cover the various aspects of the IFR and ensure this type of flight safety and with a workload acceptable to the crew.

In fact, the IFR provides operational smoothness and increased safety thanks to both the technical improvements and the capability to no longer fly across the high voltage lines, tree tops or antennas erecting in our open country.

It has been known for a long time, mainly on airplanes, that though the significant technical improvements solve certain problems and eliminate pilot's actions such as «land immediately» or «land as soon as possible» which are not compatible with the IFR flight, the crew however are of greatest importance in IFR : they have to maintain the flight paths, to achieve safety maneuvers as necessary, to make up for any possible technical failure, to cope with unforeseen situations and also provide comfort and safety to the persons carried.

The general feeling has always been that two pilots is not too much for such flights. But, as on fixed wing aircraft, two pilots aboard light weight and medium- weight helicopters obviously becomes arguable because of the penalties involved. The request for current single-pilot IFR versions therefore became urgent, sometimes supported by the equipment manufacturers who were worried on the development of the two-pilot IFR using very few of their pieces of equipment.

Therefore, the operators and manufacturers have been the initiators of this option whereas the regulations makers tried to conciliate the technical and operational solutions with the big problem of the human aspect set by the single-pilot IFR.

I am thus going to draw your attention to the features specific to the single-pilot IFR within the three following fields : operational, technical and human and to examine how certain problems are currently solved and others remain outstanding and on which the discussion is still proceeding..

I shall then propose you the results of a mini-questionnaire including certain questions that seemed important to me for the single-pilot IFR flight and which a number of pilots, I would like to thank, answered to.

2– OPERATIONAL FIELD

2.1 – The weather condition minima for approach and landing are generally increased by 50 to 100 % in single pilot IFR flight. This constitutes a significant penalty that one has to consider for the air traffic smoothness but that really shows that one of the critical points lies in the transition to visual flight at the end of let-down (refer to answer to questionnaire).

2.2 — In most of our countries, the IFR routes were not designed for helicopters. A better adaptation of these routes to the helicopter characteristics could lighten the pilot's workload especially as he could take advantage of a large support provided that the air traffic authorities and controllers take into account the specificity of the helicopter single pilot IFR flight via a particular aid.

2.3 — For the time being, in most of our countries, public air transport by professional pilots is not authorized in single-pilot IFR conditions. It seems a paradox to allow single-pilot IFR flight for private transport by pilots who, most of the time, are less trained and less experienced.

2.4 — The helicopter flight envelopes are often limited in IFR flight and even more limited in single-pilot IFR flight. For example, on a helicopter, the aft centre-of-gravity limit does not permit flying with a single-pilot on board since the c.g. limit is too aft and has to be compensated by loading passenger, cargo or ballast.

2.5 — Qualification and training

In single-pilot IFR operation, the crew is of course composed of only one pilot. In our countries, the IFR qualification does not differentiate between single-or two-pilot configurations.

It would be adequate to issue a qualification (or a special mention) for single-pilot IFR operation through a greatest experience gained either from the initial training or from two-pilot IFR operation as it is done very often for the basic qualifications (copilot then captain). Moreover, the qualification revalidation requirements should be more severe.

For example, in France, 6 IMC flying hours and 6 bad weather condition approaches have to be performed within the last 6 months. Twice this experience could be required for single-pilot operation. It should be noted that the pilot may not practice IFR flight in IMC for a very long time (several months) and that his qualification enables him to suddenly shift to the flying minimums the most stringent for his category.

Practicing the IMC flight is considered as very important for the pilot to be at ease and to safely conduct the IFR flight.

Lastly, to put an end to this subject, the possibility of a no-pilot crew member, sometimes referred to, should be mentioned. This solution does not seem desirable since, notwithstanding the support it would provide for certain maneuvers, it does not resolve the two very important points in single-pilot IFR operations which are, first, saving a seat or its equivalent and secondly efficiently palliate the human failure.

3— TECHNICAL ASPECT

3.1 — Platform stabilization, handling qualities

All the countries comply either fully or partly with the Helicopter Instrument Rules (H.I.R.) required by the F.A.A. imposing helicopter stability criteria.

These criteria are more stringent in single-pilot IFR and thus entail operating upgraded hence more sophisticated autopilots.

Since there is an autopilot, the associated sudden failures have to be compensated and once again the manual control recovery criteria are more severe in single-pilot operation and lead almost systematically to either DUPLEX or monitored SIMPLEX autopilot. Hence new sophistication.

3.2 — Equipment

In this field, single-pilot operation practically requires the same equipment as in two-pilot operation except for the 2nd pilot instruments.

In fact, the same electric, radio and radionavigation equipment is required. The same essential circuit redundancy is needed : direct current, alternating current, air data, radio transmission-reception equipment, lighting, ...

All these items must have safer redundancies in single-pilot operation since, in IFR operation, the object for the pilot is to get rid of the whole «aircraft control» part to dedicate himself to his mission : to follow the scheduled and unscheduled flight paths with less effect of any possible single failures on his workload.

Everything which could be done by the 2nd pilot should then be achieved either by the pilot himself without any significant effort or ensured by the redundancy that permits flight continuation.

Here, and joining back the previous stability aspect, the pilot's workload with or without failure of any system has to be assessed during the certification flights. In this matter, whatever the basic stability of the helicopter, it seems to me that no one can assess a single-pilot IFR helicopter without any means of maintaining a flight path, at least heading and altitude.

That means I can't imagine a single-pilot IFR helicopter without a basic coupler / flight director able to maintain both these parameters at least which in fact, should be done by the second pilot. It seems very unrealistic that the workload for single-pilot should be acceptable without, at least, this equipment.

3.3 — Special equipment - Meteorological problems

No specific single-pilot regulation has been set up as concerns icing, turbulence or lightning strike although these problems are more frequently met in IFR configuration. Instead of prohibiting or advising against flying in these conditions (this is easier said than done and two pilots are better than one in this case), technical improvement should be developed to help the single pilot under these circumstances.

It must be realized that the IFR helicopter, which is not yet pressurized and whose performance is degraded in altitude, is flying in the altitude range (50 to 150 level) where dangerous meteorological phenomena are most frequent. These problems are only now being solved, with great difficulties, for general aviation's fixed wing aircraft and remain to be confronted for the IFR helicopter.

3.4 — The installation of IFR specific and, if necessary, special equipment to meet the most severe meteorological conditions considerably weigh down the helicopter which, contrarily to fixed wing aircraft, must retain its versatility. It is indeed important that a maximum useful load as well as the capability to transport the heaviest underslung loads be retained with sufficient visibility for this type of operation ; this is particularly important on small helicopters that are most often used for single-pilot IFR flight.

One of the most striking paradoxes of single-pilot IFR flight is that a low number of hours is flown with helicopters that are heavily penalized in this configuration. No operator would envisage devoting more that 25 % of an Ecureuil, Hirundo or Bolkow's flying time to IFR operations, the single-pilot equipment will simply weigh down the aircraft the rest of the time.

For example, single-pilot IFR flight will, cost two passengers or one hour endurance on an AS 355 Twinstar. Can we say then that final results are positive ?

4— HUMAN ASPECTS

4.1 — This is in my opinion, the essential aspect of flight and operations in single-pilot IFR configuration. In spite of cost and weight difficulties, technical problems are easy to solve. The human aspect is however hard to perceive and solve satisfactorily. Physiological and psychological problems particular to flight in IMC conditions without external references are well known. IFR pilots realize that these problems are aggravated when they are flying solo.

4.2 — Vertigo

or, to put it more gently, disorientation. Pilots are familiar with this phenomenon in IMC conditions and know, out of personal experience, that it becomes more frequent and latent in solo flight.

This problem is aggravated in helicopters as :

- There is no physical support such as airplanes' wings
- Stability is not, in general, as good as in airplanes
- Window surfaces are larger thus increasing susceptibility to vertigo.

4.3 — «Loneliness»

Pilots flying single IFR missions are well acquainted with this problem. Their «sense of boredom» is aggravated in this case, they do not feel very much at ease, cannot concentrate on the task at hand, accumulate mistakes and very quickly reach a mental saturation point. The workload acceptable to the pilot is certainly decreased.

I should mention the problems that may arise whenever a passenger becomes restless and cannot be restrained by the single-pilot as well as the help available to the pilot when air traffic control proves efficient ; but it must be pointed out this help has so far proved deficient in most countries.

4.4 — Philosophical problem

This, as a conclusion, is the critical point dominating our approach of single-pilot IFR operation problems. Whatever technical improvements are embodied on the aircraft, whatever the pilot's experience and skill may be, what will happen if he fails ? This question also rises in VFR configuration but it is considerably worsened in an IFR environment.

This is why single-pilot IFR flight is authorized for private and generally not for public transportation.

Considering the safety problems involved for properties and persons residing under the helicopter path (Certification regulations were drafted for their benefit) and, as a consequence, for passengers, we should ask ourselves whether single-pilot IFR flight ought to be authorized ?

Numerous operators refuse to fly IFR missions ; certification authorities reluctantly authorize IFR flights, pilots fly these missions with a great deal of apprehension.

This philosophical problem is an essential aspect of single pilot IFR operation and the above questions remain open for discussion.

CONCLUSIONS

I have tried, during this expose, to draw your attention on to the important problems involved in single-pilot IFR operation.

To summarize :

1) Operational aspect :

Weather condition minimums are set higher. Pilots should be better trained and qualified. Air traffic control's role is essential to facilitate IFR traffic of helicopters.

2) Technical aspect :

The equipment necessary to carry out single-pilot IFR missions limits the helicopter's capabilities and aptitude for other conventional missions.

3) Human aspect :

Operators and Certification Authorities' reluctance to authorize IFR flights demonstrates that there are loneliness-and workload-related problems for the single pilot operating in a sometimes hostile environment and these problems cannot easily be mastered.

Despite these unfavourable aspects, we should expect a development in single-pilot IFR operations with, in particular, small helicopters that proved well suited for this role.

As techniques are improved and increasingly reliable, as pilots are better trained and assert themselves professionally, as better comprehension of their problems and greather assistance from air traffic control organizations should help pilot assert themselves, single-pilot IFR operation should become as common as for airplanes and possibly more.

APPENDIX

SINGLE-PILOT IFR GALLUP

(These questions were asked to pilots)

	YES	NO
1) Do you fly IFR	85 %	15 %
2) Do you fly single-pilot IFR (Replies varied widely depending on country)	35 %	65 %
3) Does the helicopter size affect the single-pilot IFR flight	80 %	20 %
4) Do you think a particular single-pilot IFR qualification is necessary ?	85 %	10 % (No but further training required : 5%
5) Are helicopter IFR regulations satisfactory in your country ?	45 %	55 %

(Wide variations between countries :
- G.B. 100 % YES
- Italy 100 % NO)

6) What IFR operational improvements do you expect ?
- < 10 % → 5 %
- between 10 and 25 % → 55 %
- > 25 % → 40 %

7) What type of stabilization would you require for single-pilot IFR flight ?
- None : 0 %
- SAS : 5 %
- SAS + ATT : 5 %
- SAS + ATT + Upper Modes 50 %
- Full AFCS : 40 %

8) Critical points :
- Transfer from VMC to IMC and vice versa
- Workload after failure or during diversion
- Cockpit poorly designed or to be improved
- Adverse weather conditions
- Loneliness