IFALPA
The Global Voice of Pilots

Accident Analysis & Prevention
Briefing Leaflet

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Airmanship and the fuel tank – the results of the IFALPA fuel use survey

Introduction

Before we can effectively consider the role of airmanship in the use of fuel and or fuel planning, we must first establish a definition of airmanship for the purposes of this study. Let us consider this explanation "Airmanship is skill and knowledge applied to aerial navigation, similar to seamanship in maritime navigation. Airmanship covers a broad range of desirable behaviours and abilities in an aviator. It is not simply a measure of skill or technique, but also a measure of a pilot's awareness of the aircraft, the environment in which it operates, and of his own capabilities[1].

Airmanship can be defined as[2] :

- A sound acquaintance with the principles of flight,
- The ability to operate an airplane with competence and precision both on the ground and in the air, and
- The exercise of sound judgment that results in optimal operational safety and efficiency.

The three fundamental principles of expert airmanship are skill, proficiency, and the discipline to apply them in a safe and efficient manner[3]. Discipline is the foundation of airmanship[4]. The complexity of the aviation environment demands a foundation of solid airmanship, and a healthy, positive approach to combating pilot error[5]."

In aviation, many of our terms and traditions are taken from the sea and seamen even the very title "pilot" has maritime roots – perhaps not surprisingly since there are many parallels between the two professions. While the English language is famous for its adaptability for new expressions that can be used to make precise descriptions. Other languages do not have this adaptability when it comes to aviation. Interestingly, while many languages have expressions for the art of seamanship they do not have an equivalent phrase for the "aviator's art". Of course, it can be debated at length if a technical activity like flying should be considered as having the merits of an art it can be argued that this art comes from the fact that to be considered a good pilot one must know and understand a lot more than is covered in an ATPL syllabus or within the content of a type rating course. Just as important is the knowledge and good sense that instructors and senior colleagues pass on to new pilots. This process of strengthening experiences and the interrelation with the – very important – theoretical details lasts the whole of a pilot's professional life.

1.DeMaria, Chris, CFI (2006-11-09). "Understanding Airmanship". Aviation Channel. Retrieved 2007-02-24
2 Airplane Flying Handbook. U.S. Government Printing Office, Washington D.C.: U.S. Federal Aviation Administration. 2004. pp. 15–7 to 15-8. FAA-8083-3A
3 Kern, Anthony T,; Kern, Tony (1997). Redefining Airmanship. McGraw-Hill Professional. pp. 21. ISBN 0070342849.
4 Kern, Anthony T,; Kern, Tony (1998). Flight Discipline. McGraw-Hill Professional. pp. 3. ISBN 0070343713.
5 Lankford, Terry T. (1998). Controlling Pilot Error : Weather. Introduction by Tony Kern. McGraw-Hill Professional. pp. xvi. ISBN 0071373284.

Airmanship and fuel planning

Completing sound fuel calculations with the help of computers, graphs or tables is basic knowledge for every pilot. To explore the role of airmanship on top of a mathematical calculation, let's have a look at fuel planning.

How much extra fuel should been taken for a standard flight (in Europe)?

- Armed with the known weight of the aircraft and its load, the meteorological data for departure airport, en route and the destination as well as Notices to airmen (NOTAM) affecting airports and the planned route, the anticipated fuel consumtion (trip fuel = take off, climb, descend, approach, landing) can be calculated very precisely. Usually a 5 % allowance will be calculated for unpredictable circumstances.

- Additionally a fixed amount will be added for taxiing.
- In case the aircraft needs to divert to another airport an additional fuel allowance is calculated and added to the fuel uplifted (alternate fuel = missed approach from decision height at destination to missed approach altitude, climb to cruising level, cruise, descend, approach, landing at alternate).
- On top of that comes some more fuel that never should be used – the "final reserve" (30 min holding 1500ft over the alternate in standard atmospheric conditions with estimated mass on arrival at alternate). If an aircraft lands with less fuel than the final reserve it has to be reported as an incident and will be investigated by the accident investigation authorities.
- An airline could also give the order to take some more fuel for possible irregularities and foreseeable special events (additional fuel and company fuel).

Up to this point everything is clear and regulated by the authorities.

Now "airmanship" comes into play. The aircraft commander has the right to order "extra fuel". Based on experience, anticipation and responsibility he/she will take some extra fuel in many cases. The reasons that this fuel might be required are manifold: The calculated flight level may not be available, wind forecasts could be too optimistic or holding are possible (or likely!) at the estimated arrival time at an airport. Another trend which has emerged in recent years, especially for long haul flights, is that the weather appears to change more rapidly and unforcasted "heavy weather" a more common occurrence. To some extent his/her thinking must cover complex situations.

A good example of this is a diversion to Bratislava. Bratislava is a relatively small airport and often the alternate for the much bigger Vienna Airport. If a number of aircraft have to divert at the same time say due to bad weather at Vienna, the capacity of Bratislava can be quickly overwhelmed and approach delays are predictable (cascade effect).

Although the extra fuel is not wasted, the additional consumption has to be taken into account. Using a 737-800 as the baseline, the aircraft will consume 4,500kg of fuel[6] on a 800nm flight lasting approximately two hours (flown at FL350) If it is necessary to take up a hold for a further 25 minutes before commencing approach, then another 1,000kg of fuel will need to be added and as a result fuel consumption will climb to 4,560kg (or 1.3%).

If you consider the number of flights made by even a small airline then it is easy to see that this translates to a significant increase in the airline's financial bottom line. In the current climate where high fuel cost and low fares have narrowed margins the balance between what is safe and what is financially viable is a delicate one. Airmanship in this context means being able to maintain that balance.

It should be left to the airmanship of each pilot in command to make decisions concerning the maintenance balance in this area (as well as the myriad other factors which go towards a safe, financially profitable operation). Airlines should be confident to rely on the accumulation of experience and professionalism of their pilots. However this is not always the case, some airlines guide pilot decisions in an effort to lower operating costs. These initiatives range from elaborate reporting systems when ever extra fuel is uploaded to direct interventions on fuel upload allowed.

Analysis of accidents and incidents

A research of the "ASCEND" database[7] reveals that there were 137 fuel related accidents between Jan 1990 and August of 2008 in commercial operations (including Helicopter and Corporate flights). This figure also takes into account all fuel issues including contaminated fuel, fuel starvation from failed fuel tanks and pumps. This translates to an average of 7.82 accidents per year. Theoretically from these figures it is possible to estimate the number of fuel related incidents – Using ICAO's model that assumes a ratio of incidents to accidents[8]. The annual fuel incident rate is estimated at 469 or around nine a week, more than one a day. It is reasonable to assume that among these events in addition to various technical problems there have been a number which have been the result of a fuel planning issue.

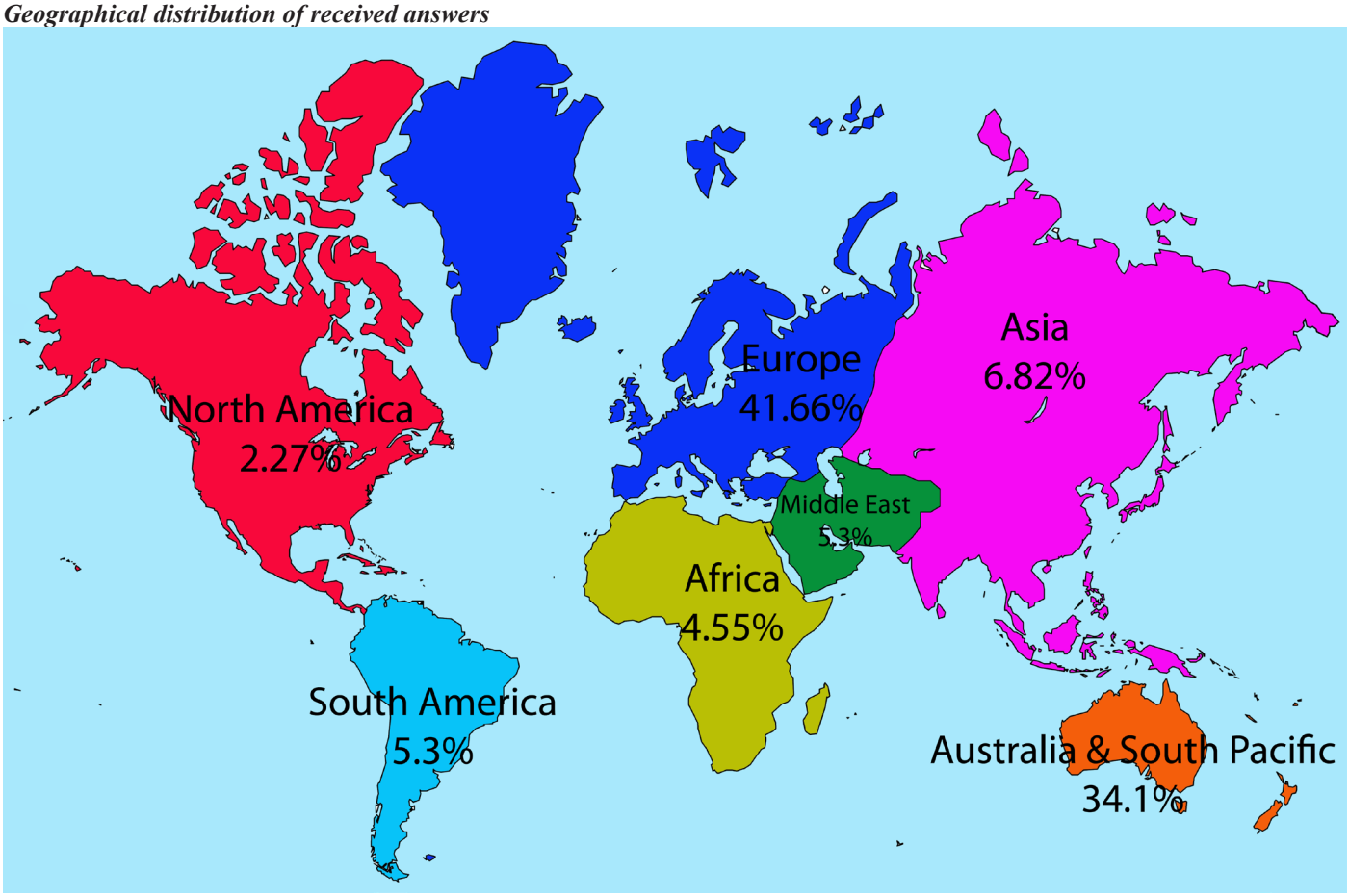
While pilots are quick to think of impact on flight safety from fuel shortage it is also true that cases where an aircraft's engines have failed because of running out of fuel are, thankfully, very rare but it is also worth considering the impact on safety that might come from the perception that the aircraft is about to run out of fuel. It is beyond the scope of this Briefing Leaflet to consider the effect that fuel concerns may have led to rushed or unstable approaches (in turn significant factors in runway overrun events).

6 Boeing B737-800W / CFM56-7B27, 55 000 kg LDG WT, STD conditions
7 World Aircraft Accident Summary (WAAS)
8 ICAO Doc 9859 SMM

The IFALPA survey

In order to fully understand fuel-planning policies the IFALPA Accident Analysis and Prevention Committee commissioned a six-month anonymous survey of airline pilots and asked them about their airline's policy on fuel planning and their views of the policy. The survey was accessible via the Federation's web site and by the conclusion of the sample period 132 questionnaires had been returned.

Geographical distribution of received answers



Aircraft types flown by respondents

A 319, A 320 + (F), A 330, A 340, ATR 42/72, Beech 1900, 717, 737-300/800, 747, 767, 777, CRJ 200/700/900, DHC-8, EMB170/190, LET410, MD80

Questions and distribution of answers

1) Is there a structured fuel cost saving programme in your company?

YES: 87%
NO: 13%

2) The actual price of fuel paid by an airline often is a well-kept secret. Thus a question to the pilots was, if they know about fuel prices in any form.

YES: 52 %
NO: 48%

3) How is the fuel price published? *(Only for YES-answers in section 2)*

Company manual

Price on company flight plan

Ad hoc management updates

Weekly reports by chief pilot or senior vice president

Intranet

4) What is the role of dispatchers at your airline?
Answers to this open question are widespread and reflect the wide diversity of airline operations and varied from *"they choose the policy"* and/or *"they calculate the fuel"* to *"none"* and *"we don't use dispatchers"*.

Examples: *'There is no built in safety margin any more due to aircraft weight increase or last min pax increase or change in FL, route or WX'; Dispatchers are inexperienced and often miss holding or WX requirements'; Minimum block fuel!'; Reserve of 30min is rounded up to give an hour at destination. This does not always give alternate fuel if the RWY became blocked and could catch someone out'*
60% or respondents think that the dispatch plays an important role regarding extra fuel', while 40% don't see the dispatch important in this regard.

5) Is there dissatisfaction with the fuel policy in your airline?
Answers varied from, *"no"* up to *"a lot of complaints"* - but 50% of the participants of the survey are dissatisfied!

6) Is there a notification requirement if a pilot decides to take "extra fuel"?
While some participants expressed their outrage in putting forward this question (replying NO!, never and won't happen in future!') it is interesting that for one third of the participators indicated a ,yes, written report is required to uplift extra fuel'.
YES: 34%
NO: 66%

7) Do you, as a pilot, want to have more authority of how much fuel you take?
YES: 40%
NO: 60%
Among those who expressed their dissatisfaction some respondents noted that *"pilots feel pressure"* and *"junior captains see taking no extra fuel as a way to express company mindedness"*.

8) The final question of the survey was if incidents (experienced by her-/himself or reports from others) connected with fuel amounts are known.

Nearly all participants have knowledge of incidents related with fuel. Approximately one third of all participants reported landings with less than the "final reserve" in the own airline. While there were some hair-raising examples given, generally speaking a broad range of events are reported. Many describe mistakes made during re-fuelling and the perception that savings are to be made by a limited fuel load (the latter more prevalent in low cost carriers). Landings with very little fuel remaining may not attract the attention of Air Traffic Control (ATC) or passengers so it is not surprising that there are few subsequent reports – however what is interesting is the lack of comment from ground personnel when they have to refuel the aircraft.

An example of one of the events reported was that of a 737-800 operating from Stansted Airport (EGSS) to Alicante Airport (LEAL), the aircraft was cleared to land on runway 10 and had to execute a go-around due to a windshear on final. The crew then flew a new approach out of the go around to the reciprocal runway 28 but the wind conditions were similar. The crew finally decided to divert to Valencia airport (LEVC). They made a PAN call due to the fact that they were below the final fuel reserve and then, when in approach had to upgrade the PAN to MAYDAY. The aircraft landed on runway 12 in Valencia uneventfully. At the Airport, fuel quantity was checked and found to be 440 kg in tank 1, 470 kg in tank 2 and 0 Kg in centre tank), the aircraft was refuelled and the crew continued to Alicante Airport with the passengers on board[9]. In another airline it has been reported makes its trip fuel calculation based on the assumption of flights always getting direct routings (almost never available in reality) from ATC. As a result in one case involving an A320 the aircraft was 1,500Kg short on fuel and had to use its final reserve.

However, according to respondents, landing with astonishingly small amounts of fuel occurs on long range flights as well as on short haul flights.

Interpretation of the survey findings

While the survey has revealed some extreme examples of fuel problems, overwhelmingly the practice of good airmanship is widespread in the industry. That said, it is also true that there are tremendous differences in the fuel policy practiced by operators in all parts of the world. It may also be true that a significant number of fuel incidents go unreported and certainly it is difficult to assess from outside how large this number might be.
The effect of a potential cascade of fuel problems that can occur if large numbers of aircraft are required to divert at the same time to the same nominated alternate must be considered a possibility. The scenario where traffic from a partially or fully closed major airport rapidly overwhelms a smaller neighbour is not unusual. Therefore, it may be worth considering how the selection of alternate is made.
The practice of a number of low cost carriers is to avoid the use of "extra fuel". This raises a number of concerns not least the erosion

9 Due to data protection an officially documented example was chosen / see homepage of CIAIAC (2010) http://www.fomento.es/mfom/lang_en/direcciones_generales/organos_colegiados/ciaiac/investigacion/2010/010_2010.htm

of Captain's authority to make decisions based on his/her experience and knowledge. Furthermore, risk awareness is often connected to the operational environment. If almost all pilots take marginal fuel, this will be perceived as normal. Concerns over a lack of fuel can lead to pilots continuing approaches that are unstable and landings made when a go around would be the safer, better option.

Conclusion

The author of this Briefing Leaflet has been flying for more than 30 years. Over this time the instructions at his company regarding fuel reserves have changed many times. While it is true that new methods of calculating fuel consumption have enhanced the accuracy of these calculations so that error margins have been able to be reduced, it is also true that in the same time frame a variety of new challenges have emerged from the increase in traffic density and the rise in fuel price to the emergence of environmental considerations and the growth of new competitors, have all directed the management thinking to examine ways in which every possible saving can be made. Only on a small number of flights are fuel reserves needed, for the vast majority of flights fuel reserves are never used…but among the most useless things in aviation is fuel in the bowser (together with altitude above you and runway behind you). Having enough fuel and therefore, time can be worth its weight in gold. The IFALPA AAP Committee will continue to monitor this issue.

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