DISTRESS CALL FROM THE FLIGHT DECK:

CROSS-CULTURAL SURVEY OF AVIATION PROFESSIONALS REVEALS PERCEPTION THAT FLIGHT SAFETY IS DECREASING

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ABSTRACT

Commercial pilots and air traffic controllers interviewed for a human factors research project were united in painting a pessimistic picture of the direction of aviation safety. This finding comes from the analysis of interviews with twenty-three aviation professionals from four European countries. According to these front-line operators, while aviation statistics may still portray a healthy industry, the operational reality is another matter altogether: the negative impact of economic scarcity and the ever-increasing focus on profits has reduced safety through changes in management practices, organisational structure, and regulations.

The interviews were conducted in the context of a larger study, aimed at mapping the variation in safety perspectives across the aviation industry. The results of an opinion survey revealed that the largest variation in perspective was related to the national culture of the respondent. Profession was the second largest factor correlated to variations of the results. Overall, the variations did not seem dramatically different, but they were statistically significant. The largest spread in the results was between Northern Europeans and Human Factors professionals on one end of the spectrum (rejecting the traditional safety perspective), and Southern Europeans, South Americans, and aircraft mechanics on the other (agreeing with the traditional safety perspective).

The qualitative interviews with pilots and controllers from two Northern and two Southern European countries were carried out in order to better understand the results of the survey.

Key Words: Safety paradigm, resilience, cross-cultural differences, occupational culture

UNDERSTANDING SAFETY: A MOVING TARGET

The way people think about safety influences how they carry out and structure their work; the safety paradigm one employs as a framework for understanding safety interacts reciprocally with ones activities and the work environment. Historically, however, the accepted way of thinking about safety has been a moving target. Rasmussen explains that the many social and management science areas (related to risk and safety management and human factors) have been evolving over the past several decades (1997). This is not surprising given the rapid transformation of technology and the nature and organisation of work itself (Hollnagel, 2005). Safety scientists have been discussing the different philosophical, scientific, and epistemological approaches to understanding safety with increasing frequency (for example: Amalberti, 2001; Dekker, 2005; Pariès, 1999; LeCoze, 2005; Leveson, 2002). In Erik Hollnagel's work (2007, 2009) and recent lectures he describes two opposing views: the "traditional" perspective (also called Theory W) and the "systemic" perspective (Theory Z). We refer to the latter here as the "resilience" perspective.

The perspectives represent more than just different points of view; they reveal fundamentally different underlying paradigms and basic assumptions about the nature of socio-technical systems. Table 1 presents an overview of some of the basic characteristics differentiating the Traditional from the Resilience perspective on safety. These characteristics attempt to synthesize ideas from presentations and lectures by Erik Hollnagel, Jean Pariès, René Amalberti, and John Wreathall as well as some of the fundamental ideas in Dekker's "Ten Questions on Human Error" (2005).

	Traditional Safety Perspective		Resilience Aspirations
Model	Sequential	→ Epidemiological	Systemic
Accidents	Simple, linear	→ Complex, linear	Complex, non-linear
System	Cartesian, mechanistic, decompositionist, Newtonian, simple	→ Cartesian, mechanistic, decompositionist, Newtonian, more complex	Systemic, complex, ecological
WYLF (IWYF)	Causes, cause-effect links	→ Active and latent failures	Couplings; resonance; loss of control
Scientific focus	Proximal components	→ Distal and proximal components	Situated, integrated wholes; emergence
Change action	Reactive response	→ Proactive attention	Proactive anticipation
Intervention	Error prevention	→ Error prevention and recovery	Maintaining control; building in slack
Safety paradigm	Normative	→ Normative with some allowances for mitigating factors	Local rationality, constructionist
Scientific philosophy	Positivist	→ Positivist with some scepticism	Postmodern, social-constructionist

Table 1: The evolution over time of the Human Factors or Ergonomics paradigms, from the Traditional Safety Perspective to the aspirations of the Resilience Engineering movement. WYLF (IWYF) stands for 'What You Look For (Is What You Find)'.

In practical terms, the application of these different perspectives leads to different approaches to such areas as safety and risk management, understanding and investigating accidents, and the role of humans and automation. Within safety-critical industries such as aviation, the existence of diametrically opposed perspectives could pose barriers for cooperation. This research study initially set out to map the variations in beliefs and the acceptance or rejection of traditional safety assumptions and attitudes across various aviation professionals.

THE QUANTITATIVE: SARA, A SURVEY OF AVIATION PROFESSIONALS

A survey was designed based on the assumptions and beliefs associated with the Traditional Perspective of safety or "old view" of human factors, mainly derived from the literature and the previous work of members of the team. Since the paradigm shift from the Traditional to the Systemic Perspective is in line with the move towards a Resilience Engineering paradigm, this questionnaire is referred to as the Safety Assumptions and Resilience Attitudes (SARA) survey. The survey consisted primarily of statements and assumptions such as:

- Various definitions of human factors, ranging from simple to complex.
- Various accident models, such as the domino, Swiss Cheese, and complex interactions of
- If people just followed the procedures, there would not be any aviation accidents.
- In my opinion, the most important aviation human factors issue is managing human error.
- Technology (such as computers and equipment) is safer than the operators (people).

Thirty of these types of statements were presented in the survey with a scale of 1 to 5 for the respondents to indicate their level of agreement with the statement. The scale was marked with the anchors "Totally Agree" and "Totally Disagree" (i.e. do people accept or reject the Traditional Perspective) as well as a sixth option: "Do not know / no opinion".

The following demographic and background information was collected:
- Job description;
- employer type (e.g. Airline, ANSP, maintenance provider, regulator, OEM, etc.);
- company size;
- years of work experience;
- seniority level;
- amount of recent human factors training;
- age;
- gender;
- education level; and
- country of residence.

One of the research hypotheses was that a person's breadth of experience or exposure to different world-views would correspond with the rejection of the Traditional Perspective. In order to explore this hypothesis, the following information was gathered in the survey, and an indicator of breadth of experience:
- Past experience working in another type of aviation job;
- first-hand experience with an aviation accident;
- experience living abroad; and
- amount of contact with people from other aviation organisations (e.g. conferences, training, or industry partnerships, etc.).

The online survey was disseminated publically in English, French, and Spanish based on a convenience sample of the researchers' professional networks as well as online professional groups and associations. A "snowball" sampling method was also employed, whereby respondents are encouraged to forward the survey on to others. The target population was commercial air transport professionals in any type of job or company, excluding human factors researchers or specialists. The distribution of the 705 usable responses according to geographic region and profession is shown in Figure 1.
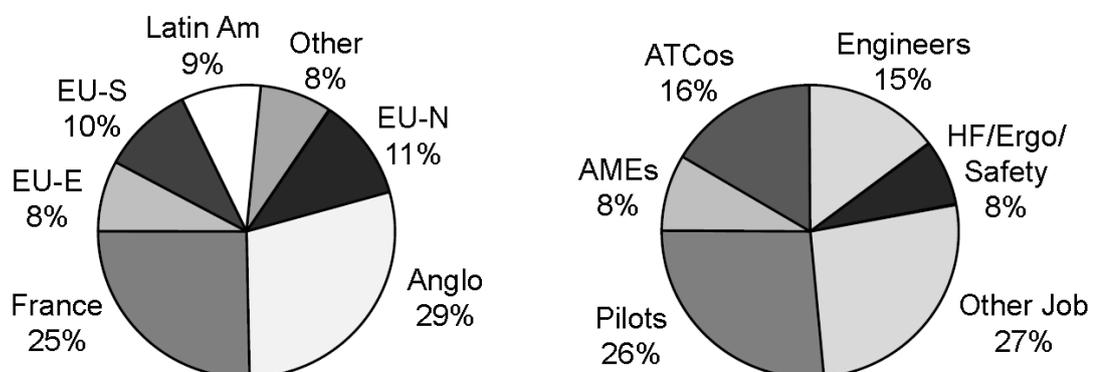

Figure 1: Distribution of the 705 survey responses according to Geographic Region and Job

Northern Europe (EU-N) includes Scandinavia, The Netherlands, and Flemish-speaking Belgium. Southern Europe (EU-S) includes Spain, Portugal, and Italy. Eastern Europe (EU-E) includes the new EU members and CIS states (except Russia), Turkey, Greece, and Malta. France also includes responses submitted in French from Switzerland, Luxembourg, and Belgium. Anglo (English-speaking nations) includes the UK, US, Canada, Australia, New Zealand, and South Africa. Latin America (Latin Am) includes Mexico, the Caribbean, South and Central America.

The jobs groups as shown in the figure are air traffic controller (ATCo), pilot, aircraft mechanic, technician or maintenance engineer (AME), design or other types of engineer (Engineer), and HF or ergonomics expert or safety manager (HF/Ergo/Safety). Eight percent of the respondents were human factors or safety specialists, and although this was unintended, it did provide a useful baseline for comparison.

VARIATIONS IN SARA RESULTS ACROSS NATIONAL AND OCCUPATIONAL CULTURES

The results were analysed to determine whether there was any correlation between safety perspective, as measured by SARA, and demographic variables. Multiple correspondence analysis (MCA) revealed that variations in the survey responses were most strongly related to country of residence: Scandinavian responses indicated the strongest rejection of the Traditional Perspective, and South American and Southern European responses slightly favouring the Traditional Perspective. MCA was used to identify the main trends but the more familiar descriptive statistics (i.e. mean and standard deviation) are used here, since for the purposes of this discussion the results are the same. Figure 2 shows the survey results by geographic region.
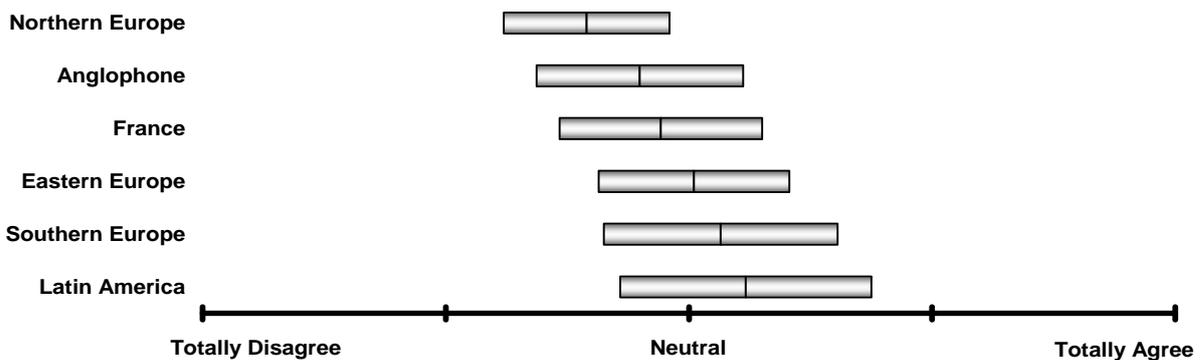

Figure 2: Average SARA survey responses (agree or disagree with the Traditional Perspective) according to Geographic Region. The bars display the mean score and one standard deviation (σ) on either side of the mean.

There is also a difference in response to the survey questions according to job type: aircraft mechanics and human factors specialists represent the limits of the range of responses, with HF professionals on average rejecting the Traditional Perspective, as shown in Figure 3.
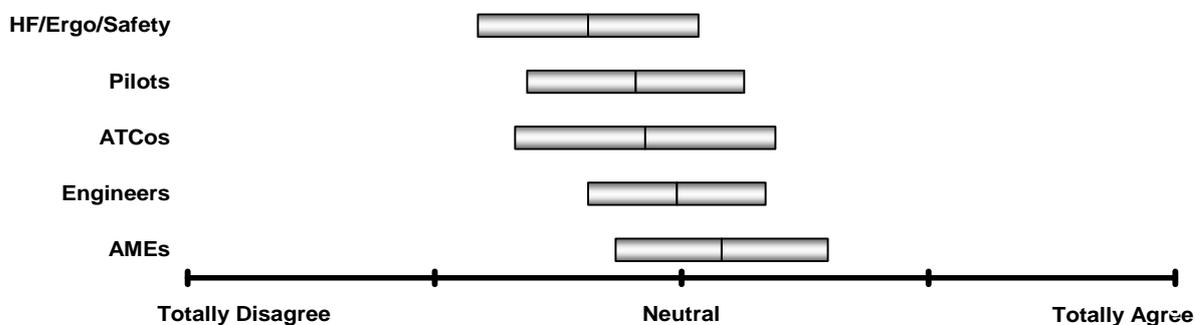

Figure 3: Average SARA survey responses (agree or disagree with the Traditional Perspective) according to Job. The bars display the mean score and one standard deviation (σ) on either side of the mean.

There was a fairly even distribution of the different professions in the different geographic regions, so there was no interaction between these variables which appeared to skew the results. No other single variable was correlated to such large variations in survey results. More detailed interpretation of the results is published elsewhere (e.g. Zimmermann, Pariès, Amalberti, & Hummerdal, 2011).

THE QUALITATIVE: INTERVIEWS WITH OPERATORS FROM THE NORTH AND THE SOUTH

To better understand the results of the survey, interviews were conducted with 23 pilots and controllers from four countries: two countries from Northern Europe and two from Southern Europe. The original intent was to interview aircraft mechanics as well, however access to suitable participants was limited; the final number of mechanics interviewed was small in comparison with the pilots and controllers so that data will not be treated here. The interviews took place during the spring and summer of 2009.

The intention was for people to participate of their own accord and give their personal opinions frankly – not to speak as an official "representative" of their organisation. To this end, attempts were made to recruit interview participants directly through peers of professional contacts, and conduct the interviews confidentially, rather than arranging official participation with organisations and allowing management to select the participants. Overall, this was not entirely successful; about two-thirds of participants were accessed through a company HF or safety post-holder and interviewed in a private room on company premises. Participants were informed that the content of the taped interviews would be confidential and any published results would be de-identified. The interviews were all carried out individually. In most cases, the sample of participants representing one profession within the same country all worked for the same local unit of the same organisation (e.g. a base for one airline or a tower for a nation's air traffic service provider).

The introduction to the interview explained that they had been selected to participate based on their profession and geographic region but that they should try not to speak on behalf of any group, just give their individual opinion. They were reminded that the objective of the study was to better understand people's personal points-of-view with respect to safety and that there were no right or wrong answers to the interview questions.

The questions covered during the 45 - 90 minute semi-structured interview are listed in Appendix A. Some questions asked about opinions on specific questionnaire results, for example: "88% of people (responding to the questionnaire) agreed that HF is related to their work, do you agree with that? For whom do you think HF is most important?" Other questions were taken directly from the questionnaire but the respondent was prompted to explain their answer, such as "Do you think aviation is safe? Why, or why not? What are we doing right (or wrong)? Why are there not more accidents?" and "Who (among this list of aviation professions) do you think puts safety first? Why?"

The responses were coded for basic content and main ideas. The coded responses for each question were grouped according to the four different groups representing the two regions (North or South Europe) crossed with the two professions (ATCo or Pilot). To protect the identities of the interviewees cited in this paper, they have been assigned a reference number composed of either "N" or "S" to indicate North or South, "P" or "A" to indicate pilot or air traffic controller, and then a number.

The pooled responses were examined for trends or similarities within each group, as well as compared across groups for similarities or differences for each individual question and across groups of related questions. The results can thus be considered more descriptive than analytical. The results of the analysis of the survey and the interviews combined is still underway, and beyond the scope of this paper. All interviews, coding, and analysis were carried out by the author.

One of the findings from this phase of the research was the pervasive theme of conflict between economic and safety interests.

"SAVING MONEY HAS A PRICE": SELLING OUT SAFETY IN HARD ECONOMIC TIMES

One of the more prominent patterns to emerge from the interview data was the perception that the level of safety in aviation is "not as high as it used to be" ("N-P-3", interview, June 30, 2009) and continuing to decline.

Almost unanimously, the group of pilots explicitly voiced this perception even though it was not directly asked[1]. Several of the pilots and a number of ATCos expressed the belief that the current economic context and lower ticket prices have reduced the overall safety level, and airlines in particular are suffering. Nearly all interviewees described a conflict between financial and safety objectives. As one pilot explains "There is always a balance between safety and economics… you have to admit it" and anyone who claims otherwise "is lying" ("N-P-2", interview, 25 June, 2009).

This conflict was frequently mentioned in response to questions about which groups are leading or lagging in terms of safety and which groups prioritise safety. Responses included things like: only groups without economic goals can put safety first; airlines no longer prioritise safety because they are desperate to save money; the safety level is higher in ANSPs who are not evaluated based on financial criteria; all groups have an interest in safety but some have to balance that against economic interests; richer organisations such as legacy airlines or "flagship carriers are leading the way" ("N-P-2", interview, 25 June, 2009) in terms of safety because they can afford to make safety investments which only pay off in the longer term; contract pilots and/or pilots at airlines with financial problems are "forced to do things that we (at a 'good' airline) would not do" by management ("N-P-5", interview, 3 July, 2009). Organisations who focus on cutting costs are seen to have relatively worse "safety cultures" and as one controller put it: "saving money has a price" ("S-A-6", interview, 27 August, 2009).

Examples of various cost-saving strategies which the interviewees described as compromising safety included increased duty days causing fatigue, outsourcing maintenance, and hiring contract pilots from other countries. "I am sure we will see some incidents in the future" since at many companies pilots cannot just excuse themselves from duty because of fatigue, they end up "flying until they fall asleep", ("N-P-3", interview, 30 June, 2009). This is eerily reminiscent of the warnings about fatigue and the impacts of financial strain on flight safety echoing around North America both before and after the high profile Colgan Air accident in 2009 (e.g. Halbfinger, Wald, & Drew, 2009; Matchette, 1993; Rosekind et al., 1994; Stark & Barrett, 2009).

The pilots and controllers in this study are not alone in their concern. Following the famous ditching of an Airbus in the Hudson River, Captain Sullenberger used his moments in the spotlight to make his (similar) concerns public in no uncertain terms. During testimony about the accident to the US House of Representatives, Capt. Sullenberger explained how the financial management of airlines has him "deeply troubled" about the future: since pilot salaries and working conditions have deteriorated to the point where the piloting profession can no longer "attract the best and brightest" lowering the entry standards with clear ramifications for flight safety (Sullenberger, 2009). "We will see negative consequences" since the investments "vital to safe air travel" are no longer being made, and the profession is no longer adequately valued and compensated (ibid.).

Several interviewees reinforced Sullenberger's claim that "revolving door management teams… have used airline employees as an ATM[2]" (Sullenberger, 2009): The interviewees in explain that modern-day management with a primarily financial background pass through airlines with a high turnover rate, using the company as a stepping stone on a management track with no specific concern or interest in the flying business or the aviation industry. This results in short-term thinking with a financial focus; the so-called "revolving door" style. Decisions are made according to inappropriate quantitative cost-benefit criteria imposed by people without enough familiarity with the operation. The result is a squeeze felt at the sharp end which negatively affects safety. Interviewees explained that "management do not see the economic benefits" of non-quantifiable or long term safety investments, such as HF training ("N-A-1", interview, 23 June, 2010; "S-A-4", interview, 26 August, 2010).

SAFETY IN NUMBERS

In response to the question "Do you think aviation is safe?" several people responded "yes…", paused, seemingly conflicted, and then qualified their response with explanations like: "it is statistically safe" or "safer than all the other modes of transportation". They generally described behavioural, procedural, and operational examples of "safety" in their daily work. This revealed a distinction between safety as the active *experience* of an activity (e.g. flying) in contrast to the "safety level" described by statistics reflecting the *outcomes* of that activity (e.g. fatalities or hull losses). A review of the interview data reveals that, with very few exceptions, safety was

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[1] The goal of the question "Do you think aviation is safe? Why (or why not)?" was to elicit explanations of how safety is created and to whom or to what they would attribute the credit for aviation's exemplary safety record.

[2] "ATM" (Automated Teller Machine) is the American term for bank machine, cash machine, or "bancomat".

discussed as the qualitative, tangible experience of the risk involved in the activity, and this risk is compared to some cognitive or affective baseline – what could be considered the "comfort level" of the individual.

Although it may seem obvious that practitioners will not discuss safety in terms of trends and statistics, it is relevant to our community of researchers and decision-makers to occasionally remind ourselves of the distinction. Accident statistics based on outcomes are used as the universal measure of safety presented to the public as well as for risk management and in decision-making. The interview data highlights the disconnect between quantitative safety statistics and 'real-time safety' as part of the ongoing, dynamic, daily activities of pilots, controllers, and other aviation professionals. Logically it seems that the two are not independent: if the work is not carried out in a conservative, consistent, conscientious manner (i.e. "safely") then the statistics should reflect that and aviation's laudatory safety record will not be maintained. Over time. But who can afford to wait for the statistics to prove the veracity of these warnings?

CONCLUSION

Through this study of the differences in perspectives and beliefs of aviation professionals across national cultures, the trade-off between economic and safety interests was identified as a common concern. According to a diverse sample of pilots and controllers, while aviation statistics may still portray a healthy industry, the operational reality is another matter altogether: the impact of economic scarcity and the ever-increasing focus on profits has reduced safety through changes in management practices, organisational structure, and regulations.

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Introduction

I'm going to ask you some questions about Safety and Human Factors topics in general, I am not testing your knowledge – there are no right or wrong answers, and I don't expect you to be an expert on HF – I want to know what you as a (pilot/ATCo) know and think about it, your personal opinion. I recently did a survey and I also want to show you some results from that and see what you think.

I am not asking about what goes on at your specific organisation – I just want to understand your point of view about some general aviation topics.

The interview data and transcripts are confidential. Your name and your organisation, and any personally identifying details will not ever be revealed to anyone, and the tapes and personal information will be kept secure and I will be the only one to see them. I am doing some interviews with pilots, controllers, and mechanics in different parts of Europe and I will be presenting the results all together in a very general way (e.g. I will never write: A 43-year-old Dash-8 pilot from a commuter airline in a large Irish city said "…"). Everything will be generalised. So please feel free to speak openly, your answers are completely confidential.

Waiver Form

[Interviewer explains the waiver form and both parties sign the form, indicating they have given informed consent to participate and outlining the participant's rights to privacy and to withdraw consent at any time.]

Questions

1. What does the term "human factors" (or ergonomics) mean to you (as it relates to your work)?

2. Do you think that what you learned in your HF training makes a difference in how you perform your job? What's your opinion of the content/relevance of the training to your work? What's your opinion of the amount/frequency of training?

3. According to my survey[3] nearly all respondents, from the many different types of aviation jobs, agreed that HF is related to their work. Does this surprise you? For whom do you think HF is (most) important?

4. Do you think there are some people doing a better job than others of taking HF into consideration? Any specific group(s) who you think are the example to follow, or anyone who is lagging behind (e.g. regions or professions or others, like LCCs or legacy carriers, regional airlines, etc.)?

5. And what about safety, do you feel that there differences between the regions/professions/other groups? Any specific group(s) you think are the example to follow, or anyone you think is lagging behind in terms of safety?

6. We all want to believe that everyone in the aviation industry puts safety as their top priority, yet I hear comments in my interviews saying things like 'management only care about being on time, saving money' or 'regulators don't care think about safety, they only think about checking the boxes, following the rules'. In your opinion, who, on this list, really puts safety first?
   - Pilots
   - Air Traffic Controllers (or ANSPs)
   - Airlines
   - AMEs or Maintenance facilities
   - Aircraft manufacturers and equipment designers (like Boeing, Airbus, GE, etc.)
   - Regulators/government inspectors
   - Airport and ground staff

7. As you know, I did a survey about how people think about aviation safety, how they feel it could be made safer, how they think about accidents, the safety of technology vs the safety of humans, their definition of HF,

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[3]All questions regarding the survey results were supported with visual aids i.e.: graphical representations of the demographics of respondents or the response averages according to geographic region or profession.

etc. The survey respondents from Latin America and Southern Europe answered very differently than participants from Northern Europe (i.e. Scandinavia and the Netherlands). For example, if an Italian pilot agreed with a statement, a Dutch pilot disagreed. Or vice versa. All the way through the survey there was a difference in point of view on a variety of topics about safety and HF.

8. Does this surprise you? We all fly the same aircraft, follow the same SOPs, use the same regulations, manuals, checklists, use the same tools to tighten a nut to the same torque setting, etc. So can culture really make a difference? (If so, how?)

9. I also saw a difference (not quite as big as by Region) between the answers from Pilots / ATCos compared to the answers from mechanics. Does this surprise you? Do you think there is a difference in the way AMEs think about safety and HF versus how pilots and controllers think about these topics? (If so, why?)

10. In general, do you think aviation is safe? Why or why not? Why do you think there are not more accidents?

11. Describe to me how you think accidents happen? How does it work, is there a single cause which starts a chain, or is it a combination of many, unrelated things, or is it maybe just bad luck... How does it work, in your mind?

12. I spoke to a pilot contact of mine from back home in Canada, flying for a commuter airline. She told me that at her company they have a rule [example of a blanket company safety policy] that sometimes isn't applicable, thus constituting an unnecessary task. The resulting delays increases the time-pressure and stress on the crew to catch up during the remaining legs, which is actually bad for safety, in the end. But the crew has no choice, they have to follow the procedure even when they know it is not necessary for any safety reasons, they do it because otherwise they will be violating company policy and would get into trouble. Do you experience any similar situations in your work, when you know a procedure might be unecessary but you have to follow it anyways just to cover your butt?

13. In the questionnaire I asked whether people agreed or disagreed that "It would be possible for a computer to fully perform my job". Nearly 100% said they disagreed. But this seems ironic, since we are moving towards more and more automation especially in ATC and the flight deck, you often hear about how automation does the job better and eliminating the human is a good way to make the system more reliable, etc. What do you think about this result? What (if anything) is it that humans do that computers cannot?

14. In the questionnaire, Engineers and Aircraft Mechanics agreed most with the statement: "Technology is safer than people" and ATCos disagreed most strongly. Do theses results surprise you? Do you have any ideas why the responses from Engineers and Mechanics might be different than pilots and ATCos?