CULTURAL ASPECTS CONCERNING CABIN SAFETY

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Foreword
This paper has been written by the Author as participant in the JAA Occupant Survivability Project Advisory Group (OS PAG) and in the Cabin Safety Research Technical Group (CSRTG), as sent from the ENAC, Italy. Although his efforts while writing it were constantly directed towards obtaining the largest possible adhesion within those organizations, its content has to be referred primarily to the person of the Author only.

Purpose and scope
A main purpose of present paper is to give information, guidance and to possibly promote research initiatives. Anyway its content hasn't to be understood as a specialist contribution on the matters. In addition its scope is not to give a thorough view within a "Culture and Safety" area, but just to mention some very noticeable possibilities in it, especially for the Cabin Occupant Safety concern.
While doing it both the specific and general viewpoints on the matters have to be examined if one wants to range throughout at least two main possible viewpoints on cultural aspects.

This is also consistent with the fact that extensions from the area currently named "Human Factor" are steadily growing beyond the man-machine and individual human error areas (see e.g. Maurino et al., 1995), towards organization and culture. Before or beyond distinguishing between cockpit and cabin dedicated studies a their common area has then also to be pointed out and examined.

From the cultural viewpoint a main aim of this paper is finding a common purpose and goal for the many different cultures: enhancing safety, and more specifically Cabin Occupant Safety for Transport Aircraft. Although starting from its main actors is an obvious necessity, a progressive understanding and cover of the safety needs of any culture is deemed even necessary. That needs to be done before and beyond any attempt to cultural conforming or anyway technological rules standardization, especially in cases where it is neither a culturally feasible solution nor a technically suitable opportunity.

Main activities in the professional area
Let's start giving an idea of the main recent and present activities concerning cultural aspects which may be of interest for Cabin Occupant Safety aspects. A professional area is considered first, divided

into the three main sub-areas of Business, Cross-cultural Psychology and Aviation Safety professional men.

Business

- Geert Hofstede
In the Business and other surrounding academic areas the name of Geert Hofstede is outstanding. He did perform a large research on the IBM employees started on year 1968. Based on some theoretical assumptions and on factorial statistical analysis, Hofstede has singled out four main dimensions of human behavior: Individualism (IDV) (where low Individualism is called generically Collectivism), Uncertainty Avoidance (UA) (e.g. staying with the same Company throughout all the life), Power Distance (PD) (concerning management), and Masculinity (MAS) (e.g. Tendency to a satisfactory career within a contractually challenging work environment). The initial study on IBM employees has then be enriched by further correlation with the results of other studies in the surrounding areas. Current Crew Resource Management (see below about Robert Helmreich) is largely based on such results.
Hofstede's first main book on the matters, Culture's Consequences (1980), has been enriched until today by additional basic data and a further series of additional correlations. Its 2nd edition has been published this year (see Hofstede G., 2001). A noticeable reference to its relevant applicable content is made herein.
To Geert Hofstede is also strictly related the origin of the Institute for Research on Intercultural Cooperation (IRIC). For a more direct concern of Aviation Safety a mention of its Scientific Director, Joseph Soethers, is opportune. He is also teaching at the Breda Aeronautical Academy, and did make a very interesting work on the correlation between Hofstede's dimensions (more specifically UA) and accident frequencies in the military NATO domain (Soeters, 2000). As one of the possible explanations it must be noted that high accident death rates were found by Lynn and Hampson (1975, cited in Hofstede, 2001:155) to be correlated to a factor which they called "neuroticism", or "anxiety". This in turn has been found to be quite strongly correlated to high UA Index (UAI) values.
For the civil aviation however accident rates seem to be correlated more directly to low Individualism values, or, even more, to low Gross National Production/capita (GNP) values (see Hofstede, 2001:115). A correlation with low Individualism (but not so much with GNP) values has been found also for car traffic accidents (Hofstede 2001:514).
The zero-accident levels of aircraft safety reached by UK in the period 1990-99 (see Civil Aviation Authority, 2000) and by Australia (see G. Braithwaite et al., 1997, Braithwaite 2001), two highly Individualist countries, seem to confirm the above results. That, together with other elements, would allow a meaningful view throughout the whole Aviation Safety area, Cabin Occupant Safety included, see also below. Of course the present is a selection made to just simplify the exposition of some characteristics and possibilities: in practice pilots' characteristics result to be correlated to
more than one of Hofstede's dimensions (see e.g. Helmreich and Merritt 1998: 97).

Before examining more directly the Individualism dimension let's examine what may be significant among GNP and its correlation.

Gross National Production/capita
As it appears to be the most strongly correlated to Civil Transport Aircraft accidents, even with respect to the Individualism dimension (see Hofstede, 2001:115), it would seem to allow thinking that a main cause of those accidents would be lack of proper economical and technical means. However the same Hofstede recognizes that the Aviation Safety area is very complex. Let's note in fact that such a result has to be compared to the above mentioned military NATO accident rates, as well as to the other above mentioned general data on accidents furnished by Lynn and Hampson. The same idea of GNP is remembered by Hofstede to be debatable (Hofstede, 2001:68).

Other noticeable correlation is that GNP, or Wealth, on the whole countries' specimen, is: positive with IDV, while Population Growth (PGR) with even IDV is negative (see Hofstede 2001:519).

A graph of the Population Growth index (PGR) versus GNP may then help furnishing interesting indications (see Fig. 1). In fact, where it could be thought that a population growth should be positively correlated to its GNP, this could be possibly verified in only specific sections of the graph, while the same graph as a whole would seem to show a different relationship. As shown by Marieke De Mooij (2001) (cited by Hofstede 2001: 507, 228a), a negative correlation of IDV with the question "Marriage needs children" may help to start understanding the meanings and potentials of the different features being considered. In fact this would lead to think that on the opposite there would be societies or groups who would find their power or anyway main value on having large numbers of solid members, and on increasing them.

The graph in Fig. 1 below is based on GNP (year 1970) and PGR (years 1960-70) data taken from Hofstede (2001:68-71), which include 50 world countries. Of them 22, on the basis of GNP, have been classified as wealthier, 28 as poorer: a division which seems to have some correspondence in the different distributions within the said graph, as well as in other Hofstede's statistical findings.

After the above clarification on GNP let's now better focalize on Hofstede's Individualism-Collectivism dimension, which has been shown above to be also of prominent interest for the Civil Transport Aviation accidents. About Collectivism it may be worth to say that it is not much frequent in Europe: Greece, Portugal and Croatia, Serbia, Slovenia are the only European Nations presenting high Collectivism values. This however doesn't mean that variations on Individualism among European more individualistic countries are not significant.

Individualism

Let's then choose from Hofstede's above mentioned book (Hofstede, 2001) the following general characteristics concerning Individualism (within parentheses those on Collectivism):

?? Productivity by considering performance (or harmony) (id: 241a,b)

?? Association according to tasks (or to pre-existing relationships) (id: 234-35)

?? Tasks prevailing (or family-like ties prevailing) in the work situation (id: 235-240)

?? Risk of inter-group conflict: low (id:248)

These first results may be significant in indicating some possible interpretation of the Individualism-Collectivism polarization. Characteristic for that purpose seem to be the evident connections between harmony, pre-existing inter-personal relationships, family-like ties and high inter-group conflict on one side and emphasis on work performance and tasks on the other side. Low inter-group conflict for the individualistic pole would complete the picture of a group structure which appears to be more oriented to inter-individual contract and work than to family-like ties and inter-group aggressive actions (e.g. as for feuds between different families). Considerations on Safety and its different features among the two poles should be based on the same above aspects. A likely hypothesis could be that in collectivistic groups or cultures Safety should have at least some characteristics nearer to Security.

?? Achievement (and morality). The above picture is further detailed by an element, even directly related to the Individualism Dimension, which more than others could be significant in evaluating e.g. the public opinion concerning aircraft accidents: it would be the polarization between achievement-based (or calculative) and moral involvement, studied by Amitai Etzioni (1975, cited by Hofstede, 2001: 212).
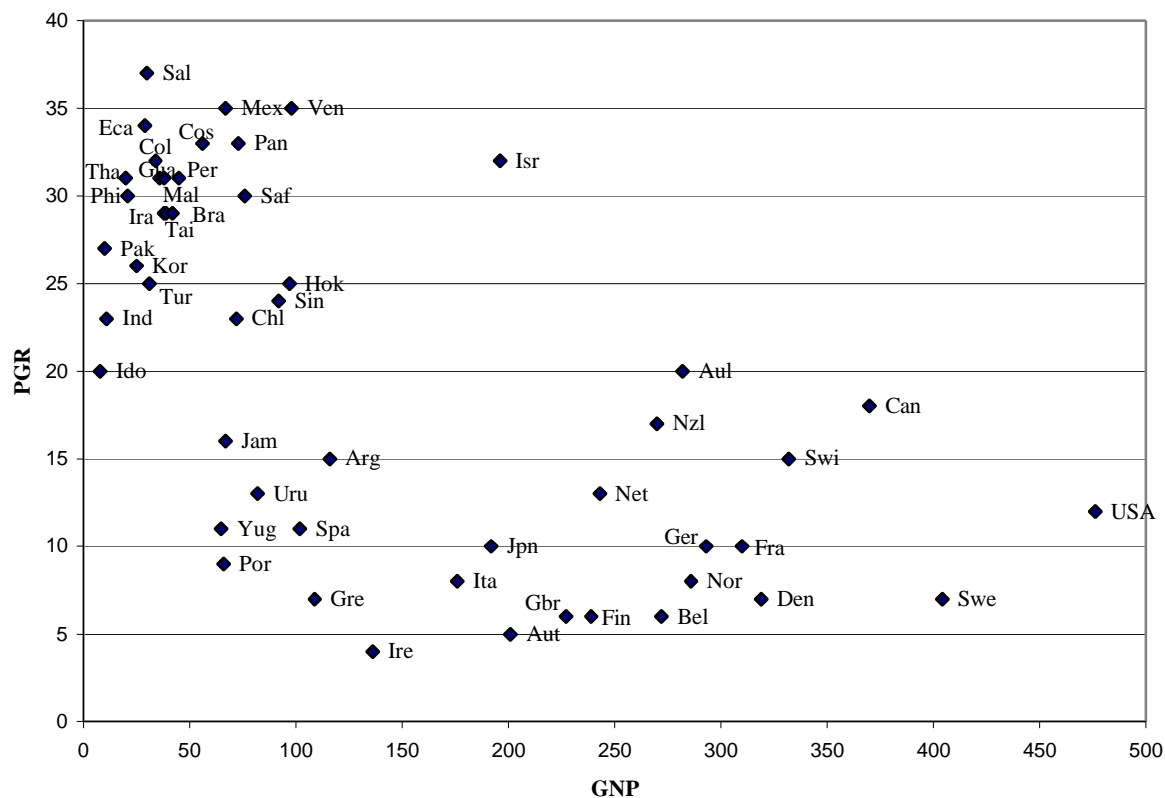
Fig. 1 - Population Growth (1960-70) versus Gross National Production/capita (1970)

Country	Code	Country	Code	Country	Code
Argentina	Arg	Hong Kong	Hok	Peru	Per
Australia	Aul	India	Ind	Philippines	Phi
Austria	Aut	Indonesia	Ido	Portugal	Por
Belgium	Bel	Iran	Ira	Salvador	Sal
Brazil	Bra	Ireland	Ire	Singapore	Sin
Canada	Can	Israel	Isr	South Africa	Saf
Chile	Chl	Italy	Ita	Spain	Spa
Colombia	Col	Jamaica	Jam	Sweden	Swe
Costarica	Cos	Japan	Jpn	Switzerland	Swi
Denmark	Den	Korea (S)	Kor	Taiwan	Tal
Ecuador	Eca	Malaysia	Mal	Thailand	Tha
Finland	Fin	Mexico	Mex	Turkey	Tur
France	Fra	Netherlands	Net	United States	Usa
Germany (West)	Ger	New Zealand	Nzl	Uruguay	Uru
Great Britain	Gbr	Norway	Nor	Venezuela	Ven
Greece	Gre	Pakistan	Pak	Yugoslavia	Yug
Guatemala	Gua	Panama	Pan		

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?? Health&Wealth. Individualistic cultures are clearly positively correlated to Health and low Traffic Deaths (id: 243a, 243b). A likely reason for a minor frequency of accidents would be a more calculative involvement in traffic (Hofstede 2001: 243). That reason would seem to be in agreement with the fact that commercial airline pilots' individualism is much higher than that of the corresponding IBM employees (Hofstede 2001: 261). And let's remember in addition the case of the Asia Pacific region, that is a region characterized by high PD and low IDV values, and which is found to be the highest in number of crew caused accident rates(Braithwaite, 2001:7, Fig. 1.2, citing Boeing, 1993). A consideration of this fact in the light of father-like figures, steepest hierarchies and familial cultures (id., :119) cannot but lead to some thought on the matters.   On the other side however let's appreciate the great avoidance of unjustified ethnocentrism by Helmreich and Merritt (1998: 103-105). At this point it seems to be opportune to note the many indications above in favor of a greater frequency of accidents in dimensions' index ranges which may be classified as high rigidity that is high PDI, High UAI, Low IDV (see also G. Sacco, 1998: Appendix 4). However no conclusion on the subject is now drawn, also for the promotional characteristics of present paper.

?? The further note, on disabled persons (id: 243a), has been included here not much because of its capability to explain a possible behavior towards those persons, but also for its capability to confirm the tendencies to assertiveness as applicable within an individualistic and high Masculinity Index (MAS) culture like that of the USA.

?? Training of individualistic people is most effective when focused at individual level (id: 238a,b). This results to be particularly true because Individualism Index is strongly negatively related to the importance of training (id: 214b). More in general, training is more effective when conducted conforming to the basic National culture of the student, and vice versa.

?? Incentives to individuals (or to groups). A note on incentives, as to be given to individuals or to groups (Hofstede, 2001: 240b, 241a), seems to find a very specific parallel in the experiments conducted by Helen Muir (see e.g. H. Muir and A. Cobbett, 1996) on aircraft emergency evacuation.

Synthetic view on Hofstede's Dimensions' distribution
A synthetic view   on the distribution of most characteristic Hofstede's Dimensions throughout the world may be useful.   For Eastern world and Central America the most characteristic dimensions are high Power Distance plus Collectivism, for Western world they are high Individualism and high Uncertainty Avoidance. This means among others that, although there may be other factors of rigidity, Europe as a whole, and especially Central and Southern Europe as a whole, is not corresponding to High Collectivism.
 For a worldwide synoptic graph see G. Sacco (1999).

- Other authors in the Business area
While Hofstede's studies are based on employees, those of Fons Trompenars, are based on managers. He is making often reference (see e.g. 1993) to the works of Talcott Parsons and Kurt Lewin.
Nancy Adler has done an extensively referenced work on multi-cultural organizations (see N. Adler, 1997).
Noticeable experiments, on multi-cultural groups of students, were made on the basis of   an article by Carol Kovach (1976) (see in N. Adler, 1997). In fact by them it was determined that the effectiveness of a multi-cultural group could be either high or low, while single-culture groups did show   mean values of effectiveness. It seems quite evident tat the effectiveness and good performance results may have some correspondence with the above mentioned High Individualism aspects, e.g. Association according to tasks.

Cross-cultural psychology
Within the area of Cross-cultural psychology let's cite Kurt Lewin, a German psychologist who did emigrate to the USA. He did make important descriptions on German and US mindsets, like Diffuse and Specific mentality respectively (Lewin, 1936, cited in Trompenaars, 1993).   The work of this

author (more specifically Lewin, 1952) did characteristically inspire both Western and Japanese research programs on leadership, but with different orientations (Hofstede, 2001:241). Anyway Helmreich's capability to deal with both theory development and application to groups in natural settings is largely inspired to his example (Helmreich and Merritt, 1998:2-3, 231).

Among other works within the same area it is worth to nominate the Handbook of Cross Cultural Psychology, a collection of works in three volumes (1996) edited by John Berry and other world experts on the matters.

Aviation Safety Professional Men
Let's list here some experts, acting mainly at the personal or professional level.

The case of the experiments conducted by H. Muir on evacuation by using different motivational protocols, based on incentives to individuals or to groups, is renown, and has been already mentioned above.

Graham Braithwaite is especially illustrating the case of Australia as an example of low or zero accident rate civil transport aviation (Braithwaite, 2001).

A noticeable novelty is represented by Dirk Helbing's work (Helbing et al., 2000, see also Low D., 2000). By defining a variable index of follow-up between different people (herding effect, Collectivism) in an evacuation from a building, he was able to define a formula for that evacuation. Depending then on different values of that index it is possible to obtain the calculated dynamic evacuation behavior of crowds with different values of individualism. He did focus mainly on the increase of evacuation performance with increasing collectivism until a certain value (about 0.4 on a total scale of 1) after which the crowd performance would sharply collapse. The noticeable fact is also that some crowd behaviors after that collapse, like the crowd accumulation near a not functioning door (especially in smoke conditions), resembles very much some notes on passenger dependency given by Mary and Elwyn Edwards (1990:210, 213). An important difference between buildings and aircraft is that in aircraft evacuations guidance by flight attendants is normally available. And dependent people (or, simplifying as said above: collectivist people) are supposed to be sensitive to that guidance.

Ron Westrum's original work (1995) is not far from the range of Crew Resource Management. Beyond the case of Pathological organization and communication style, where all is subordinated to highly conflicted organizations, subjected even to personal power, he considers Bureaucratic, rigid organizations, and finally Generative, "organically managed" organizations. It would be not difficult to arrive from that description to some parallel to Hofstede's dimensions and their characteristics.

Jean Paries (1995) has drawn a meaningful picture of two different if not opposite safety paradigms: the first inspired e.g. to nominal aspects of the system, discipline, automation, error avoidance, the second to dynamic stability of the system, auto-control, avoidance of automation-created problems, error and risk management respectively. It is not difficult to compare this alternative to the above Westrum's one, even on the basis of CRM philosophy.

Together with the professional men is to be listed also Ashleigh Merritt (see also below). After a period of intensive cooperation with Helmreich she is now active part, with Jean Paries, of the International Company Dedale**.**

Neal Latman is conducting for the TCCA a work on Personality Profiles, a subject which is connected to works like the Cattell's 16 Personality Factor Questionnaire (16PF) and the Jackson Personality Inventory-Revised (JPI-R). The aim is similar to that of the above mentioned work of H. Muir on emergency evacuation. The report is being presented during this Conference.

Brent Hayward (1997) has done a noticeable review on the connection between Safety ad Culture.

Robert Helmreich. The idea of Crew Resource Management as now conducted by Robert Helmreich and his staff is today extending throughout the world, not only to Cabin Crew, but also and mostly to Maintenance operations. In addition it is extending also outside the Aviation Safety area, to medical teams, which would be quite coherent with the above mentioned correspondence of Health and Safety. Although undergoing a worldwide expansion, CRM is declaredly a product of an individualistic society like the USA. This is evident e.g. from the quite assertive role which is being attributed in it e.g. to the Flight Attendants in their relationship with the Flight Crew. In fact in collectivistic cultures a greater distinction between in-group and out-group should theoretically happen, however in practice a similar more acceptable possibility is a paternalistically benign encouragement towards the subordinates (Helmreich and Merritt, 1998:102). In other cases however even speaking about an assertive behavior of an Oriental First Officer with respect to his Captain during a CRM course was found not acceptable (Helmreich and Merritt, 1998: 186-87).
From the lots of works performed by Helmreich and his staff lots of information and studies involving Hofstede's Dimensions may be obtained.
Let's give e.g. a hint to Automation and other construction characteristics. Automation is positively correlated to high PDI and UAI, and to low IDV. This confirms that, as hinted above speaking about Jean Paries, automation may be seen in different ways with respect to safety.
Engineers, and aircraft, result to be located at a higher level than pilots in France, while in the USA, as for flight attendants, the situation for pilots is better. (Helmreich and Merritt, 1998:86-92, 97).
Robert Helmreich's group is now developing the Human Factors Research Project, currently funded by the NASA and by the National Space Biomedical Research Institute (NSBRI). It includes the study of the effects of culture on crew performance.

Main activities in the Administration area

Let's now examine the activities of the Airworthiness Authorities and other Public Bodies on the matters.

FAA
Current FAA National Plan for Civil Aviation Human Factors includes many aspects involving cultural influences. These are concerning training, human performance, error, organizations and standardizations.

NTSB
In their activities of the recent past years NTSB is revealing to be sensitive to cultural aspects. The first Corporate Culture and Transportation Safety Symposium held in April 1997 was sponsored by the NTSB.

NASA
NASA are financing the Human Factors Research Project conducted by R. Helmreich at the Austin – Texas University, see also above.

ICAO
Another noticeable source and place of activities is ICAO. In fact for its own nature ICAO is dealing with the most different Nations and cultures. Besides its characteristic tendency to edit documents which are deemed to be suitable to any culture, the ICAO, and especially within its Flight Safety and Human Factors Programme led by Capt. Daniel Maurino, is organizing conferences and publications on cultural issues. But especially Daniel Maurino is an active writer on the matters. In addition to the

above cited book concerning an extension from pilot error human factors to organizational aspects (Maurino et al., 1995) let's cite e.g. a his paper on the difficulties encountered by the CRM during its expansion (Maurino, 1996), and his foreword to Helmreich's and Merritt's book (1998), including important notes on cultural colonialism.

FAA-JAA Harmonization Conferences
A main Authorities' activity   which may be classified as concerning multi-cultural aspects is corresponding to the yearly Conferences between the main Authorities' bodies, mainly FAA, JAA and TCCA.   Very important considerations are being done during those Conferences, e.g. on the gap with Safety results by third countries. However the happenings of these Conferences are here deemed to exceed the limits of present paper.

JAA Research Committee
As for the JAA Research Committee,   a preliminary research has been conducted by the ICON Consulting Company (see Rose M. et al., 2001) on multi-cultural cockpits. That work, still making reference to Hofstede's philosophy,   has pointed out interesting negative aspects connected to multi-cultural alternatives similar to the above. An example may be that of communication problems: where the flying task is highly proceduralised communications between subjects of different nationalities have little value in unexpected situations.   It must be said however, even if with due prudence, that there are   also hints to positive aspects concerning multi-cultural cockpits (see e.g . a S. Ratwatte's citation in Helmreich and Merritt, 1998:210:11).

CSRTG activities
Concerning CSRTG and OS PAG activities, let's first remember   the herein cited activities by H. Muir for the CAA, and of N. Latman for the TCCA. A mention to some activity by the Author seems to be also suitable. In addition to some herein cited works, whenever possible a personal research activity on the matters is also being done. Its characteristics are both qualitative and quantitative, characteristics which, together with the already mentioned consideration of both theory and practical realization, are found in common with those mentioned by Helmreich and Merritt (1998:231).
One of the main products of CSRTG activities is now present Conference, which, considering the inherent difficulties, see herein on different possible features of Safety and Safety Culture, appears to be a highly appreciable result, especially considering the noticeable possibilities of its further future development.

Transport Canada Civil Aviation
Transport Canada Civil Aviation (TCCA) is financing a research on Personality Profiles for the concern of cabin occupants during an emergency evacuation. See above about N. Latman.

Let's hint by the occasion to a possible comparison between Hofstede's and Cattell's methodologies. Although Cattell did analyze also country-level variables in other his works, Hofstede (2001) doesn't try to make comparisons with them. In fact Hofstede, who did use also theoretical notions to define some of its Dimensions, finds e.g. Cattell's factors difficult to interpret, mainly due to unsystematic selection of variables of great diversity (Hofstede 2001:32).
In few words,   Hofstede's comparisons are mainly between cultures, those of Cattell would address more specifically personalities, and would then seem to be more acceptable to individualistic cultures.

Recommendations
As a possible development of the initial main aim of this paper a main recommendation emerges: flexibility in applications.
Let's cite, for that purpose, Nancy Adler (1997: 136), where maximum flexibility in designing and marketing products to suit demands of   different participating countries led to great advantages. Suitability to specific cultural cases is anyway strictly connected to the consideration of cultural differences. First examples may CRM and Training, as said above. More in detail, as refers A. Merritt

(1993), for cross-cultural training to be successful, it must acknowledge the presence of national culture and bend its intentions accordingly. In addition, a research priority within the above current FAA National Plan for Civil Aviation Human Factors is aimed at reaching a greater compatibility of aviation standards and practices concerning Human Factors with cultural expectations.

For that purpose Cabin Safety, as largely dealing with passengers, public, and anyway human being aspects, may play a not negligible role. A suitable management within discussion groups dealing with such aspects is of course often a need for that end.

Let's now hint to some possible developments in the technical area which may be a consequence of the above evidences.

Naturalistic Decision Making

By many sides, even by R. Helmreich and A. Merritt, but also from other areas (e.g. Decision Making, see e.g. Flin R. et al., 1997), an instance in favor of a more realistic approach is evident. Lab experiments may seem to be perfect as for methodology and quantitative results, but wherever they cannot approach the reality they have to be deemed as secondary with respect to other more suitable methodologies. Simulators are someway half way between lab experiment and reality, however an evacuation simulator employing real persons to simulate emergency evacuations may approach the reality with some heavy constraints only, due to the employment of human beings in experiments. Where however the emergency behavior by passengers, cabin attendants included, would be simulated by suitable computer programs, such an instrument could be useful to allow a suitable training of cabin attendants and their commands for real emergency evacuations. A suitable development of such programs, considering e.g. Dirk Helbing's findings, seems then to be highly desirable.

Progress in Fire Control and Emergency Evacuation

Another consideration is that progress in Aircraft Fire control is continuing, and hopefully a not distant day the needs for an emergency evacuation due to fire won't be so pressing as today.

Money investment on research concerning evacuation could then start to become questionable. For that reason a greater coordination between other sections of research on Human Factors and Cabin Safety aspects would also need to be realized.

Unruly Passengers

There are at the end subjects, like that of Unruly Passengers, which seem to grow in importance throughout the time. The aspects dealt with are also manifold, including e.g. the above mentioned Naturalistic Decision Making (see e.g. Duggan and Harris, 2001), and locating the attention in an interesting area, that is halfway between Safety and Security. Another interesting aspect may be an even more necessary inclusion of passengers within the Human Factors' domain (Angela Dahlberg, 2001). A greater consideration of such subjects would satisfactorily increase knowledge about public, passengers and their management, in a way possibly useful also for otherwise neglected sectors of the above activities.

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