

AN AIRMAN'S PERSONAL ATTITUDE: PILOTS' POINT OF VIEW

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Abstract. The purpose of this study was to examine airline pilots' own formulation of desirable non-technical skills. Qualitative and quantitative methods were used to identify the pilot community's own perception of desirable personal attitudes. Group interviews formed the basis for developing statements. A sample consisting of 174 pilots were questioned on their perception of desirable attitudes. The major finding indicated clusters of attitudes pilots perceived as desirable. The attitudes pilots called attention to were intimately linked to the concept of airmanship. Factor analysis revealed at least four factors in pilots' conception of desired personal attitudes of an airman: "knowledge", 'flying skills', 'CRM', and 'self-awareness'.

Keywords: airline, attitude, behavioural marker, factor analysis, CRM, pilots.

1. Introduction

Historically there have been several conceptions of a good pilot. The interpretation and perceptions of a good pilot have varied, and many factors have been perceived as important in order to become a skilled pilot. F. C. Dokeray and S. Isaacs reported after conducting participant observation that "[q]uiet methodological men are among the best flyers" (Dokeray, Isaacs 1921). Rippon and Manuel at 1918 on the other hand, described the successful pilot as a high spirited and happy-go-lucky sportsman. Over the years the selection process and the tests used may serve as indicators of the different interpretations and perceptions of a good pilot (Hunter, Burke 1994; Martinussen 1996). A large number of tests have been developed over the years that measure a variety of cognitive and psychomotor abilities as well as motivation and personality (for a historical overview, see (Hunter 1989).

Traditionally, the selection of ab-initio pilots has relied more on performance on ability tests than on personality and interpersonal skills (Hunter 1989; Martinussen 1996). Job analyses of both civil and military pilots have identified a large number of skills and interpersonal skills necessary to perform the job. H. M. Goeters, P. Maschke and Eißfeldt identified several cognitive abilities as relevant or highly relevant to performing the job of pilot, in addition to sensory and psychomotor skills. In the category for teamwork and social skills, stress tolerance, communication, and decision making were rated as most important by commercial pilots (Goeters *et al.* 2004). Another job analysis of military pilots identified a large number of cognitive abilities. The highest ratings were given to situational awareness, memory, achievement motivation, and reasoning (Carretta *et al.* 1996).

The evolution of CRM modernised the perceptions of needed and desirable skills of a skilled pilot (Benison 2000; Helmreich *et al.* 1999; Driskell, Adams 1992). The contemporary perception of a skilled pilot is that he or she has a reciprocal mixture of technical and non-technical skills (Martinussen 2005; Hedge *et al.* 2000; Franz *et al.* 1990). A young assistant flight manager ironically commented on the evolution in aviation: "Historically aviation has been looking for pilots with the right stuff. Nowadays airlines are looking for pilots with the right stuffing, so to speak".

Behavioural markers

The prominent focus in aviation-related research over the last decades has been on pilots' non-technical skills. In particular, pilots' ability to work within the frames of CRM has had an overwhelming impact. Several researchers (Helmreich *et al.* 1993, 1999) have suggested the concept of a skilled pilot needs to include non-technical skills. Increased emphasis on non-technical skills demanded a radical shift in the perception of a skilled pilot, in the aviation industry as well as in the research communities. In other words, the perceptual change demanded a cultural change (Helmreich *et al.* 1993). The ability to perform together with others has been depicted as a certain skill: to communicate, cooperate and interact with others. Skills and abilities in these areas have been formulated and studied as pilots' "attitudes". The term attitude dates back to the writings of Jung (1921) and can be found in contemporary use of the term as a behavioural marker in the cockpit (Flin, Martin 2001; Salas *et al.* 1999). In modern psychology, attitude has been referred to as an individual's personal strategies or enduring patterns of evaluative responses for dealing with the world and the realities of life: towards a person or persons, objects, or issues (Oxford... 2005). Researchers and also practitioners have searched for behavioural markers that may serve as indicators of pilots' non-technical or CRM related skills in the cockpit environment. R. Flin and L. Martin claimed the term behavioural markers refers to a prescribed set of behaviours indicative of some aspect of performance (Flin, Martin 2001). Typical behaviours are listed in relation to component skills and are now used for selection and competence assessment. Behavioural markers were defined as observable, non-technical behaviours that contribute to superior performance within a working environment and can be observed within teams or from individuals. The behavioural markers were organised within different systems. M. J. W. Thomas described the LLC and the NOTECHS-system as the two most important behavioural marker systems for evaluating air crew performance (Thomas 2001). The Line/Line-oriented-Simulation checklist (LLC) was developed by the Human Factors Research

Project at the University of Texas, while the NOTECHS system was created as a result of the requirements in Europe (European Joint Aviation Requirements – JAR). In these systems, behavioural markers were embedded within categories of attitudes. Some of these attitudes were labelled as interpersonal or "social skills" categories and some were labelled "cognitive skills".

The behavioural marker systems were based on the assumption that certain attitudes lead to certain behaviours in the cockpit. This assumption has proven to be a complicated matter. P. Simpson and M. Wiggins (Simpson, Wiggins 1999) recognised the existence of several theoretical and empirical studies with different perceptions about the relationship between attitudes and behaviour in general, and specifically about the matter of behavioural change (Ostrom *et al.* 1994; Kraiger *et al.* 1993; Wilson *et al.* 1989). Furthermore, cultural aspects (national, professional, and organisational) influencing attitude and behaviour have been brought into prominence by R. L. Helmreich (Helmreich 1999). Nevertheless, M. Thomas justified the use of behavioural markers because they gave access to what would otherwise be hidden cognitive processes T. Thomas (Thomas 2001, 2004). Implementing behavioural marker systems had an important objective. Namely, to identify and assess a pilot's attitudes and behaviours in the cockpit considered of importance to the aircrew's performance. Behavioural marker systems gave instructors an opportunity to influence pilot behaviour that enabled CRM and thereby increased safety.

Pilot resistance to CRM and behavioural marker systems

The resistance of pilots to accept behavioural marker systems has represented a substantial challenge in implementing CRM and greater emphasis on non-technical skills among pilots, historically and currently. Accordingly, efforts to document the effects of CRM and behavioural marker systems have not been substantially successful. The Cockpit Management Attitudes Questionnaire (CMAQ), developed by R. Helmreich, and J. A. Wilhelm to measure changes in a pilot's attitude towards increased safety awareness has been discussed and disputed (Helmreich, Wilhelm 1990; Simpson, Wiggins 1999). A study conducted by E. Salas and co-workers (Salas *et al.* 1999) revealed little empirical evidence of the effects that supported strategies such as human factors in general and CRM and behavioural marker systems in particular and their efficacy in training critical aviation crew competencies. Studies by H. S. Jing, P. J. Lu, K. Yong, H. C. Wang and R. R. Seva, A. M. J. A. Gutierrez, H. Duh, Been-Lirn and J. Chong stated that the length of CRM training and its latency did not prove to be significant determinants of CRM-related attitudes (Jing *et al.*

2002; Seva *et al.* 2007). The effectiveness of behavioural marker systems in training and the efforts to assess non-technical CRM skills have varied in congruence with pilots' acceptance and perception of the adequacy of CRM concepts and the various behavioural marker systems (Simpson, Wiggins 1999; Flin, Martin 2001; Helmreich *et al.* 2001; Beubien, Baker 2002; Seva *et al.* 2007).

Personal attitude and CRM behaviour: Pilot's point of view

There seems to be optimism regarding the implementation of behavioural marker systems as an assessment instrument to directly or indirectly increase pilots' competence in communication, cooperation and interaction. Nevertheless, there are still substantial challenges that need to be addressed in order to succeed in this effort. The evolution of and the effort to implement CRM and behavioural marker systems became the very starting point for this study. The findings reported in the study of J. M. Beubien and D. P. Baker indicated that a considerable proportion of pilots either directly disagreed or had a passive response to questions about the positive aspects of CRM and about the various efforts to implement CRM-related training (Beubien, Baker 2002). The percentage (ranging from 25–38%) of pilots expressing disagreement or responding passively (neither agreeing nor disagreeing) indicated another perception of the relationship between attitude and performance than that formulated by the CRM concepts and the behavioural marker systems.

The main purpose of this study was to develop an instrument for assessing pilots' attitudes towards flying skills and proficiency. An important aim was that the measurement instrument had to be considered useful and adequate by the pilots themselves. A fundamental starting point was therefore that the instrument ought to contain pilot communities and pilot cultures, conceptions and formulations of desirable attitudes. The following research question was developed: can complementary conceptions on the reciprocal mixture of technical and non-technical skills of a proficient and competent pilot be identified among commercial pilots flying in civilian airlines?

2. Method

A two-step research project was designed. The first step was to perform a set of interviews of pilots in order to collect different formulations and variations in the perception of a skilled pilot. The aim was to bring pilots' own understanding of a good pilot into prominence. The intention was to get an insider or a skilled understanding of what pilots themselves think of as important factors influencing the attitudes, behaviour and performance of pilots and aircrews. The second step was, based on these

interviews, to develop a scale that could be used to measure these attitudes.

Study I

Participants

A total of 250 pilots that participated in a company-held CRM course in two different Scandinavian commercial airlines were interviewed in groups in 1997–2007. In addition, 30 individual interviews were performed. Participating in group interviews or individual interviews was voluntary. All pilots interviewed held a current pilot licence (JAR-FCL, ATPL). All the pilots were professionals in the sense that they were employed pilots. The range of experience was from 650 to 27500 flight hours.

Measurement and procedure

The pilots were asked about their perception of the increased emphasis on CRM and on pilots' interpersonal and social skills and its influence and impact on aircrew performance. During the interviews the pilots were asked to pinpoint factors and in their own terms formulate what they regarded as important requisites and prerequisites for a skilled pilot. A total of 15 group interviews were performed. All pilots had previous experience attending CRM courses. For practical reasons, group interviews were performed before, during or after an annual mandatory company-held CRM or technical refreshment course. The first author in this study was the CRM instructor for some of the groups that participated in this study. The number of participants in these group interviews ranged from nine to fifteen. In each of these groups, participants were asked to sit in even smaller groups to discuss and define a good pilot. All groups used the term "airmanship" and "the attitudes of a good airman" to describe a good pilot. The groups were asked to define the concept of airmanship and attitude, write down the definition of attitude, and formulate statements defining a good airman with a good attitude. After working in small groups, all the participants in the CRM course met in a plenary session and discussed what the different groups had come up with. Together and in collaboration with the instructor, their statements were transformed into questions that could be used in a questionnaire.

Results study 1

The qualitative study revealed that the pilot community seemed not to have an explicit or an articulated definition of a good pilot other than a good pilot had to have the marks of a good airman. There were no single standards defining whether a pilot was a good pilot or not, nor was there a single definition of what constituted a good pilot's ability or qualities (skills) in flying. Skills constituting a good pilot in one flight operation were not

necessarily skills defining a good pilot in another flight operation. Standards defining whether a pilot was a good pilot were closely related to the flight operation itself, and these standards were specific for each operation. A pilot that is characterised as a good pilot in a military flight operation is not necessarily defined as a good pilot in a civil flight operation. Several pilots claimed: "In certain military flight operations, a good pilot has very different skills and abilities from commercial pilots. Being a good pilot in military flight operations is something very different from being a good commercial pilot" (interview, no 4, 2005). Nevertheless, when pilots referred to good or skilled pilots, they referred to pilots that had a certain "personal attitude". The personal attitudes were pointed out as marks or characteristics of a good airman. A good pilot performed like an airman was supposed to. He or she had the attitude of an airman: "A good pilot has the competence to perform well. An airman acts and performs at all times according to his level of knowledge" (interview, no 4, 2005). When pilots spoke of an airman's personal attitude, they distinguished between the individual's attitudes towards others and the individual's attitude towards oneself. The term "airman's personal attitude" served as an abstraction of several features demanded in order for pilots to be accepted as members of the pilot community. Use of the term was in itself an indicator of this ability. How to act and how to socialise, how to interact with respect for other people's boundaries personally and professionally, and how and when to say what and understanding the unwritten codes for conduct were important features in this knowledge: "Attitude is a way of being aware of and performing according to the conditions in aviation. And you must have a well-considered understanding of what you have going on in your life" (interview, no 13, 2005).

The qualitative approach revealed a common perception among pilots that an integral part of being a good pilot was being a good crewmember. And being a good crewmember was an integral part of being a good pilot. Being a competent crewmember was regarded as a type of knowledge: "Being good at working closely with other people is important knowledge in aviation. On a day-to-day basis, on every leg, you have to feel your way to when and how you deal with the other guy" a pilot claimed (interview no 12, 2005). Cooperation and interaction was perceived as an essential aspect of the desirable qualities of a skilled pilot. "Being a good crewmember is certainly not something that you can read your way to. You have to experience it. Being a good crewmember is a part of being a human. It's a social thing" (interview no 12, 2005). Being good at cooperation and interaction with others demands interpersonal skills: "A good pilot is perceived as a good communicator. He is attentive towards others. People surrounding this pilot feel welcomed and

respected. A good pilot allows people around him to be themselves. But he is also good at letting people know his boundaries, both personally and operationally. And he lets people know when and why these bottom lines are set. Other crewmembers rely on him because he is predictable. Other crewmembers always know how and when to act" (interview no 7, 2005).

Analysis of the qualitative data revealed humbleness to be the overwhelming perceived precondition for a desirable personal attitude. "A good pilot is humble enough to acquaint himself with his own errors and limitations regarding his own trade and with those of the other crewmembers. And he is also humble enough to help others when they face problems, professionally and personally" (interview no 7, 2005). But at the same time, self-awareness, self-efficacy, and self-esteem was brought into prominence: "A good pilot is so sure of himself that he has no problems asking others for help. A good pilot has self-awareness. A good pilot is someone that is aware of himself and his flaws and errors. That way he can easily interact with others" (interview no 7, 2005).

In all of the group interviews, pilots emphasised that the extent to which an individual pilot had adopted the general attitudes of an airman as his or her own personal attitudes would influence his career: "In order to become a good pilot you must have or you have to have the ability to learn the attitude of a good airman. Becoming a good pilot demands insight and thorough understanding of oneself, the aircraft, and the system. This awareness is closely related to the pilot's attitude" (interview no 4, 2005). To learn to operate an aircraft within the frames of CRM was regarded essential: "A pilot's attitude will determine whether he or she over time will experience an increase in competence and performance" (interview no 7, 2005). To learn to fly an aircraft implicated the ability to adapt to certain behavioural standards or attitudes. These behavioural standards were referred to as the attitudes of an airman or the airman's attitude. These standards had to be personal standards, and these attitudes had to be integral in rules by which to live. To learn to fly an aircraft as expected of an airman was to learn the hidden or unspoken values and rules of conduct and behaviour.

Study II

A large number of items were developed based on the statements in study I. Pilots' use of the concepts of "airmanship" and "personal attitude" indicated that there were several factors within these concepts. The following research question was formulated: When pilots referred to the term airman and airmanship, could complementary factors in the inventory of pilots' perceptions of the airman's personal attitude be identified?

Participants

The participants were pilots in two Scandinavian commercial airlines. The number of pilots working in these airlines was 290. A total of 174 pilots completed the questionnaire (51 pilots from one airline and 123 pilots from the other). The sample consisted of 86 commanders and 88 first officers. The average age of the pilots was 38.4 years (*SD* = 9.13), and the mean flight time was 5,653 hours (*SD* = 4,105) with a range from 550 hours to 20,000 hours. The study did not differentiate between male and female pilots, and due to the small number of women, it was not possible to examine gender differences in attitudes. Some of the participants in study I most likely also participated in study II since the questionnaire was sent out to all pilots in the two companies. Nevertheless, the research group had no information on the extent of the overlap between participants as no names were collected and the participation was voluntary.

Measures

The purpose of study II was to validate the concept of airmanship and personal attitude produced in the individual and group interview sessions. After all fifteen group interviews, information from all the group interviews were collected and compared. A questionnaire that contained statements on airmanship and attitude covered by all groups was then developed. The pilots were asked questions about rank (commander or co-pilot), flying hours, flying hours on certain aircraft, years in a company, and age. To measure the concept of airmanship and personal attitude, questions were developed based on the findings from Study I. The questionnaire covered topics such as principles in the airman's knowledge, humbleness, self-awareness, flying skills, and CRM. Each item in the questionnaire was rated on a 10-point Likert-type scale. The questionnaire included descriptors for the numbers 1 and 10 (1 = do not agree at all and 10 = fully agree).

Procedure

The questionnaire, along with an invitation to participate in the study, was sent to all the pilots. The pilots were also informed that participation was voluntary. A hard copy of the questionnaire was sent out to the pilots in one airline. The pilots in the other airline received the ques-

tionnaire as an attachment to an e-mail, and they had to print a copy before completing and returning it by mail.

Statistical Analyses

In order to examine the factor structure of the items on airmanship and personal attitudes, a principal component analysis was performed. A decision was made using varimax rotation (orthogonal), because this was an attempt to explore concepts that might be rather independent of each other. All the statistical analysis was conducted with SPSS (V16).

A principal component analysis (using varimax rotation) exploring nineteen items covering different possible factors was performed. These nineteen questions are reported in table 1. Several analyses were performed, removing items with a low score or items with parallel loading to more than one factor. Kaiser-Guttman rules (eigenvalue > 1.0) in combination with a scree test were used as factor selection procedures (Brown 2006). A solution with four factors consisting of fifteen items was selected. This solution showed rather high loading on the factors, and there are conceptual relationships underpinning the loading between items and the four factors.

Bivariate correlations were computed to examine the relationship between the scales and demographic and experience variables. These correlations are reported in table 2.

3. Results

Table 1 contains descriptive statistics (means and standard deviations) and the results from the Principal Component Analysis. Four factors were extracted, explaining a total of 60.3% of the variance. Cronbach's alpha was used to estimate score reliability, and the results from the four scales showed $\alpha = .79$ for Principles in Airmanship Knowledge, $\alpha = .80$ for Self Awareness, $\alpha = .81$ for Flying Skills, and $\alpha = .64$ for CRM.

Bivariate correlations between demographic variables and the four attitude scales were computed (Table 2). All but one correlation were small and non-significant. A negative correlation between the number of years employed in the company and flying skills was observed.

Descriptive statistics about the factors (Table 2) shows that CRM and knowledge have the highest means, and this could indicate that the pilots experience these as two important factors.

Table 1. Principal component analysis results for attitude items (N = 174)

	Mean	Std	Principles in Airmanship Knowledge	Self-awareness	Flying skills	CRM
A good pilot always thinks ahead of his own actions	9.33	.87	.81			
The good pilot is aware of the limitations of the aircraft.	9.44	.90	.75			
A good pilot shows initiative to become better at what he is doing	9.45	.82	.72			
Crew members should monitor each other for signs of stress or fatigue	8.91	1.36	.64			

End of Table 1

	Mean	Std	Principles in Airmanship Knowledge	Self- awareness	Flying skills	CRM
A good pilot becomes a role model for other pilots	8.66	1.41	.64			
A good pilot takes the initiative to apply good airmanship	9.32	0.89	.76			
A good pilot knows rules and regulations	8.75	1.36	.43		.31	
A good pilot is humble enough to acquaint himself with his own errors and limitations	9.40	1.05	.40	.39		.41
The good pilot is good at helping others when they face problems professionally	8.84	1.41	.39			.47
A good pilot communicates without difficulties with all the members of the crew	8.55	1.64		.81		
A good pilot is so sure of himself, that he has no problems with asking others for help.	8.38	2.35		.77		
A good pilot can easily interact with others.	8.39	1.70		.76		
A good pilot is perceived as a good communicator.	8.20	1.70		.69		
A good pilot is someone that masters procedures.	7.27	2.06			.86	
A good pilot is someone that is good at manual flying.	6.24	2.31			.85	
A good pilot is someone that has the ability to operate "fifty miles ahead of the fan"	7.60	2.17			.75	
The way a crew cooperates and interacts will effect how safe a flight operation is executed	9.49	.78				.63
Good communication and crew coordination are as important as technical proficiency for the safety of flight	8.91	1.36				.72
It is important that all members of the crew are in the communicational loop	9.34	1.06				.76
Percent explained variance			36%	9.6%	8.9%	5.8%

Note: Loadings < .30 were omitted from the table.

Table 2. Inter correlations between flight hours, number of years in the company, age and the four attitude scales (Principles in Airmanship Knowledge, Self Awareness, Flying skills and CRM) (N = 143–174)

	Mean	SD	1	2	3	4	5	6	7	8
1. Total flight hours	5653	4105	–	.73** N = 150	.52** N = 146	.84** N = 151	.01 N = 154	–.06 N = 154	–.08 N = 154	–.11 N = 154
2. Total flight hours on type of aircraft	2432	2075	X	–	.53** N = 143	.67** N = 147	.07 N = 150	–.05 N = 150	–.07 N = 150	–.10 N = 150
3. Number of years in this company	3.83	4.02	X	X	–	.49** N = 159	–.05 N = 162	–.07 N = 162	–.25** N = 162	–.07 N = 162
4. Age	38.38	9.13	X	X	X	–	–.08 N = 166	–.15 N = 166	–.14 N = 166	–.12 N = 166
5. Knowledge	9.16	0.82	X	X	X	X	–	.40** N = 174	.38** N = 174	.48** N = 174
6. Self-awareness	8.38	1.45	X	X	X	X	X	–	.27** N = 174	.39** N = 174
7. Flying skills	7.03	1.88	X	X	X	X	X	X	–	.24** N = 174
8. CRM	9.25	0.83	X	X	X	X	X	X	X	–

Note: * p < .05, ** p < .01. (two-tailed)

Discussion

Results of several studies suggested pilots' generally accepted view was one of many crucial factors for implementing CRM and behavioural marker systems (Simpson 1999; Flin, Martin 2001; Helmreich *et al.* 2001; Beubien, Baker 2002; Seva *et al.* 2007). Historically, pilots and the pilot community have more or less been forced to accept the CRM concept and adapt to the behavioural markers and standards these systems were founded on. The research group was inspired by C. Geertz's distinction between "experience-near concepts" and "experience-distant concepts" to understand and enlighten the challenges in implementing CRM and behavioural marker systems in aviation (Geertz 1983). Could pilots' prejudice against CRM and behavioural marker systems reflect a general resistance toward the "experience-distant" concepts CRM and behavioural marker systems were founded on more than the contents of the approaches? If so, did the pilot community have "experience near" ways of understanding and formulating the relation between a pilot's personal attitude and his or her behaviour in the cockpit, with the crew, and in the company environment? The main purpose of this study was to develop an instrument for assessing pilots' attitudes. In order to do so, this study aimed to embrace the pilot's point of view and use their "experience near" conceptions in developing an assessment instrument. The purpose of this study was to identify possible common perceptions among pilots on desirable skills. A two-step research design was outlined. The design was to interview pilots (Study I) and have them formulate statements that could be used in the inventory used in the second step (Study II). The research group wanted to use pilots' own formulations and pilots' own accounts for the relationship between attitude and behaviour in order to develop an assessment instrument. This assessment instrument would therefore have a better chance of overcoming the challenge of earning the general acceptance of pilots.

Comparison of the results from Study I and Study II indicated concurrent perceptions among pilots concerning desirable non-technical skills. The results of the qualitative approach (Study I) indicated airmanship as a superior concept containing different fields or areas of competence and self-reflection. Pilots regarded, and formulated, essential aspects of non-technical skills as the personal attitude of an airman. An airman and his or her airmanship is an intricate and indistinct concept. In essence airmanship is the ability to act wisely in the performance of flight operations under all conditions—or to operate an aircraft safely and in all foreseeable situations (Redefining... 1997). Airmanship is the cornerstone of pilot competency. Airmanship is the individual pilot's combination of knowledge, skills and discipline required to perform a task well. To learn the

knowledge of flying an aircraft is intimately interwoven with learning airmanship. Airmanship is a type of awareness, a knowledge pilots must adopt in order to become and be appreciated as a pilot (Molander 1998; Wittgenstein 1971). Among the most important factors frequently pinpointed in interviews was the individual pilot's humbleness. Results from Study I indicated a pilot must have personal awareness and focus on committing himself or herself to develop areas of competence: in the area of knowledge, in the area of working with others, in the area of applying flying skills, and concerning his or her own self-reflection. Ideally, pilots continually improve in each of these aspects. Moreover, results indicated that these areas of competence were parts of a holistic understanding. The factors identified constituted and were parts of what pilots themselves pointed out as airmanship. In other words, pilots' use of the concept airmanship and reference to his or her personal attitude contained several factors. To learn the knowledge required to fly an aircraft was intimately interconnected with learning airmanship.

The quantitative approach (Study II), the factor analysis, identified at least four factors within the area of technical and non-technical skills. The factors identified were interpreted as integral to the concept of airmanship since the questions used in the questionnaires were formulated by pilots with the particular perception that airmanship was a superior concept containing several fields of expertise. The factor analysis identified four factors, which were labelled knowledge, CRM, self-awareness and flying skills.

The first factor extracted in Study II, knowledge, was distinctly pronounced in interviews (Study I). The desired attitudes pilots referred to constituted a holistic awareness that pilots need to have in regard to the activity of flying. In order to learn the knowledge required to fly an aircraft, pilots must adopt the attitudes the knowledge of flying an aircraft is founded upon (Nergård 2005; Molander 1998; Wittgenstein 1971). In Study II some of the aspects concerning the knowledge base airmanship was founded upon were identified. The commonalities of the items identified within the factor were that they were fundamental principles of the knowledge required to fly an aircraft and basic requirements of monitoring and improving one's level of knowledge. This was an outspoken principle articulated in interviews. Monitoring and improving one's and others' level of knowledge was considered a fundamental value. The need to always be aware of one's and others level of knowledge had an important practical implication: "An airman always acts according to his level of knowledge", an experienced captain claimed.

The second factor extracted was labelled self-awareness. This factor contained several elements concerning

individual traits, including self-efficacy, self-esteem, communication and interaction. This factor had strong coherence with the qualitative results indicating the ability to achieve good communication, cooperation and interaction with other crewmembers as crucial proficiencies. Being a good pilot demands that an individual must have self-awareness, insight, and a thorough understanding of himself or herself, psychologically and socially. In interviews, pilots claimed that self-awareness and thereby self-reflection were important aspects of learning airmanship. In interviews, it was pointed out that self-awareness had a special dimension in aviation. The consequence of pilot error can be fatal, not only for the passengers but maybe first and foremost for pilots themselves: "Pilots die as a consequence of their own mistakes. And we are blamed for our mistakes. In contrast to other professionals, we do not necessarily survive to explain and defend ourselves", an experienced pilot stated. Responsibility for other people's lives is an important thing pilots need to consider. Consideration of and reflection on these matters is an integral part of the socialisation process young pilots go through to become an airman. In this respect, adaptation to airmanship and the implicit self-awareness might be a key element in understanding behaviour and behavioural change.

The third factor, labelled flying skills, was also pronounced in all the interviews. Flying skills were pinpointed as a cornerstone in pilot competency. In interviews, flying skills were described as multi-faceted knowledge, not solely a technical skill. Flying skills were pinpointed as containing two different principles. In interviews (Study I), pilots named these two principles "flying by the seat of one's pants" and "flying by the book". The skill of flying by the "seat of one's pants" is the ability to master an aircraft by relying on flying techniques and instinct. "When I strap on my seat belts, it's like I strap on the aircraft. I "put on" the aircraft. The aircraft and I are one. When I fly, I feel the aircraft. The aircraft and I communicate. We are one. I communicate with the aircraft. I need to feel that I am synchronised with the aircraft. That way I can make it perform like I want it to do". This is a feeling you cannot learn from theoretical studying. You can only learn to fly by flying (interview no 4, 2005). The pioneers of flying flew only by their seat of the pants. The reason was obvious. There were no other ways to fly. The first pilots had only their instincts to depend upon when they flew. In modern flight operations, mastering the aircraft manually by applying flying techniques and instincts are still considered a highly relevant competence. In addition, the modern skilled pilot was said to have equal skills at performing a flight operation "by the book". To fly "by the book" was defined as performing a flight operation like it is described and defined. "The book" was often used as a collective term

for standard operating procedures (SOP), the operations manual (OM), or the pilot operation handbook (POH). The discipline to fly "by the book" was pointed out as "obvious": "By following the book, pilots are less prone to make the same deadly or lethal mistakes others have made before them. Most procedures, rules and regulations, check lists, etc. are written in blood. They are developed and accumulated experiences of incidents and accidents", a senior captain claimed. To fly "by the seat of one's pants" or to fly "by the book" was not only used as a distinction between traditional and modern knowledge. It was also used as a distinction between two different ways of flying. The principles were not considered to be mutual exclusive, however. The essence of flying skills was pinpointed as a competence: Being a good pilot is not only related to flying by the book. It is also an instinct of knowing when to stop following the book and begin follow one's instincts. The bare essential of flying skills was formulated in interviews (study I) as mastering the principles of flying skills that allow the pilot to be in front of the aircraft. A pilot formulated the principle: "My first flight instructor taught me to always try to stay ten miles ahead of my propeller in my mind". In study II, the aspects of flying skills were observed in three items: "a good pilot is someone who masters procedures", "a good pilot is someone who is good at manual flying", and "a good pilot is someone who has the ability to operate 50 miles ahead of the propeller".

The fourth factor observed was labelled CRM. Crew cooperation, social interactive communication, and its effects on performance formed the fourth factor. CRM has been defined as the effective utilisation of all available resources to achieve safe and efficient flight (Helmreich 1999). A modern flight is based on communication, cooperation and interaction within a flight crew. Crew behaviour is therefore considered one of the most important factors determining the level of safety and efficiency in which the flight was performed (Helmreich 1999). Although various versions of CRM courses have been held depending on the evolution of the concept itself since the late 1960s (Helmreich 1999), the principles these courses have been based on are relatively constant: Increase safety by creating awareness and stressing the individual, social and cultural factors that directly or indirectly have led to incidents or accidents (Helmreich 1999). Study II revealed that many of the principles taught in the various versions of CRM courses have become part of the modern concept of airmanship. Nevertheless, Study II supported the major finding in a study conducted by G. W. Ho and P.C. Tang, which indicated that crew members perceive interpersonal skills to be the crucial quality of proficient pilots, in particular captains, and more important than flying skills or information management (Ho, Tang 1998).

The main purpose of this study was to develop an instrument for measuring pilots' attitudes. An important aim was that the measurement instrument would be considered useful and adequate by the pilots themselves. The results indicated that the aim was to some extent accomplished. Results from Study I and Study II indicated the existence of common perceptions among pilots about desirable non-technical skills. This indicated that the two-step research design approach where the pilots themselves formulated the questions, in a tone and a way of familiar to them, proved effective. Nevertheless, using the pilots' formulation also represented a methodological weakness because most of the items were positively formulated. Another weakness in the research design was the percentage of pilots replying to the questionnaire. Of the potential 290, only 174 pilots replied. The percentage of respondents was 60%. The research group reflected on this matter. The relatively low percentage of replies could be an indication that this study shares the fate of many other studies and did not succeed in engaging the pilots sufficiently. The research group was aware of the obvious weaknesses the two-step research design possessed. It is important to emphasise that the research design was not intended to meet the demands of methodical triangulation (Massey 1999). The intention was first and foremost to bring the pilots' point of view on desirable skills into prominence.

The study had its starting point in the historical and contemporary interpretations and perceptions of a good pilot. Pilots' reluctance to adopt the conceptions CRM and behavioural marker systems were founded on was perceived as the most important challenge in implementing them. The study has succeeded in identifying features of pilots' own understanding and perception of non-technical skills. Overall, the findings in this study revealed that pilots own perceptions of desirable skills for a skilled pilot were to a considerable extent similar to the perceptions CRM concepts and the behavioural marker systems were founded upon. The prime difference between the perceptions of pilots, researchers, and training professional results in different formulations. The perceptions of what it takes to be or become a skilled pilot were similar. The prime difference was the way these perceptions were formulated. Pilots formulated their understanding from their point of view, with concepts near their own experience, in their day-to-day practice of flying an aircraft. Researchers and training professionals, the creators of CRM and behavioural marker systems, also formulated their perceptions of a skilled pilot in terms that are near to them. The problem seems to be that these perceptions, and thereby the formulations, have been perceived as (experienced as) distant by pilots. The challenges in implementing CRM and behav-

oural marker systems are in this perspective manageable: An important success factor in achieving a higher level of implementation of CRM and behavioural marker systems is that training must be closely related to pilots' practice (Summers 2007). P. Simpson and M. Wiggins pointed out that human factor training was itself of importance for pilot's acceptance of CRM and behavioural marker systems (Simpson, Wiggins 1999). J. M. Beubien and D. P. Baker claimed that attempts to evaluate CRM performance had frequently met with resistance from line pilots who did not believe that CRM skills could be assessed with the same degree of precision as "stick and rudder skills" (Beubien, Baker 2002). P. Simpson and M. Wiggins concluded that pilots must have the possibility to personally experience and the opportunity to develop appropriate behavioural strategies that mitigated involvement in human error-related aircraft incidents or accidents (Simpson, Wiggins 1999). Efforts have been made to integrate or contextualise CRM-related training in every practice. J. M. Beubien and D. P. Baker surveyed over 30,000 airline pilots and concluded that training programmes that integrated CRM principles throughout the entire training curriculum were perceived more favourably than stand-alone CRM training courses (Beubien, Baker 2002).

4. Conclusions

Pilots' conceptions of airmanship hold maybe the most important solution to the challenge of developing new or improving existing instruments assessing cockpit behaviour. The challenge to implement CRM and behavioural marker systems is in this sense to assess behaviour in a manner that takes the point of view of both parties. The measurement instrument in this study is a good starting point. The factors identified in this study must be further elaborated to make them applicable in measuring and assessing attitude and cockpit behaviour. Future research must therefore further address the relationship between attitude and cockpit behaviour. A starting point could be the factors measured in this study and how they influence pilots' cockpit behaviour, communication, cooperation and interaction. In future research, the point of view of pilots holds maybe the most important clue to fully understanding the relation between attitude and behaviour, and in particular the matter of behavioural change: The perception of the existence of a relation between a pilot's personal attitude, his or her cockpit behaviour and performance in flying an aircraft.

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PILOTŲ POŽIŪRIS Į ASMENINES PILOTO SAVYBES

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Santrauka. Šio tyrimo tikslas buvo išanalizuoti oro linijų pilotų suformuluotus reikalingus netechninius gebėjimus. Kiekybiniai ir kokybiniai metodai buvo naudojami tam, kad būtų atskleisti pačių pilotų labiausiai vertinami gebėjimai. Teigiamiems gebėjimams nustatyti buvo apklausti 174 pilotai. Nustačius tam tikras gebėjimų sritis paaiškėjo, kad geriausiai pilotai vertino tuos gebėjimus, kurie yra susiję su skraidymu. Buvo atskleisti keturi labiausiai pilotų vertinami faktoriai: žinios, skraidymo įgūdžiai, CRM ir savikontrolė.

Reikšminiai žodžiai: oro linijos, požiūris, elgesio rodiklis, faktorių analizė, CRM, pilotai.