Flight Training and Pilot Employment

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"Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terribly unforgiving of any carelessness, incapacity or neglect."

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Executive Summary

This paper is about professional flight training and how it acts as a supplier for the airline pilot workforce. The connection between flight training and airline requirements is vague and we might talk about a missing link. Via an analysis of requirements, standards and the training offered, a solution is put forward how to bridge this gap. The specific situation in the Netherlands is examined but the outcome is probably valid for many other countries as well. Chapter 1 is about aviators and the reasons they make mistakes. The modern cockpit is full of tools to ensure a safe flight. However there is still something missing when examining aircraft accident reports. This missing link can be trained and the most effective and efficient way to do this is to start at the initial training phase. Flight schools, airlines and authorities have to work together to accomplish this. Improvements must not only focus on flight technical skills but also on the development of total airmanship. The degree of effectiveness and the level of efficiency is how a training program must be adjudicated. Chapter 2 outlines the operation of the training industry in the Netherlands and the questionable suitability of this country for advanced flight training. The positive as well as the negative aspects of alternatives are discussed. The implementation of the JAA JAR-FCL transformed the already volatile flight training business, not only in Europe but in the USA as well. Chapter 3 examines the employment opportunities and looks at future pilot demands. Chapter 4 makes a case about the questionable exposure of low-time pilots to the demanding airline environment. Developing structured training programs, like an enhanced simulator course, can address this dilemma without compromising aviation safety. This chapter also looks at the importance of operational monitoring and how to apply it during line training. The final chapter sums up a number of conclusions and recommendations that could be applicable for students, schools and employers.

List of Abbreviations

A	Aeroplane
ADM	Aeronautical Decision Making
ALA	Approach and Landing Accident
AMC	Acceptable Means of Compliance
APQ	Airline Pilot Qualification
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
ATPL	Airline Transport Pilot Licence
BASIS	British Airways Safety Information System
CFIT	Controlled Flight Into Terrain
CPL	Commercial Pilot Licence
CRM	Crew Resource Management
CTA	Cognitive Task Analysis
EAAPS	European Association of Airline Pilot Schools
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FCL	Flight Crew Licensing
FO	First Officer
FOQA	Flight Operations Quality Assurance
FSC	Full Service Carrier
FTD	Flight Training Device
FTO	Flight Training Organization
GA	General Aviation
IEM	Interpretative Explanatory Material
IFR	Instrument Flight Rules
IR	Instrument Rating
JAA	Joint Aviation Authorities
JAR	Joint Aviation Requirements
JARTEL	Joint Aviation Requirements Translation Elaboration Legislation
JOC	Jet Orientation Course
LCC	Low Cost Carrier
LOFT	Line Oriented Flight Training
LOS	Line Operational Simulation
MCC	Multi-Crew Cooperation
MEL	Minimum Equipment List
NASA	National Aeronautics and Space Administration

NOTECH	Non-Technical
NTSB	National Transportation Safety Board
PF	Pilot Flying
PIC	Pilot in Command
PNF	Pilot Non-Flying
PPL	Private Pilot Licence
SO	Second Officer
UAA	University Aviation Association

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Introduction

The road to become a professional aviator is not as clear compared to the rather straightforward manner someone can apply to become a doctor, lawyer or engineer for instance. There are numerous Universities and Institutes for Higher Education to offer studies to become such a professional. In the Netherlands alone there are 9 law schools offering more than 27.000 positions to become a lawyer (September 2001). Each tightly controlled through government regulations and professional standards. No significant contribution is required from the student to pay for the tuition.

For future aviators things are rather different. There are a wide variety of schools, each with another philosophy, background and objectives. Each of them claims to offer good and cost efficient flight training, but there is no active supervision. With a limited number of training positions, estimated at around 200 positions per year, this field is rather unique compared to the more traditional studies. Cost is a major factor in flight training; almost all of it will have to be paid by the student or the parents through bank loans or extended mortgages. To keep professional flight training affordable and in reach for all who qualifies, the industry must change and the parties involved must cooperate with each other. The objective of this research project is to examine methods to make flight training more effective and more cost efficient and assure that qualified people will be able to become professional pilots based on their skills and not on their financial situation.

The method of research was based on analysing the current options for flight training in the Netherlands. Flight training data was then evaluated against airline requirements and industry standards, to determine a strategy for effective and efficient flight training. Relevant data was collected via interviews, related literature and personal experience. All Flight Training Organizations (FTO's) in the Netherlands offering commercial training have been visited and a number of experts on the subject have been interviewed. All the findings were then evaluated to determine where and how it would fit into the case.

Aviation safety will without doubt improve when the cockpit workforce consists of effectively trained, properly selected professionals. This can only be accomplished when all involved; the training organisations, authorities and airlines work together. How this can be done and why it is imperative to actively work on aviation safety improvement is laid down in this paper.

NOTE: Only the training possibilities and employment opportunities for civilian pilots will be discussed in this paper.

NOTE: The use of the male gender implies the female gender and vice versa.

Chapter 1
Aviators

Coachmen

For almost every form of transportation, from a horse-and-carriage to a wide-body jet, there is always a need for people to guide, control and operate the available means of transport. The goal is to transport persons and commodities from point A to point B in a timely manner without any injury to persons or damage to property. In order to achieve this goal we must select the right people, train them to predetermined standards and create an environment for safe operation.

The high standards in aviation and the extravagant cost of training, demand well developed and reliable selection procedures. Pilot selection methods need to be designed based on job analysis, and are subject to change due to the ever-changing requirements in aviation. The employers and the flight schools must determine together what is required from the cockpit workforce. A variety of methods are available for identifying the aptitudes required for a job and should be used to define the specific requirements.

Exchange of information between the airlines and the flight training industry is a crucial element in developing successful and professional training programs for student pilots. Professional flight schools must identify and satisfy their customer's needs, who could be the student or in case of a sponsorship, an airline or perhaps a corporate flight department. Every student's objective is to pass his training in the least amount of time for a reasonable price and with a good prospect for an airline career, starting in the right seat of an airliner. Unbiased and reliable information about flight training is very difficult to obtain and must improve to guide young people to make the right choice. Unfortunately this is not the reality, expensive and inefficient training programs are still chosen by many enthusiastic candidates. Many programs are lacking essential elements and expertise and do not prepare the student well enough to operate in the highly disciplined airline environment. The student, or in this case the customer's needs, are not being met.

An effective selection system will reduce the cost of training, not only in financial terms but will also diminish the number of disillusioned unemployed pilots. Like the development of successful and professional training programs, is selection another important issue for cooperation between schools and airlines.

One of the fundamentals of running an airline is being safe[1]. Improvements in aviation safety will start off by getting all participants involved, the schools, the airlines and the authorities. According to Captain Dan Maurino of ICAO, the proactive development of training and human resource is a tool to improve safety and efficiency of the aviation system[2]. He also states that:

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[1] *Bethune, G. and Huler, S. From Worst to First, Wiley 1998, p101.*

> *Training in aviation has a successful track record, and if it is to remain a useful and applicable tool, it must be relevant to the needs of the end-users.*
> *In order to be relevant, aviation training must be based (a) upon an appropriate safety paradigm, (b) upon an understanding of systemic deficiencies and therefore, (c) be context-specific*[3].

Selection, training and the organization, like civil aviation authorities and aviation companies and its management, are the determinants of aviation safety.

Safety and Numbers

Human failure is the major cause in aircraft accidents. Humans cause around 80 per cent of all accidents, while only 20 per cent is attributable to technical failures, this is known as the 80/20 problem[4]. Several studies indicate that the lack of adequate training is the main cause of aviation accidents. The primary causes of aircraft hull-loss accidents can be divided into five categories: flight crew, airplane, maintenance, weather and airport/air traffic control. The flight crew is a primary factor in more accidents than all other categories combined[5].

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[2] *Telfer, R. and Moore, P. Aviation Training: Learners, Instruction and Organization, Ashgate 1997, Foreword by Capt Dan Maurino.*
[3] *Telfer, R. and Moore, P. Aviation Training: Learners, Instruction and Organization, Ashgate 1997, Foreword by Capt Dan Maurino.*
[4] *Reason, J. Managing the Risks of Organizational Accidents, Ashgate 1997, p42.*
[5] *Flight Safety Foundation, Flight Safety Digest, December 1997.*

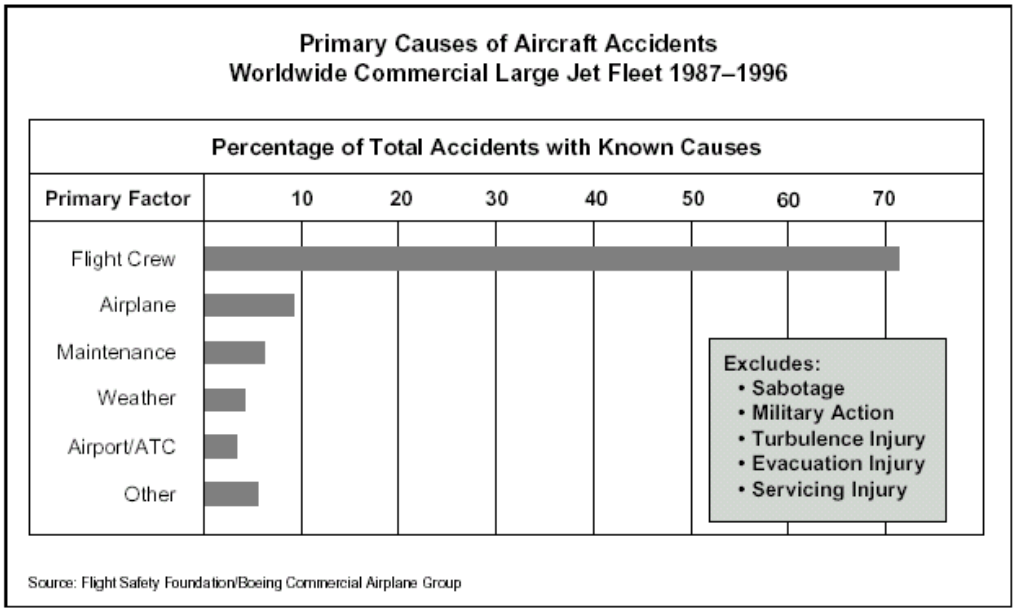


Figure 1.1

Most accidents occur in the Approach and Landing phase or fall into the Controlled Flight Into Terrain (CFIT) category. In a Flight Safety Foundation report about Approach and Landing and CFIT accidents worldwide, the top 5 primary causal factors are all crew related[6]. All 5 factors; omission of action or inappropriate action, lack of positional awareness, flight handling, poor professional judgment and a lack of airmanship, are the result of deficiencies in aviation training.

These accidents happen with aircraft with no major technical defects and like most airliners, well equipped with either a conventional or an advanced flight deck. Most of these training related deficiencies can be fixed by implementing appropriate training practices from the beginning. One of the principle "laws of learning"[7] is the "law of primacy", what is taught must be right the first time. Basic flight training plays an important role in this matter and can make a substantial difference in solving the shortcomings in aviation training and improve it altogether.

The second, most frequent circumstantial factor in the 279 reviewed fatal Approach and Landing Accidents (ALA's) worldwide, is the failure in Crew Resource Management (CRM). CRM is the effective utilisation and management of all resources available to the crew[8]. In 47 per cent of the fatal ALA's, a failure in crosschecking and coordination was a circumstantial factor. This deficiency in management and monitoring skills by crewmembers can also be

[6] *Flight Safety Foundation, Flight Safety Digest, Special FSF Report, February 1998.*
[7] *Aviation Instructor's Handbook, FAA AC 60-14 1977, Learning principles by Professor E. Thorndike, Columbia University, New York.*
[8] *Lawson, D. CRM Training Manual, Martinair Holland, ITA 1998.*

trained relatively simple when compared to the rather expensive training of flight skills. The objective of CRM training is to help reduce incidents and accidents, and to improve crew coordination and performance[9]. CRM training can change pilot attitudes. The results of extensive research, in particular done by Robert Helmreich[10], confirms that CRM courses promote more favourable attitudes. CRM is an acquired skill, which must be instructed and trained in all phases of the training process, from the initial pre-solo flight lesson to the periodic operators proficiency check.

Two types of failures contribute to these accidents; they can be described as active failures and latent conditions[11]. Active failures, such as judgment errors by the flight crew, are the consequences of latent errors. Latent conditions are present in all systems and include training deficiencies or inadequate selection procedures.

Recognizing latent conditions and adjusting the system will, over time, is more effective in improving safety than merely focusing on active failures. Shortfalls in aviation training and selection must be identified and restored by all participants involved.

Figure 1.2

[9] *Lawson, D. CRM Training Manual, Martinair Holland, ITA 1998.*
[10] *Robert Helmreich has been the leading scientist in the development of training and measurement tools for CRM in the airline industry in the 1980s.*
[11] *Reason, J. Managing the Risks of Organizational Accidents, Ashgate 1997, p10.*

Between 1990 and 1999, there have been 421 large jet and turboprop accidents worldwide [12]. This is an average of 42 accidents per year with a predicted declining rate. Traditional airline safety management is based on analysing the causal and circumstantial factors after an accident or incident and subsequently implement procedures to avoid such an incident or accident in the future. These reactive measures are not enough to maintain a safe and healthy operating environment. Proactive measures must be used as well. Fewer accidents mean less investigation, so fewer reactive measures can be applied. The importance of proactive measures is evident.

Through effective safety information systems, airline and flight school management can customize and improve pilot training. The implementation of Flight Operations Quality Assurance Programs (FOQA) is an important tool to move into proactive safety management. Information networks such as the British Airways Safety Information System (BASIS), the FAA/NASA sponsored Aviation Safety Reporting System (ASRS), Flight Safety Foundation's publications and the airline training department can assist in determining relevant flight training standards.

Airmanship

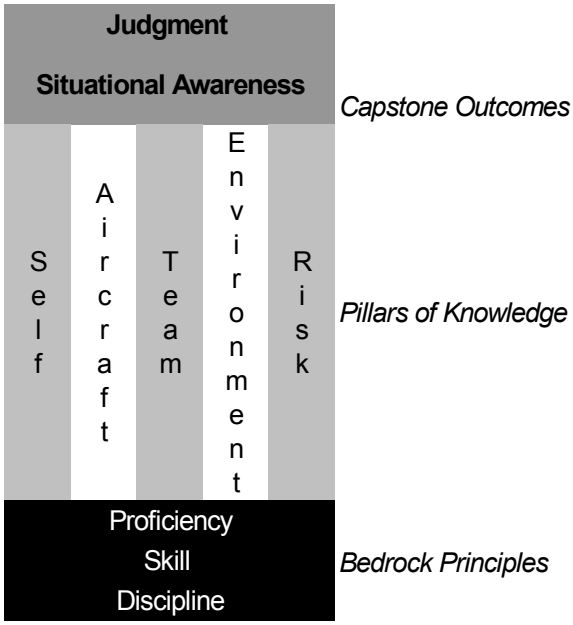
After a lengthy process of selection procedures, medicals, flight- and ground training, simulator training, numerous examinations and line checks, the end result should be a competent pilot. The skill to let an airplane fly and put it back on the ground safely, the so-called stick-and-rudder skills, are not enough for today's modern aviators. For basic flying, whether sitting in a Cessna 152 or in an advanced airliner cockpit, only psychomotor skills are used for controlling the aircraft. But to complete a flight in a safe way, a series of mental skills are needed as well. The effect of psychomotor skills is just the result of a mental process. Other vital skills include; problem solving, exercising good judgment, clear communication, risk analysis and discipline.

Every pilot has been trained to carry out a safe crosswind landing, for which theoretically only technical skills are required. But when the same landing is performed under different circumstances like in heavy rain, low on fuel, on a non-precision approach at an unfamiliar airport, after a 10-hour flight through the night and with a new co-pilot, more than just technical skills are required to land safely.

Major Tony T. Kern, gives a clear analysis of the required skills for an aviator and calls it airmanship. Airmanship consists of three basic principles; skill, proficiency and discipline. To apply these efficiently, a pilot needs to have a thorough understanding in five areas of

[12] *Civil Aviation Authority, Aviation Safety Review 1990-1999, CAP 701, October 2000.*

expertise; self, aircraft, team, environment and risk. The outcome is consistent good judgment and situational awareness[13].



Source:The Airmanship Model, Kern, 1996.

Figure 1.3

Aviation judgment or Aeronautical Decision Making (ADM) is defined as the mental process to formulate aviation decisions[14]. Many authors on this subject and related matters, like Jensen (Jensen 1995), Telfer (Telfer and Moore 1997), Trollip (Trollip and Jensen 1991) and Kern (Kern 1996), are convinced that these qualities can be systematically developed through practice and effective flight training. When two or more crewmembers in a cockpit combine their airmanship skills effectively we call it good crew resource management. This management skill must also develop and improve on a recurrent basis through airline sponsored CRM courses or via a multi-crew cooperation course (MCC), required by the JAA for ATP applicants and/or candidates for a multi-pilot airplane type rating.

[13] *Kern, T. Redefining Airmanship, McGraw-Hill 1996, p21.*
[14] *Jensen, J. Pilot Judgment and Crew Resource Management, Avebury 1995, p5*

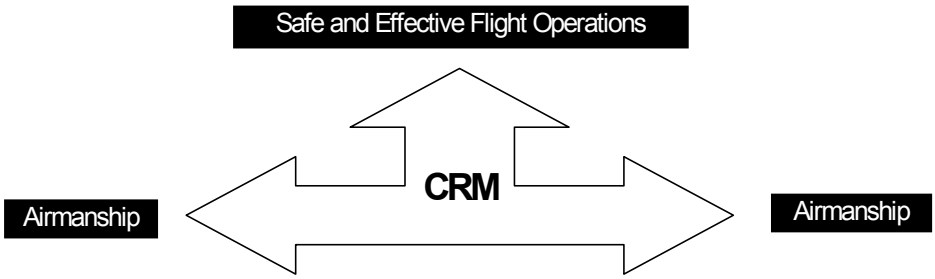


Figure 1.4

Effect and Efficiency

One of the foundations of airmanship is skill, and the best method for skill acquisition is through experience or hands-on training. Improvements in flight training need to focus on giving students ample experience in suitable types of aircraft. The training environment should be professional, well equipped and dedicated to prepare students for an airline career. The quality of this training needs to be guaranteed through a quality system, which is a prerequisite for FTO's approved under JAR-FCL.

The increasing use of advanced Flight Training Devices (FTD's) is of great importance for ab initio pilots. Simulators or FTD's provide a much more effective learning environment than the confines of a noisy cockpit. The cost is also substantial lower than performing the same scenarios in an aircraft. So when assessing a flight training program, two elements are central in the evaluation; effect and efficiency. When a graduate is capable of using good judgment, is competent and has a high level of situational awareness, the training is effective. When the outcome is conducted within a realistic timeframe and for a reasonable price, the program is also efficient.

The art and craft of flight instruction is a crucial element in the specialized field of aviation instruction. Flight instructors must be committed professionals with a rich mix of experience, preferably recruited from the airline workforce on a full-time or part-time basis. Using highly experienced instructors is an effective instructional method according to Ross Telfer. He also argues that relevant and valid research can ensure that all instructors, including the young and inexperienced, reach an acceptable level of professional competence[15]. The lack of total flight or airline experience amongst most flight instructors does not encourage innovations though. The combination of working in an actual airline environment and the need to complete the company's yearly recurrent training program makes an airline pilot a more suitable coach/instructor for his future colleagues.

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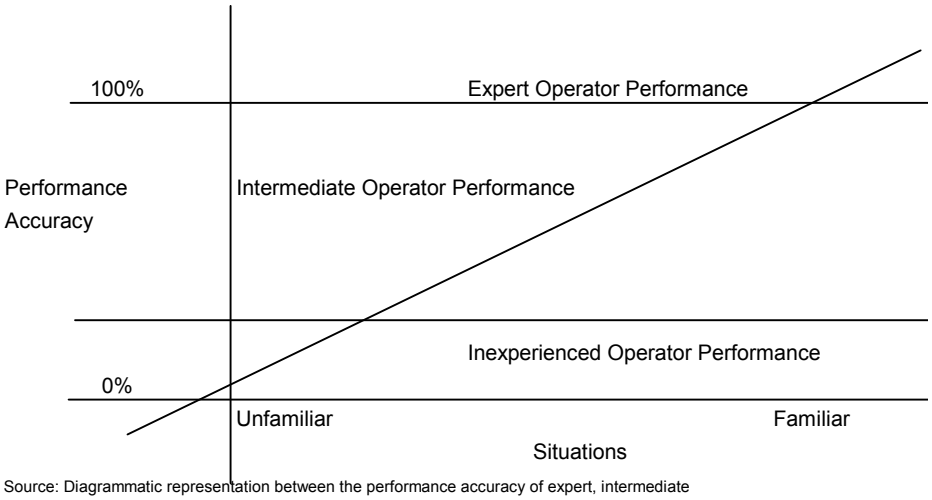
[15] *Johnston, N. , McDonald, N. and Fuller, R. Aviation Psychology in Practice, Avebury 1994, Improving Aviation Instruction by Ross Telfer, p344.*

On-the-job learning or trial-and-error practices are not an option for the aircrew member[16]. The numerous first officer programs were a pilot pays for a restricted flying job, are no examples for quality learning. Only when this on-the-job-learning is well structured and the trainee has finished a good and well monitored basic flight training's trajectory, this practice can be very useful. But these inexperienced pilots could easily be exposed to situations beyond their capabilities and increase the risk of pilot error.



Source: Diagrammatic representation between the performance accuracy of expert, intermediate and experienced operators during familiar and unfamiliar situations, Wiggins, 1997.

Figure 1.5

Unfortunately this practice is becoming more and more popular, especially with the fast growing, jet-equipped low-cost carriers (LCC) in Europe. Using less sophisticated but demanding turboprops could do the job as well, maybe even more effective. Experience can also be gained effectively through well-developed aviation training courses. Only when a time building program is controlled and monitored it will be effective and efficient. The pay-for-hours schemes should be abolished immediately from a moral and financial point of view. The majority of the examined FTO's in the Netherlands use the experience minimums as laid down in the applicable JAR-FCL regulation. The same tendency was observed for the MCC courses, which should have a minimum of only 20 hours of practical training. The aim of the MCC course is to gain proficiency in operating in a multi-pilot environment. Item 13 in the Acceptable Means of Compliance section of JAR-FCL 1.261(d), mentions the insufficiency of a single exposure to the course. Why is it then, that none of the examined schools offers an enhanced and maybe a more effective MCC program?

[16] *Telfer, R. and Moore, P. Aviation Training: Learners, Instruction and Organization, Ashgate 1997, The flight crew member's responsibility and role in aviation training by Brett Gebers, p99.*

To ensure a high standard of education, over-learning is by and large the most important concept in aviation training. This not only improves the chance of recall but also makes performance of the task more resistant to stress[17]. The high cost of airline training prohibits over-learning, so this task can be carried out much more efficiently by the initial training organization for a fraction of the cost. Therefore feedback from the airlines is crucial for a training organization to develop an effective training curriculum. Regulatory minimums should not be used by the training organization as the basis for the flight syllabus but should only serve as a parameter to satisfy the authorities.
Methods like Cognitive Task Analysis (CTA) can help in identifying the training needs and effective training methods for the novice pilot. CTA focuses upon the characteristics of decision-making and problem solving, the development and application of conceptual representations/mental models, and the interpretation and integration of task related information[18]. A typical CTA identifies[19]:

- The key job components.
- The knowledge and skills required for similar job components.
- Important knowledge and skill differences between novices and experts, or between good and poor performers.
- The conditions that best facilitate learning.

Various CTA methods can be used, but many problems need to be overcome before CTA can be useful. Who can tell which pilot is an expert or which decision is the most suitable in the aeronautical decision making process is one of the challenges in CTA research. Most of these items are difficult, if not impossible to measure. CTA is still in a developing phase and it will take time before it becomes integrated into existing training development procedures.
To evaluate a flight training program we need to look at various factors, like facilities, equipment, selection, training and flight safety standards and the organization as a whole. Each element must be appraised separately before the effect and efficiency of the program can be determined. When this is done, then it is possible to give aspirant pilots an unbiased advice in choosing a flight school, which can teach them how to become competent aviators via an efficient way. The exchange of information between the flight training industry, the airlines and the authority will undoubtedly increase the effect and efficiency of flight training when applied in the right way. The degree to which congruence or alignment occurs across the three

[17] *Hawkins, F. Human factors in Flight, Training and Training Devices, Second Edition, Avebury 1993, p196.*
[18] *Telfer, R. and Moore, P. Aviation Training: Learners, Instruction and Organization, Ashgate 1997, Expertise and Cognitive Skills Development for Ab Initio Pilots by Mark Wiggins, p61.*
[19] *Johnston, N. and McDonald, N. and Fuller, R. Aviation Psychology in Practice, Avebury 1994, Cognitive Task Analysis by Richard Redding and Thomas Seamster, p192.*

groups, trainees, trainers and the system, determines the potency or dilution of training effectiveness[20].

Chapter 2
Flight Training in the Netherlands

National Aviation

The past 25 years we have seen a fundamental change in the civilian flight training possibilities for aspiring pilots in the Netherlands. After the Second World War, airline pilot training was only done by the RLS (Rijksluchtvaartschool), established in 1946. This school was set up by the Dutch government because of the need for civilian pilots primarily for the national flag carrier KLM. A thorough selection process and a high standard of instruction are still characteristics of this school. KLM would hire the majority of the students direct after graduation, this is no longer the case however. The number of students with a job guarantee is declining and these agreements might be nonexistent in the future.

In 1968 a second school started a commercial pilot training program, the initially in Rotterdam based NLS (Nationale luchtvaartschool), part of the Schreiner Aviation Group and recently taken over by CAE. This school is now specialised in ab initio training and since 1978 operating from a regional airport in Limburg, the most southern part of the Netherlands. Graduates from this school do not only apply with KLM, but also with other Dutch or European operators who accept ab initio low-time pilots.

During the 70´s, more and more flight schools started offering commercial pilot training, but without the backing of a major airline or aviation company. The alliance of a flight school and an airline will under normal economic circumstances result in a job guarantee for aspiring airline pilots. A negative consequence of such an alliance is that the choice by prospective students for a flight school is dictated by the assurance of an airline position and not especially by the merits of the school. The absence of job guarantees and the substantial tuition fees that now have to be paid by the student, make it a lot more difficult for schools like the KLS or NLS to attract enough qualified candidates.

There are currently nine JAA approved flight training organizations[21] in the Netherlands, offering a commercial flight training program. These FTO's range in size from 70 employees with dedicated multiple training facilities to a modestly staffed and limited equipped instructor/owner school. Besides FTO's, which have their own training facilities and airplanes, there are also a number of agencies promoting training programs at foreign flight schools.

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[20] *Telfer, R. and Moore, P. Aviation Training: Learners, Instruction and Organization, Ashgate 1997, The roles of learning, instruction and the organization in aviation training, p1.*
[21] *Source JAA, Overview FTO´s and their activities, July 2001.*

Usually the training opportunities in the USA or elsewhere are marketed with a huge profit margin for the agency involved. More on this will be discussed later in this chapter.
The aviation environment in the Netherlands cannot be called "friendly"; not for airlines flying from or to Dutch airports and certainly not for the general aviation sector. Authorities, regulators and various other groups involved are relentlessly creating many barriers for this already heavily regulated sector. The combination of this impediment and several other unfavourable geographical characteristics of the Netherlands, makes it not the greatest place for advanced flight training. Several elements are required or must be suitable to create a climate for effective and efficient flight training:

- Airports; only 25 public-use and military airports[22] in the Netherlands. Included in this list of 25 airports are military fields with restrictions for use by civilian operators, grass strips with no navigational facilities and airports with limited hours of operation. Additional operational limitations at all airports, even the grass strips, are imposed via stringent noise abatement procedures. High landing fees and even fees for flying an approach are being charged at all airports.
- Airways; there has never been a well organized national airway system, aircraft are unable to fly via airways at low altitudes under instrument flight rules from or to the majority of the national airports. Only via locally developed procedures is it possible to carry out the necessary IFR training flights.
- Navaids;
- ATC and Meteo services;
- Geographical location; with the North Sea surrounding the country to the west and north, and the equally restricted Belgium airspace in the south, only Germany is the nearest suitable region for training.
- Weather; due to the effect of the North Sea and the northerly latitude, the climate is characterized by numerous days of marginal VFR conditions and long periods of adverse weather.
- Authorities; national and local political parties consider aviation as a necessary evil and it is expected that even more restrictions and operational limitations on aviation based on noise, pollution and location will pass legislation in the near future. Except the two "main ports", Rotterdam Airport and Amsterdam Airport Schiphol, none of the remaining airports are considered crucial for the infrastructure[23]. Regional airports experience the numerous touch-and-go exercises, which are necessary for basic flight training, as an activity with no economic value. To reduce the number of these training flights, landing fees are increased or the flights are even banned altogether.

[22] *Jeppesen, VFR chart, edition 1999.*
[23] *Standpoints political parties on aviation, PNL issue 1, 2002.*

When this environment is compared to that of other countries, it is clear why even the established national flight training institutions are looking for opportunities elsewhere. Countries like Spain, Portugal, the United Kingdom and the United States are favourite among flight schools and students for their location, weather and training possibilities.
The United States is and will also be in the future an important country for professional flight training. With almost 5.500 public-use airports[24], a well developed aviation system and over 3.000 flight schools[25], the United States plays a significant role in worldwide aviation training. The majority of these schools are very small though, with limited possibilities for students seeking professional training. There are still an increasing number of schools and universities that are capable of providing a high standard of flight training. Flight training done in the United States can take place under JAA and/or FAA requirements and is much more efficient when looking at the favourable operational conditions when compared to the situation in the Netherlands. In the past 2 or 3 years, the majority of the Dutch schools offering commercial pilot training have established links in other countries to improve the efficiency of their programs. With the limited facilities available in the Netherlands, flight schools will have to look across the border and start or expand training facilities in more general aviation oriented countries. The question is if the already limited resources and budgets of most FTO's are able to carry this investment. The cost of flying in the Netherlands is still growing and the decision to divert must be made soon before it is too late.

Joint Aviation Authorities

With the introduction and implementation of the European Joint Aviation Requirements for Flight Crew Licensing 1 (JAR-FCL 1) in July 1999, things have been changed significantly. These Joint Aviation Requirements were being developed for all categories of pilot licences and ratings without further formality in any of the participating states[26]. While not all JAA member states have introduced the JAR-FCL yet, only 10 out of the 25 full member states as of 2002[27], it is expected that all JAA members will eventually participate. So how can the European flight training industry benefit from the new licensing requirements?
Let us start by comparing the JAA commercial pilot integrated course or CPL(A)/IR course with the FAA commercial pilot certification course conducted under part 141. If we solely look at the total flight hours required according to the regulations or what is being offered by various flight schools, things are not so different. Both curricula stipulate flight training around 200 hours, which is not only the regulatory minimum, but also the economically viable

[24] *AOPA's Aviation USA, 1991 edition.*
[25] *www.aopa.org.*
[26] *JAR-FCL 1, Foreword Amendment 1, page F-1, July 2000.*
[27] *www.jaa.nl.*

maximum. The typical 200-hour program can be seen as a benchmark for the flight training industry worldwide.

The major difference however between the JAA and the FAA licensing requirements, is the level of theoretical knowledge. The JAA theoretical syllabus requires at least 500 hours of instruction for the commercial licence and 750 hours for an airline transport pilot licence[28] (ATPL), which most students will go for anyway. The aeronautical knowledge training required under part 141 for the FAA commercial pilot course is only 35 hours and 40 hours for the FAA's airline transport pilot course[29]. Although students can pass the ATPL exam under part 61 of the Federal Aviation Regulations with no requirement for formal ground training at all.

When comparing the available study material for a given subject, like "performance" for instance, the study material which can be used to pass the theoretical knowledge exam for the FAA ATPL comprises of approximately 7 pages of outlines of the major FAA tested "performance" concepts[30]. Applicants studying for the equivalent JAA licence on the other hand, will have to work through 152 pages of a detailed "performance" textbook[31]. The difference between the FAA and JAA required theoretical knowledge is clear.

Multi-crew cooperation training, better known as the MCC course is another prominent feature and can be used as an excellent tool to raise the standard of the JAA licence. This type of course, which can be conducted in an approved procedures trainer or simulator, is intended to enhance the student's proficiency in operating on multi-pilot airplanes. The course is required for students attending an ATPL integrated course and for students who wish to obtain an initial type rating on multi-pilot airplanes[32].

When a MCC course is systematically developed by experienced people and conducted with an appropriate training device, it can serve as an effective and efficient means to transform a 200-hour low-time pilot into a cockpit-ready first officer.

The JAA initiated this revolutionary program and it is up to the industry to further develop and enhance this initiative. A pilot trained according to JAA standards could become a model for the rest of the airline industry. FTO's who recognize this and work together with the airline industry to continually improve and further develop these courses, will have a major advantage.

The possibility for approved FTO's to conduct all or part of the ATPL integrated course outside the territory of a JAA Member State[33] creates new opportunities for ambitious flight schools. From a national oriented aviation culture, the government, airline or privately owned

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[28] *Appendix 1 to JAR-FCL 1.160, page 1-D-3, July 2000.*
[29] *Appendix D & E to Part 141, Federal Aviation Regulations, Amdt. 1997.*
[30] *Boyd, K.T. Airline Transport Pilot, second edition, Iowa State University Press, 1990.*
[31] *Theoretical Knowledge Manual, Flight Performance and Planning 1, Oxford Aviation & Jeppesen 2001.*
[32] *JAR-FCL, JAR-FCL 1.261(d), paragraph 1(i) and (ii), July 2000.*
[33] *Appendix 1b to JAR-FCL 1.055, page 1-A-24, July 2000.*

flight schools in Europe, need to transform into international oriented businesses able to compete with training organizations not only in Europe, but from the USA, South Africa or even Australia as well. With a top quality approach to training and the possibility to carry out all or part of the courses in more cost efficient countries like the USA, is a well managed FTO able to successfully beat the competition.

Although this paper argues the suitability of the Netherlands as a professional training location, general aviation or the GA sector is crucial in getting young people interested in an aviation career. Local airports serve as a gateway for potential candidates into the world of flying. Without a healthy GA sector, this task will be difficult if not impossible at all. There are still plenty of training related activities that can be conducted locally. Various elements of a professional flight training program, besides the actual flying, do not automatically need to be relocated as well. Selection procedures, theoretical courses and simulator sessions can be carried out anywhere. By focusing only on recreational flying, the GA sector in the Netherlands can create room for growth and should adapt for a new role instead of being destroyed by new and strict legislation when trying to fight the restrictions imposed on the industry.

The American Way

At the end of the 70's, an increasing number of persons went to the United States of America to get a commercial pilot licence. The straightforward and economical approach in teaching a person to fly an aircraft made the American flight training industry a low-cost alternative for aspiring pilots. The huge number of flight schools offering professional training creates not only choice and competition, but also a variety of standards. The FAA commercial flight training curriculum is a set of minimal standards, developed for the novice pilot with the assumption that a great number of flight hours will be acquired before moving on to a more demanding flying position. The American approach is based on the "building block" technique. A relative simple task or job for this matter must be performed or accomplished according to acceptable and correct standards before moving on to the next higher step on the career ladder. The American way cannot be called unsuccessful. Based on fatal accidents rates, the North American region turns out to be the safest in the world[34]. This experience-based trajectory can also serve as an excellent foundation to develop good airmanship. But this is based on a high number of flight hours. A typical new-hire will already have accumulated on average more than 4.000 hours[35] before being hired by a major airline. The average flight experience required for new-hires at regional airlines is over 2.000 hours[36]. If this requirement cannot be met, a more systematic and deliberate training approach is needed. There are an abundance of

[34] *Aviation Safety Review 1990-1999, Civil Aviation Authority, London, October 2000.*
[35] *Airline Pilot Career Information, Airline Pilots Association, September 2001.*
[36] *Airline Pilot Career Information, Airline Pilots Association, September 2001.*

arguments in this paper about the gains in improved flight training; we must however never underestimate the experience factor. The legendary Chuck Yeager reflected on the value of experience:

> *I have flown in just about everything, with all kinds of pilots in all parts of the world and there wasn't a dime's worth if difference between any of them except for one unchanging, certain fact: the best, most skilful pilot had the most experience.*[37]

A typical career path for a pilot trained in the US can be broken down into the following steps:

phase 8	small regional jet
phase 7	large twin engine turboprop or corporate jet
phase 6	small twin or single engine turboprop
phase 5	large twin engine piston
phase 4	small twin engine piston
phase 3	single engine piston, complex
phase 2	single engine piston, four seater
phase 1	single engine piston, two seater

Figure 2.1

All these career steps are accompanied by intensive study of systems and procedures for each applicable class and type of aircraft. By learning to fly and operate different airplanes for different operators and under a variety of conditions, a pilot will be able to acquire the necessary skills and lay a solid foundation to improve his or her airmanship when moving on to a major airline position. If one of these steps or "building blocks" are taken out, the system does not work and the result is an under performing pilot. Unfortunately this scenario is a training concept in use by several flight training agencies. With colourful advertisements in the popular flight magazines and persuasive info-gatherings, numerous agencies promote these training schemes. For the uninformed individual it may look attractive, but the effect and efficiency of these programs is ambiguous.
The successful outcome of training in the USA depends on the following factors:

- The autonomous nature of this training requires a much higher degree of motivation than the well supported flight academy candidate. The American trainee must be able to develop the necessary airmanship skills alone, due to the sometimes lower standard of the training programs. The self-selected candidate must prove that his flying skills are equal to or even better than the flight academy graduate, who went through a

[37] *Kern, T Redefining Airmanship, McGraw-Hill 1996, p57.*

thorough screening process. It takes a lot of dedication and perseverance to beat the odds.

- As mentioned before there is no substitute for experience. The prospect on a successful job interview and grading will be better for a high-time pilot. The balance between total time and the amount of relevant multi-engine flight experience will have a big influence on the pilot's career path. A further classification could be made if the experience is accumulated on multi-engine piston or turbine powered aircraft, single-pilot or multi-pilot aircraft or if the hours are flown via charters or regional airline operations. All these factors determine the value of the pilot's total flight experience.
- A particular type of flying is unfortunately often ignored and underrated by the persons responsible for cockpit hiring; flight instruction. It has been the start of the career of many airline pilots, yet many do not recognize its value. A flight instructor must possess many skills that are also essential for a successful airline pilot. A flight instructor must be able to communicate effectively, monitor the student, deal with distractions, adhere to regulations, etc. In general aviation, the less structured environment must rely heavily on self-regulation so more flight discipline is required from a flight instructor. Pilot's who worked their way up initially as a flight instructor will certainly have a hidden advantage.
- Rules regarding student visa and working permits are constantly changing for non-US residents. To carry out a successful training program including accumulating the relevant flight experience and obtaining an ATPL certificate, a minimum stay of at least 3 years is required. Current restrictions on visas and permits prohibit this length of stay and the authorization to work.
- The ability to convert a FAA licence is a key factor to train in the USA. Current legislation however requires a minimum of 1.500 hours as Pilot in Command (PIC) or co-pilot on multi-pilot airplanes to validate a JAA ATPL(A)[38]. Without the possibility of a validation, it will be much more efficient for the candidate to directly obtain an original JAA licence.

[38] *JAR-FCL, Appendix 1 to JAR-FCL 1.015, July 2000.*

The majority of pilots considering to start their flying career in the USA use or have used the services of an agency in one form or another. The cost of flight training is huge and usually paid for by the parents. The involvement of agencies in the various parts of the training will likely increase this price. No tangible advantage is perceived however when using the expensive services of an agency. The fact is that new entrants into aviation are not familiar with all the ins and outs of the airline training business. The aspiring pilot's knowledge about flight training is more often than not limited to the promising advertisements in pilot magazines.

Valuable and unbiased information about flight training should come from airlines or pilot unions. A direct link between the student and the FTO, perhaps with an airline endorsement will ultimately result in a lower and fair price. Due to the changing requirements and legislation, the future of flight training agencies is vague. The number of advertisements in a leading Dutch pilot magazine[39] by agencies offering training in the USA, diminished by half when comparing the issues from March 2001 through January 2002.

Learning to fly in the USA is a great experience, but the cost of training demands the right course. For European pilots this will be a training program according to the JAA JAR-FCL requirements but which can be conducted in other countries, including the USA.

The Student's Choice

When the decision has been made to fly airplanes for a living, one has to decide which study/training program is most suitable. Under the JAA requirements there is the option for a modular or an integrated training course. This possibility is available for commercial as well as for ATPL flight training courses.

As there is a wide-range of flying jobs in aviation, the majority of the aspirants seek a position on a jet aircraft with a major airline. A career in general aviation as a flight instructor or corporate pilot is for most candidates not an option, although these careers could be as rewarding as the airline variant. So the choice for a flight training course should be based on the stringent requirements associated with commercial air transportation.

The ATPL integrated course conducted under the JAR-FCL regulations and procedures is the most suitable course for this purpose. The structure of the ATPL integrated course guarantees a continuous program of theoretical and practical training. A FTO approved to conduct ATPL integrated courses is required to operate according to stricter rules than the FTO with only a modular course authorization. The combination of an airline oriented course structure and the high standards to which a FTO must comply with to conduct these courses makes it more appropriate for airline training.

[39] *Piloot & Vliegtuig, leading aviation magazine for the Benelux.*

A limited number of students attending a flight school prepare for a career in general aviation. For this group it is more important to get to know the local general aviation scene then looking for a high profile flight school. But for the ones with airline aspirations, the choice where to start their airline career can make a huge difference in the hiring process. The combination of minimal flight hours, self-selection and a different school status may not be advantageous when looking for a job with a major airline. According to Dr. Ross Telfer, an authority on pilot learning and training, the outcome of training and instruction is not only determined by the individual pilot or the instructor, but also by the nature of the organization in which the training occurs[40]. A graduate from a grass-strip based local flight school will be looked at somewhat differently by an employer then the graduate from a prominent international flight training institute. Dr. Ross Telfer continues with determinants of training efficiency, and shows the organization as the only component which controls all the variables influencing training efficiency:

> *We must not only concentrate on the actual instruction of pilots and instructors, but more on the management and organization which is the largest determinant of the quality of learning.*[41]

It is therefore important that professional pilot flight training is conducted by organizations dedicated to quality learning. Regulators, employers and even pilot unions have enough expertise about the various training establishments and their associated programs to help young people to make this important decision about their future career. Unambiguous information about aviation training must be made available to potential candidates, only then are they able to make the right choice.

Selection

All the studied FTO's and agencies in the Netherlands define their own entry requirements, selection criteria and screening procedures. The standards range from the ability to pay for the course to an extensive airline coordinated selection process. An example of a school with such an airline coordinated selection process is the KLS which has close ties with its owner KLM. KLS candidates are selected according to the standards set by KLM and therefore preferred above other students. Other airlines have no or little influence in this process. One can argue that a flight school should prepare their students for a position with a wide range of airlines

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[40] *Aviation Training: Learners, Instruction and Organization, Introduction; The roles of learning, instruction and the organization in aviation training, Ross A.Telfer and Phillip J. Moore, Ashgate, 1997.*

[41] *Aviation Training: Learners, Instruction and Organization, Introduction; The roles of learning, instruction and the organization in aviation training, Implications for training: influencing the gate-keepers, Ross A.Telfer and Phillip J. Moore, Ashgate, 1997.*

instead of a single company. Another example of school/airline cooperation is the NLS, which carries out ATPL(A) integrated training courses on request for various European airlines. But many other candidates for other schools and agencies who pursue a career in aviation have not passed through a proper or formal selection process.

The nature of aviation training requires special attention regarding the admission of suitable candidates. A candidate must already possess many assessable characteristics and skills essential for becoming a competent pilot. Via cognitive analysis testing, personal evaluation testing, psychometric testing, dyslexia testing and a medical examination, selection institutes are able to determine if an applicant has the right qualities. When an applicant already has flight experience, a flight or simulator test should also be part of the process. All these components of an extensive selection process must be passed according to predetermined standards. FTO's in cooperation with the airlines must establish the standards conform the requirements of the future task. Cooperation between the airlines and the FTO's regarding the screening process should be encouraged to maintain a high standard of pilot graduates.

If selection is not taken seriously, it will have a detrimental effect during training and possibly result in a training drop-out. Failures are expensive, not only in monetary terms for both the trainee and the employer, but also causes emotional stress. During times of diminishing numbers of suitable applicants, it could be tempting for schools to lower the standard and accept persons who are likely to fail during training or show marginal performance on the job after obtaining a licence. All this will cost the trainee and/or employer a lot of money and can be avoided through a well developed and fair screening process.

Many airlines spend huge amounts of money on the evaluation process for a new type or model aircraft. It is an extensive and time-consuming process where multiple departments, like operations, engineering and finance are involved. But when it comes to hiring a pilot, who could be working for the company for more than 30 years, the process is rather simple. Airlines should get involved in the initial flight school selection process, and not only during the actual flying job application. Unsuitable candidates should not pass primary pilot selection. If they do, a consequential airline selection process might not be able to detect the applicant's inaptness. The result could be disastrous and a waste of money and resources. Applicants with below standard results should not be admitted to the training program. It is too costly and will possibly blemish the image of the school or institution as well.

Pilot selection is no exact science, but with the right evaluation procedures, valid predictions about future performance can be made. Many factors affect a person's ability to become a good pilot and fit in a company culture and all these factors must be considered. Items like motivation, enthusiasm and ambition should also be a part of the screening process.

Chapter 3
Airline Requirements

The Workforce

The cyclical nature of the airline industry makes it almost impossible to predict the future requirements for airline pilots. Factors like growth rate, fleet planning, expansion and even retirement numbers can fluctuate considerably over a period of time. To give an indication of how much pilots are needed for the Dutch market, let us assume a total workforce of 2.934 professional pilots. This figure is based on membership information from the Dutch Airline Pilots Association or VNV, excluding the members based on the Netherlands Antilles and the members employed at the KLM Flight Academy. Included are the pilots working for Dutchbird and Air Exel, but who are not represented by the VNV.

Number of professional pilots employed per airline:

KLM	1.707 [42]
KLM Cityhopper	223 [1]
Martinair	403 [43]
Transavia	320 [1]
Schreiner	127 [1]
Air Holland	24 [1]
Dutchbird	40 [44]
Air Exel	90 [45]
Total	2.934

Figure 3.1

One can say that when a pilot graduates at age 25 and retires at 55 years of age, he or she will work as an airline pilot for about 30 years. This means that approximately 1/30th of the entire workforce need to be replaced every year considering no growth. This will be an absolute number of at least 97 pilots who have to qualify for an airline position. Unfortunately this is a theoretical number and the actual number of new-hires has been fluctuating enormously for the

[42] *Annual Report 2001, VNV, based on 98% membership coverage.*
[43] *Annual Report 2001, Martinair Holland NV.*
[44] *Dutchbird, Head of Flight Operations, via email.*
[45] *KLM Exel, PR & Communications, via email.*

past few years. Nonetheless this will give a good indication how big this market is and how much training capacity is needed for the future. Fleet renewal programs, market growth, new airline entrants and the ability and motivation by Dutch individuals to work abroad, may demand a lot more training capacity in the future.

Hour Building

One aspect of hiring criteria is the amount of multi-engine hours a pilot has in his logbook. This prerequisite for qualification varies among the airlines. A distinction is made between graduates from the established institutions like KLM Flight Academy and the NLS and graduates who accomplished their training at other schools or in other countries. For this second group most airlines require more multi-engine time than the first group and requirements vary between 300 hours for Transavia and 1.000 hours for KLM Cityhopper. With an average hour requirement of 600 hours multi-engine time a graduate must have been flying multi-engine airplanes for about a year before he can qualify for a selection process.

Multi-engine hour requirements[46]:

KLM	500
KLM Cityhopper	1.000
Martinair	600 (>5.700 kg)
Transavia	300

Figure 3.2

If we assume 50 graduates a year who need 600 hours of multi-engine or the more JAA oriented multi-pilot flight hours, trainees must fly a total of 30.000 hours yearly. With commuter aircraft, averaging 2.500 flight hours a year, 12 aircraft should be dedicated to accommodate trainees for hour building. This would be a feasible solution if the airlines participate and support the commuters involved. The high cost of type rating training and fluctuating pilot demand prohibit this and most pilots will have to accumulate the necessary hours abroad.

The predicted pilot shortage might be already here, incentives like the £30.000 "golden hello" offered to qualified captains for easyJet[47] is evidence that not enough qualified pilots are readily available. When the market picks up again and retirement numbers increase, airlines might find out that there are not only not enough qualified pilots to fill command positions, but

[46] *www.iac.nl*
[47] *Flight International, easyJet entices pilots with bonus, 30 January 2001, p11.*

it might be even more difficult to find enough ab initio graduates. The long-term lack of investment by airlines in ab initio pilot training and the lack of government initiatives to encourage young people into the industry might mean a halt to expansion or even a forced reduction in services for the airlines according to an article in Flight International[48].

Quality Systems

Pilot recruitment by an airline starts with establishing a set of requirements. A pilot applicant with the right qualifications will be suitable for employment. Quality means filling a requirement exactly as specified by the customer, in this case the airline. Flight training is the method to fulfil these requirements. A proven and useful tool to monitor and manage this is Quality Assurance, which is a part of a Quality System.

The harmonization or even integration of airline and flight school managed Quality Systems could be a logical step to increase training effectiveness and efficiency in the future. The already implemented Quality Systems in use with businesses operating under JAR-OPS and JAR-FCL may be integrated or linked with other systems required in the JAR's according to AMC-FCL 1.055.

The involvement of the airline industry regarding the specification of training standards and objectives will certainly result in improvements in the training programs. A feedback system from the airlines back to the training institutions can be used to constantly monitor and fine-tune the existing programs. Quality Management principles can therefore be used to link the requirements of the airline industry with the output of the flight training organizations. Not only will harmonization or integration improve the overall efficiency of basic and advanced flight training, but greatly enhance flight safety as well. There is no Safety without Quality.

[48] *Flight International, Comment and easyJet entices pilots with bonus, 30 January 2001,p5 and p11.*

Chapter 4
New Concepts

The "200 hour" Neophyte

The first hour of flight under supervision is an overwhelming experience for a beginning pilot. The excitement of pulling that amazing piece of machinery into the air for the first time by yourself will always be remembered by every pilot. After that moment, every stage during the intensive training program will be a milestone in an aviator's career. The first solo, the first check ride, becoming a commercial pilot, etc. All these events could be experienced in less than 6 months.

No one can expect from a person to grasp all these intense experiences at once. It will take time for a pilot to think about and absorb his earlier learning experiences and on that basis develop physical, mental and emotional competence. After 200 hours of basic flight training it would be unrealistic to expect that a training institution can create a skilled and proficient airline pilot. Additional airline oriented skill training will be required.

As commanders constantly make decisions during a flight, they also need advice and information from other sources. Their best asset is an experienced and well-trained crewmember[49]. A pilot just completed basic flight training is not yet equipped to do that. Unfamiliarity with a situation, operator inexperience, poor person-to-person interaction are examples of error producing conditions[50] which could result in human error related accidents or incidents caused by low-time pilots. John Lauber writes the following in a Flight Safety Foundation's publication[51] about this issue:

> *No amount of training can entirely compensate for inexperience, and it is necessary to recognize that for a period immediately following training, whether it is for a new position or a new piece of equipment, a process psychologists call consolidation takes place where the new knowledge and skills learned are put into more permanent memory. During this period of time, individual performance is slower and more deliberate, and is more prone to ´blunder´ type errors.*

To compensate for this lack of airline experience, the industry must develop compensating measures to maintain or perhaps increase aviation system safety. We first must consider that quality learning should start from the beginning. An airline oriented training organization

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[49] *Kern, T. Flight Discipline, McGraw-Hill, 1998, p216.*
[50] *Reason, J. Managing the Risks of Organizational Accidents, Ashgate 1997, p142.*
[51] *Lauber, J. Flight Safety Foundation, Accident Prevention, April 1989.*

combined with a dedicated staff of instructors is the most suitable start for a career as an airline pilot.

The airlines that will accept the majority of the flight school graduates should initiate an impartial flight school assessment program. An airline-initiated appraisal of training organizations should not be limited to Dutch or European schools but could include American based institutions as well. A systematic appraisal method and the unrestricted cooperation from the schools are crucial to make this program successful. Special attention should be paid to the school's selection process; flight schools are better equipped for this task than the airlines with their expensive overhead. Influence in the selection procedures though, must be encouraged to assist the training organization in selecting suitable candidates. Screening procedures with the involvement of an airline can also be used to observe prospective employees if they will fit in the company's culture. The development of transparent and rational selection systems assures selection procedures based on fixed standards instead of selecting candidates influenced by commercial pressures.

Special attention must be paid to the increasing role of Universities as a source for pilots. Especially in the USA were around 115 universities with aviation related curricula, represented by the University Aviation Association (UAA), train students for various aviation careers. The two leading schools, the University of North Dakota and Embry-Riddle Aeronautical University, dispatch daily a staggering 88 and 90 training aircraft respectively[52]. The size of the institutions and their relation with the regional and national airlines can create a suitable environment for airline oriented flight training.

The combination of an aviation degree with commercial flight training creates more opportunities for graduates. Candidates or employees with an advanced aviation educational background will be better qualified for a senior management position than their colleagues with no formal education. A typical aeronautical university offers different degrees in aviation related management or aeronautics. With the recognition and acceptance of the Bachelor and Master degree structure in the Netherlands, it will become attractive for Dutch students to consider an aviation related university program.

Several American universities are already offering complete integrated European JAR-FCL courses and with future harmonisation agreements between the JAA and FAA, it will become even easier to train for either a JAA or FAA licence without the current restrictions on validation. The role of universities as a major pilot supplier is still in a developing phase, but with the combination of advanced education and a good flight program, a university could become a serious competitor to the more traditional flight school.

Initiatives like the European Association of Airline Pilot Schools (EAAPS) could be useful for the entire industry. One of the organization's missions, the promotion of high standards for flight training schools in cooperation with national aviation authorities and the airline

[52] *Civil Aviation Training Magazine, The cap-and-gown Flyers, Issue 1/2002.*

industry[53], is coherent with the views expressed in this paper. Organizational difficulties and the weak financial situation of some of its members currently restrain the effectiveness of this association though.

Bridging the Gap

A good flight training program at an assessed training school is not enough to prepare a pilot for the demanding job of an airline pilot. Like a manager in a company, a pilot also has to make many decisions. Except a pilot's decision must sometimes be made in a split second and could have multi-million dollar consequences. It takes time and experience to prepare people for this unique profession.

Simulated exposure to realistic flight scenarios or mission oriented training is an already proven method to further advance and improve a pilot's airmanship. But how can the industry implement such a program effectively, by realizing airline requirements, and at the same time in a cost efficient way?

The JAA introduced the MCC course in the professional flight curriculum, but many other similar and proven training methods are already in use for many years. With names like Line Oriented Flight Training (LOFT), Line Operational Simulation (LOS), Jet Orientation Course (JOC) and with various other commercial airline career pilot programs, the industry is on the right track.

Enhancement and integration of the MCC course is the solution to fix the missing link between primary flight training and the qualification standards dictated by the airlines. The following elements are critical for the development of an effective and efficient course:

- The simulator; the ongoing development of sophisticated simulator technology creates interesting opportunities for advanced training. But not only state-of-the-art simulators or flight training devices can be used for this task, redundant airline simulators can be used as well. Maintenance and operating cost of full motion can be avoided if it affects the price by eliminating this feature. Research has proven that full motion can be counter-productive for the projected training[54] and is not required anyway for procedural and human factor oriented training. Another option is to use airline simulators during periods when no training is scheduled for the airline. Affordable high fidelity training devices are now entering the market with a wide range of usable applications. A simulator or training device is an investment requiring intensive use of the available equipment, round the clock operation, 7 days a week will improve the cost-efficiency of the program considerably. Human limitations on performance and learning during nighttime hours must be take into consideration though. To increase

[53] *www.eaaps.org.*
[54] *Hawkins, F. Human Factors in Flight, Training and Training Devices, Avebury 1993, p204.*

the effect of learning, an actual airplane type related simulator or training device would be preferred above the generic trainers. Negative transfer of procedures and wrong training habits are more likely to occur in this type of devices due to the basic and unrealistic design. A simulator or training device based on an existing airplane type will enhance the learning value and will reduce the incidence of negative training transfer. The same approved equipment can also be used for type rating training as well and provides more opportunities for an economical operation.

- The syllabus; an Airline Pilot Qualification (APQ) course is based on developing airmanship by judgment, situational awareness, procedural discipline and CRM training through dealing with a variety of scenarios in a realistic environment. The objective is to improve the professional skills to meet the standards determined by the airlines for initial training. The scenarios should represent a complete flight with several situations for the crew to resolve. Enough time must be allotted to allow the crew to understand the situation and the consequences of their decisions. Normal, abnormal and emergency scenarios can be constructed from incident and accident databases, like the FAA/NASA's Aviation Safety Reporting System (ASRS). With over 50.000 incident records[55] and the recurring nature of many incidents, is the ASRS database a very useful tool for scenario development. The following categories should be included in the program:

    - Operational (e.g. low fuel situations, technical failures, abnormal and emergency procedures, Minimum Equipment List (MEL) issues)
    - Weather (e.g. windshear, icing, thunderstorms, low visibility operations)
    - Routes (e.g. inoperative navaids, slots/ATC restrictions, airport restrictions)
    - Human Factors (e.g. dispatch, maintenance, cockpit/cabin crew members, passengers, air traffic controllers)
    - Miscellaneous (e.g. hurry-up syndrome, incapacitation, company demands, crew briefings, high-altitude operations)

  The various curriculum topics should be introduced according to a defined pattern. In a FAA sponsored guide for situation awareness training[56], it is recommended to use the following order to start with; information, demonstration, practice and feedback. Lectures, discussions and audio-visual techniques can be used in the training. Classroom presentations by each trainee to explain a particular topic will greatly enhance the student's understanding of the subject. Behavioural science research

[55] *ASRA Directline, September 1995.*
[56] *Prince. C. Guidelines for Situation Awareness Training, Naval Air Warfare Center, FAA, University of Central Florida.*

shows that the average retention rate by teaching others is 80%, compared to only 5% for a lecture session only[57].

- The instructor; the APQ course requires a different approach regarding the instructors than the "200 hour" basic flight training program. Basic training instructors are not required to have airline experience, the nature of the training asks for a particular talent, not necessarily operational knowledge of airline related procedures. The opposite is true for APQ course instructors, who should act more as a coach than an instructor. Familiarity with the various situations in the simulated scenarios is needed to ensure an accurate perception and evaluation. Only active or retired airline pilots are suitable for this job. While many skills to effectively act as a coach must be trained, experience with a scenario is an important advantage. An experiment, conducted in 1997[58], analysing the ability of observers with different levels of flight experience showed that the more experienced observers recognized more actions than less experienced observers. One of the recommendations was that an observer needs to have a level of task relevant knowledge and experience or they will not be able to recognize actions. The average general aviation flight instructor does not possess that expertise and is therefore not suitable for APQ coaching.
- The price; the previous elements of the course deal primarily with the effectiveness, the learning value. The other factor is the cost of initiating and running an APQ course efficiently. Due to the enormous cost of basic flight training it is unrealistic to expect the newly graduate to pay for the needed APQ course as well. Advanced flight training is the responsibility of the airline; only these organizations have the financial and operational resources and knowledge for this highly specific part of pilot training. It is up to the Flight Operations Manager or the Airline Training Manager to determine the potential impact and associated risk of inadequately trained new hires when this advanced training is not conducted because of financial constraints. A cost neutral solution is achievable by reducing the new-hire salary for a couple of years. The airline will pay for the advanced training and via a labour-agreement are the training expenses reimbursed through a deduction from the pilot's salary. Although it resembles a training bond, this structure is far more appealing than being unable to qualify for a job and receive an unemployment pay cheque at the end of the month.

[57] *Ariane Information Newsletter, Vol.6 –No. 04, March 19, 2002.*
[58] *Prince. C. Guidelines for Situation Awareness Training, Naval Air Warfare Center, FAA, University of Central Florida.*

Mimimum wage in the Netherlands	€ 1.206,60
Initial salary for a pilot under 27 years of age*	€ 3.662,91
Monthly amount reserved for APQ course	**€ 2.456,31**
Accumulated amount after:	
Year 1	€ 29.475,72
Year 2	€ 58.951,44
Year 3	€ 88.427,16
Year 4	€ 117.902,88
Year 5	€ 147.378,60

**Martinair Holland F/O salaryscale 1*

Figure 4.1

The above calculation shows that a significant sum can be spend on airline oriented training without forcing young pilots to borrow excessive sums of money to meet airline criteria. Living on a minimum wage for only a few years should not be difficult for a young pilot. The prospect of receiving effective training with a job option turns this financial obligation into a clear advantage for both the pilot as well as the airline. Several European Full Service Carriers (FSC), like Lufthansa and British Airways do require a training refund from the airline cadet training graduates once they start earning a salary[59]. The magnitude of the year 5 accumulated funds, as shown in the example in figure 4.1, is certainly sufficient to develop a top quality course and a lesser amount of money maybe reserved if desired.

To make the APQ concept successful, thus effective and efficient, we need to reflect on a few more issues that will affect the program.

The concept of overlearning must be used when constructing the syllabus. Overlearning means carrying the training process beyond what is required to perform to the minimum acceptable level of performance[60]. The cost effective nature of the APQ course makes it far more suitable to apply this concept, contrary to the rather expensive airline simulator divisions. Instead of allocating a specific number of hours for the course, the accomplishment of the course objective and the achievement of a company standard should be used when putting together the syllabus.

Another issue is the integration of various other applications into the course. During the course, some sessions can be used for assessment purposes. An airline can send a representative to observe the trainees at different phases in the course as part of a selection process. This will save the future employer a considerable amount of money and resources and will give a much better picture than a formal simulator session. Anxiety, stress and unfamiliarity with the equipment during a single simulator session may conceal the true abilities of a candidate.

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[59] *Civil Aviation Training Magazine, From Cradle to Cockpit, Issue 3/2002, Lufthansa graduates are required to refund € 40 000 once they start earning a Lufthansa salary.*

[60] *Hawkins, F. Human Factors in Flight, Training and Training Devices, Avebury 1993, p196.*

Another application is to measure the effectiveness of the training by testing the candidates on their judgment, situational awareness, decision-making, management and communication skills, before the course starts and when the course is completed. In this way the program can be adjusted when necessary and feedback can be given to the flight schools about the level of their graduates. Training courses can be modified or improved if needed and the APQ course can serve as a quality control tool. Several assessments techniques have been developed for evaluating the non-technical skills. The given training must be monitored on a continuous basis and a regular feedback system is part of the concept.
The JAA requirement to train and assess non-technical skills, think about the required MCC- and CRM courses, can also be incorporated into the APQ course. A consortium of European research institutes[61] has developed a feasible and efficient methodology to train and assess non-technical skills to be used under JAR-FCL or JAR-OPS rules. The NOTECH system[62] has 4 main categories divided into a number of elements:

- Cooperation
    - Team building
    - Consideration of others
    - Support of others
    - Conflict solving
- Leadership and managerial skills
    - Use of authority and assertiveness
    - Providing and maintaining standards
    - Planning and coordination
    - Workload management
- Situation awareness
    - Awareness of aircraft systems
    - Awareness of external environment
    - Awareness of time
- Decision making
    - Problem definition and diagnosis
    - Option generation
    - Risk assessment and option selection
    - Outcome review

[61] *DLR (Germany), IMASSA (France), NLR (Netherlands) and University of Aberdeen(United Kingdom).*
[62] *Flin, R. Goeters, K. Hörman, H. and Martin, L. A Generic Structure of Non-Technical Skills for Training and Assessment, September 1998.*

Behavioural examples are given for all the elements in the categories. A trained observer is then able to make a fair assessment. To improve and train the leadership and managerial skills however, extra attention must be paid to a clear delineation of pilot flying (PF) and pilot non-flying (PNF) duties and the assignment of the pilot in command (PIC). Both pilots must be fully aware of their task and responsibility as either PF or PNF and who acts as the PIC in order to create a realistic learning environment.
The NOTECH study[63] is used as a basis to develop a set of Acceptable Means of Compliance (AMC) and Interpretative Explanatory Material (lEM). Another European Union sponsored research group, known as the JARTEL project[64], is currently testing the applicability of the method. When the JAA adapt this method for the applicable regulations under JAR-FCL and JAR-OPS, the APQ course concept will be well tailored to meet the future regulatory demands.

A New Perspective on Line Training

While extensive research is conducted on pilot selection, effective flight training and human factor related matters, the level of flight experience is still a crucial factor in aviation safety. It is important that during the consolidation period after an extensive training period, the new pilot can put his skills into practice during line training. Line training should start immediately after obtaining the commercial licence. Aviation psychologists have long known about rapid forgetting immediately following training unless the skills are exercised[65].
Current simulator technology can simulate a remarkable array of situations and events in a realistic setting. But there are always situations that can never be accurately simulated in this protected environment. A real encounter with weather for instance has much more learning value than entering programmed turbulence in a box 4 meters off the ground. A new pilot must learn how to maintain situational awareness when operating in this unprotected environment. Only actual flight can offer this training.
To complete the training and assure a competent and cockpit-ready pilot, structured line training will be the last step. It is again the responsibility of the airline to provide sufficient exposure in the operational environment under the guidance of qualified and experienced training captains. Before a pilot can exercise the privileges as an instructor, adequate training and professional guidance is essential. Training must be provided, but not limited, in the following subjects; teaching and learning principles, observation training, aviation psychology and CRM training in accordance with JAR-OPS 1, subpart N. An assessment of personality traits should be a part of the airline's internal application procedure for instructors.
A differentiation must be made between on-the-job-learning via the numerous time-building programs and the structured line training as described in this paper. Captain Brett Gebers of

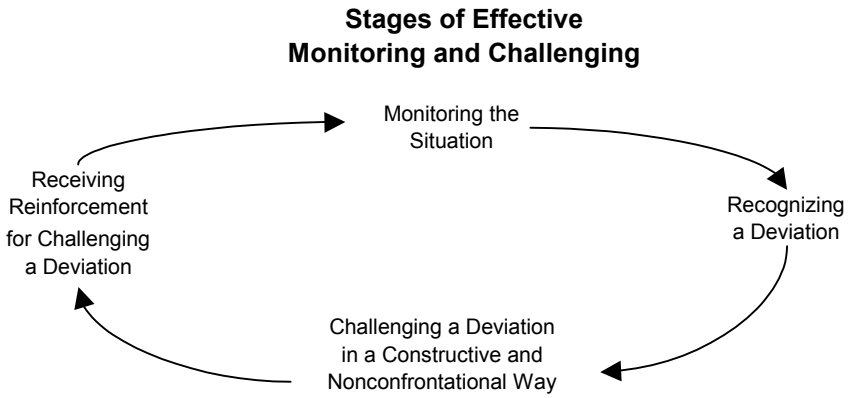
[63] *Van Avermaete, J. Non-technical skill evaluation in JAR-FCL, NLR, November 1998.*
[64] *www.sofreavia.com/jartel/jartel.html*
[65] *Lauber, J. Flight Safety Foundation, Accident Prevention, April 1989.*

South African Airways (SAA) believes that a program must be carefully spelled out and monitor the objectives. SAA's relation with a number of commuter operators is very successful and the South African cadets cope very well on the Boeing 737's after the operational commuter experience[66]. The initial operational experience on commuter type aircraft is not always practicable and is not a prerequisite before moving on to faster and/or larger aircraft. Although when considering the building-block theory of learning, it can be beneficial, especially for young pilots.
One of the most important but underrated tasks of every pilot is operational monitoring. Captain Harry Orlady made this very clear in a Flight Safety Foundation's publication about operational monitoring[67]:

> *Operational monitoring is critically important because, almost invariably, one can say three things about an air carrier accident;*
> *First, there was or should have been a very clear indication in the cockpit at some point during the flight that things were not going well.*
> *Second, there was plenty of time to have saved the airplane.*
> *Third, there seems to have been little or no awareness of the real problem.*

When conducting line training during revenue flights with fare paying passengers and cargo, operational monitoring by both crewmembers; the trainer and trainee must be maintained. The question arises if the inexperienced co-pilot is capable of carrying out that task accurately.

[66] *Gebers, B. Email interview, March 2002.*
[67] *Orlady, H. Flight Safety Foundation, Flight Safety Digest, June 1990.*



Source: Jentsch, F.; Martin, L.; Bowers, C. Identifying Critical Training Needs for Junior First Officers. A special technical report prepared at the request of the U.S. Federal Aviation Administration and the U.S. Naval Warfare Center Training Systems. May 1997

Figure 4.2

Poor crew monitoring or challenging the other pilot's actions is a major factor in accidents, especially in CFIT accidents and typical crew-error related accidents[68]. The PF is responsible for his own actions and control inputs, but the PNF has the task of monitoring and if necessary, challenge his colleague about inappropriate actions. It is common practice in the airline industry that during a typical duty period each flight segment is equally shared between the crewmembers. While during line training it might be desirable to expose the trainee to additional takeoffs and landings, the training captain will certainly be the PF on some legs as well. It means that a pilot undergoing line training is required to perform the task as a monitoring pilot as if he or she has already passed the line check and is fully qualified. A pilot under training, unfamiliar with the aircraft, terrain, airports and routes will have a huge mental workload and is unable to effectively perform the monitoring duties when assigned the duty as the PNF. Additionally might a young pilot be hesitant to challenge his superior, the training captain. The recognition of a deviation is easily missed when operating under these conditions and the trainee should not be put into that situation.

The only way to conduct line training flights in a safe way is the designation of an extra crewmember as a monitor for the training captain, not for the trainee. The trainee will be monitored, instructed and challenged sufficiently by the trainer anyhow. It is the person in the left seat who needs to be monitored and this can only be accomplished when on every line training flight, a third crewmember will take place in the observers seat and operates as an active monitoring crew member.

[68] *Sumwalt, R. Flight Safety Foundation, Flight Safety Digest, March 1999.*

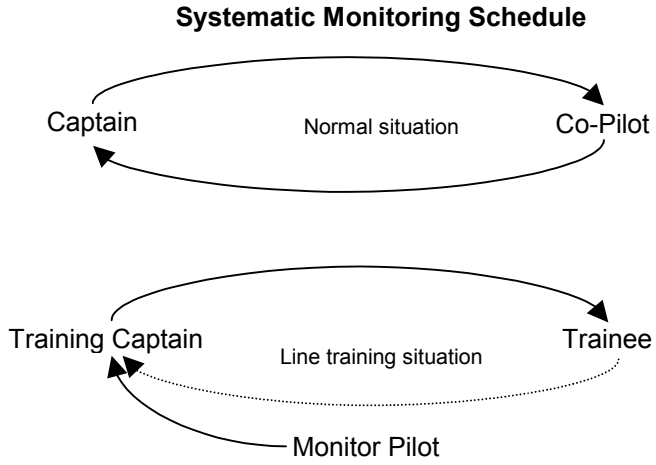


Figure 4.3

To summarize:

- Safe and effective line training can only be accomplished when the trainee starts immediately after obtaining the commercial licence.
- Structured line training is an indispensable step to teach pilots how to operate in an unprotected environment.
- Recognize the importance of crew monitoring skills and the vital role of a dedicated monitoring pilot during line training flights.

Although the majority of airlines will assign a third crewmember for line training flights, it is usually only required for a specific number of sectors or hours. The rest of the line training flights will then be completed without a monitoring crewmember and becomes a virtual single pilot operation.

Another option, in particular for long-haul carriers or airlines with only wide-body jet equipment, would be the introduction of an extra flight deck function; the Second Officer (SO). This function allows a pilot to act as a relief pilot during cruise only. A significant reduction in cost could be achieved by a limited training syllabus for SO's. The advantage for low-time pilots is that they could be hired sooner instead of buying hours or wait for an appropriate offer before they meet the airline experience criteria.

Chapter 5
Conclusion and Recommendations

Conclusions:

- Many essential aviation related skills required for an airline pilot; pilot judgment, aeronautical decision making and airmanship, can be systematically taught through training.
- Because of environmental, political and other reasons, the Netherlands is unsuitable for effective and efficient advanced flight training.
- JAA flight training is for European candidates, who are pursuing an aviation career in Europe, the most effective method of training. However the training can be conducted elsewhere for efficiency purposes. Training under JAA rules can compete against the FAA standards on quality of learning. Training in the USA for FAA licences along with the new JAA rules and regulations regarding conversions is not feasible anymore. Limitations on visa's, strict requirements regarding licence validations and significant lower training-standards, renders training directly for a JAA licence a much better choice for aspiring pilots.
- Industry growth in combination with increasing retirement numbers will boost the demand for professional pilots in the future considerably. The expansion of the LCC sector, with major players like easyJet and Ryanair, and the reorganization of many FCC conglomerates, requires a huge number of qualified pilots for the years to come. Nationality will no longer be a barrier for employment but rather an asset for Dutch nationals.
- Airlines are responsible for advanced flight training, but the graduate could easily refund part or the whole cost of training through a salary cut for a couple of years.

Recommendations:

- The Dutch airlines should participate more in the recruitment, assessment, guidance and flight training for aspirant pilots. Airline endorsement of an approved selection process and trainings curriculum will promote and facilitate the entry of suitable candidates from all groups of the society. Enhancement of training curricula with a University degree should be encouraged.
- Enhance the existing MCC courses to bridge the gap between the minimum regulatory standards and the airline requirements. Professional training institutions

could use aviation accident and incident databases to develop context specific flight scenarios for line oriented training courses. The following points summarize some specific recommendations for developing the APQ course;

  - No regulatory minimums, but accomplishment of the course based on airline requirements and standards.
  - Use of the concept of over-learning.
  - Recruit airline pilots, active or retired, as coaches for these new developed APQ courses.
  - Airlines can use the APQ course for assessment purposes as well.

- Make use of Quality Management principles and integrate or harmonize Flight Training and Airline Operational Quality Systems.
- Airlines must review their line training procedures in order to avoid infringements in their flight safety programs due to inadequate monitoring practices by not yet qualified co-pilots. Long-haul carriers could opt for introducing a new flight-deck function, that of Second Officer.
- All participants; schools, airlines and authorities must get involved to create a healthy pilot recruitment- and training system. Schools should be evaluated not only by the airlines but also by the authorities as well for the effectiveness and efficiency of their training programs.
- Abolish uncontrolled pay-for-hour flight schemes. Structured simulator training and/or line training, under supervision of an airline, are the only reliable methods to acquire the necessary skills.
- Unbiased information regarding flight training for aspiring pilots must be made available through airlines, unions and authorities.

Declining yields and fierce competition throughout the whole aviation industry structure require a more flexible approach from the pilots, their unions and the authorities towards the airlines. Flight training will be one of the areas that need a critical look regarding training effectiveness and cost efficiency. The flight training institutions and airlines that recognize the importance of this subject, will be able to compete and lay a solid foundation for their future. The modern flight environment requires prudent, capable and vigilant aviators. Only properly trained professionals are able to keep aviation inherently safe.

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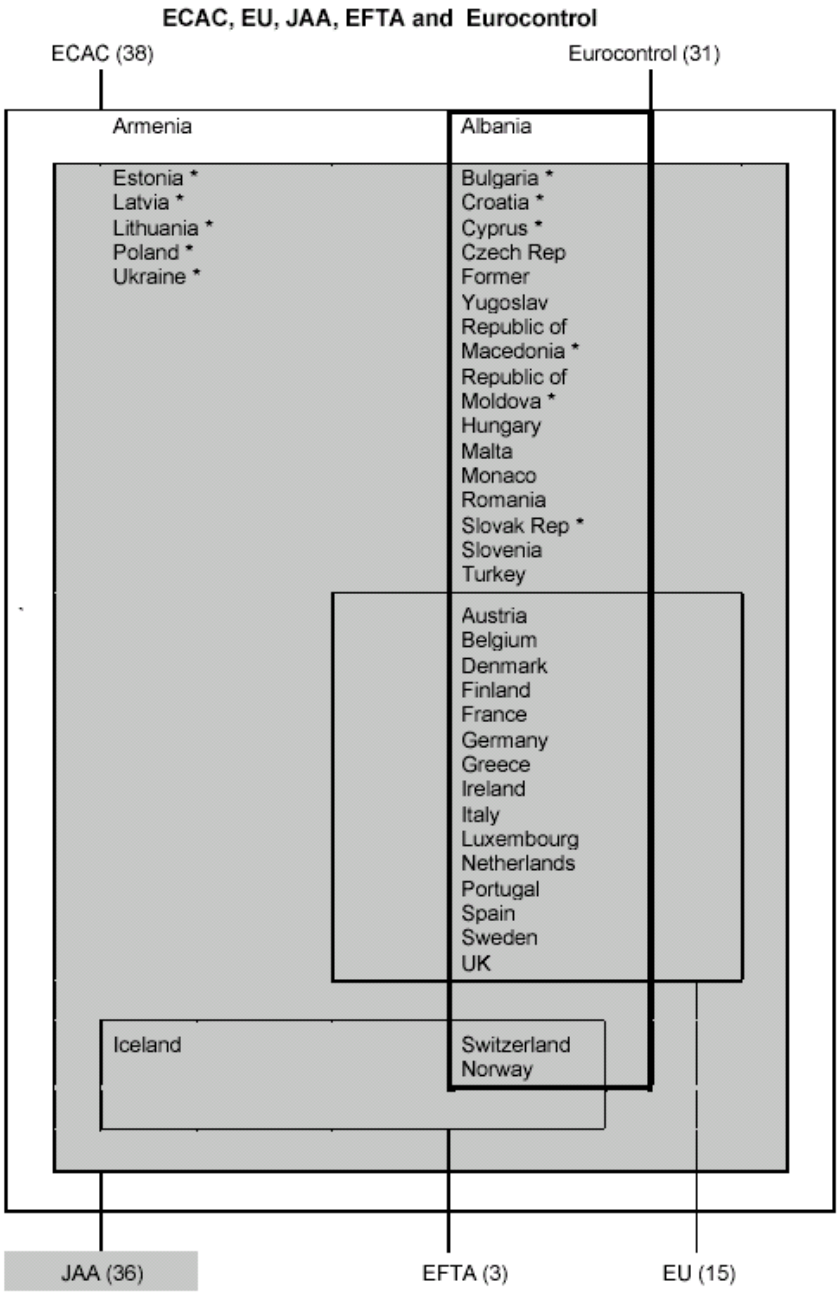
Appendixes

A: List of JAA Member States;



B: JAA approved FTO´s in the Netherlands:

Aero Noord B.V.	Hoogeveen
Nationale Luchtvaartschool B.V.	Beek
Dutch Flight Academy	Eelde
International Pilot Academy	Bosschenhoofd
KLM Luchtvaartschool B.V.	Eelde
Lelystad Flight Center B.V.	Lelystad
Lelystad Luchtvaartschool	Lelystad
Martinair Vliegschool Lelystad B.V.	Lelystad
NLS Amsterdam	Hoofddorp
Opleiding Beroepsvliegers Schiphol	Schiphol-Oost
Stichting Vliegschool Zestienhoven	Rotterdam
Vliegschool Rob van den Sigtenhorst B.V.	Teuge

Agency´s (no official approval system):

European Aviation Agency	Maastricht-Aachen Airport
International Aviation Center B.V.	Amersfoort
European Pilot Selection & Training	Maarssen

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