PARE Article

Attracting Young Talent to Aeronautics

July 2020

Based on

Chapter 10 of the 2nd Yearly Report of the PARE project

Prepared by

PERSPECTIVES FOR AERONAUTICAL RESEARCH IN EUROPE

INTRODUCTION

To **support the 23 Flightpath 2050 goals** established by the Advisory Council for Aeronautics Research and Innovation in Europe (**ACARE**), the PARE project defined **35 complementary PARE objectives.** PARE objectives 43 to 48 are addressed in the 10th chapter of PARE's 2nd-year report, entitled "**Attracting Young Talent to Aeronautics**", which analyses the reasons and factors that influence the career inclinations of young people and the measures to consider to attract them to aeronautics.

According to the **Social Cognitive Career Theory** (SCCT), the academic and career choices of young people are influenced by personal, cognitive and contextual factors (namely prior experience, social support, self-efficacy and outcome expectation) and form gradually more consciously from childhood and primary school, through teenage and secondary school to adulthood and university. The career choices also depend on the image and reputation of the employer and its ability to provide good living and working conditions and to foster the commitment and fidelity of the workforce as a second family.

To attract young people to aeronautics, it is also important to understand that aeronautics involves diverse job types (e.g. engineers, senior technicians and operators), all that require the so-called **STEM - Science, Technology, Engineering and Mathematics – skills**.

CHILDHOOD AND PRIMARY SCHOOL

In the history of aviation, many of the pioneers and major contributors started their interest at an early age. It is therefore essential **to stimulate the interest of children in aeronautics (objective 43),** which can be done in a more informal context by parents or more formally in primary schools, through specific programmes or educational materials developed for children.

KEY FINDINGS

- At the beginning of childhood, children's attention span depends on their age and the interest that objects and tasks awaken in them, in particular their ability to manipulate these objects nearby. It is very difficult for kids to focus on a monotonous and less attractive activity and consequently, they tend to easily move on from one activity to another frequently;

- Fortunately, flying-related stories are usually entertaining for children. In this manner, they usually enjoy doing activities such as playing with kites, listening to tales that take place in space or watching flying-related cartoons as well as make paper gliders. These kinds of funny activities related to aviation can act as an incentive to awaken in kids the feeling of loving this thrilling sector and, in this way, they could grow up willing to work in a job related to aviation;

- Primary school programmes/material and events are also a way to stimulate this interest in children in a more formal way. Examples worldwide include:

Country	Promoting Institution	Educational programmes/materials and events
Portugal	Aeronautical Promotion Centre & Nortávia	Visits for children to have their first contact with the aeronautical environment, in which they can have direct contact with the aircraft and their pilots and mechanics in a playful and relaxed way
Switzerland	Fédération Aéronautique Internationale	Young Artists Contest which encourages young people to demonstrate the importance of aviation through their art
United Kingdom	Royal Aeronautic Society	Primary education programmes: 1) Cool Aeronautics (outreach programme); 2) Amy's Aviation (two children's animated series called 'Amy's Aviation' that charts the adventures of Amy as she discovers the wonderful world of aerospace and aviation)
United States	Science Spark	The USA Science & Engineering Festival includes events that aim to show where "STEM Can Take You" to participating kids and produce also STEM classroom materials that teachers can download
	American Institute of Aeronautics and Astronautics	STEM programs which aim to inspire, influence, and mould the next generation of aerospace scientists and engineers by providing a series of resources and programming to teachers, students, parents, and aerospace professionals
	NASA	NASA's website has a variety of educational and entertaining materials such as explanatory videos with attractive illustrations; interactive online games and "hands-on" experiences and activities that children can explore as they learn about STEM

KEY ACTIONS

Summarizing, to stimulate children's interest in aeronautics, it is necessary to make STEM fields funny and enjoyable for kids. To achieve this objective, **PARE recommends making available on-line and accessible to primary schools and parents, children stories and cartoons involving flying that are both entertaining and educational.**

TEENAGE AND SECONDARY SCHOOL

The basic teaching of physics, natural science and mathematics, even at the secondary school level, can lead to some understanding of flying in the atmosphere. In a more practical side, 'toy' drones are now so common and inexpensive that they can be readily used to give real flying experience, train piloting skills and can teach also responsible use. Moreover, these more relaxed activities, which can occur in leisure times at school or outside the school, can be complemented by visits to university laboratories and presentations from aeronautics professionals. This combination of advanced technologies and bright prospects should be employed **to motivate teenage and secondary school students to choose university degrees in aerospace engineering (objective 44).**

KEY FINDINGS

- A variety of informal and complementary learning activities can be promoted among students and STEM educators, in a way to connect them with the STEM community and workforce, such as: teach youth at science summer camps or after-school programs; getting students to join STEM-related clubs, namely Space and Aeronautics Clubs; promote and support students' participation in science fairs and competitions; create job shadow opportunities; promote visits to Aerospace Companies; give them books and magazines on STEM topics;

- To specifically promote aerospace engineering, the ALLIES partnership has focused upon the design and development of wind tunnels that are donated to secondary schools. The wind tunnels have proven to spark interest in aerospace-related phenomena among the secondary students. The most recent ALLIES effort focuses upon the design of a wind tunnel that can be fabricated using materials, parts, and components available in most regions of the world, such that disadvantaged schools can easily replicate a wind tunnel;

- The Learn&Fly project, which finished last year, implemented innovative teaching methods in Spanish, Portuguese and Polish schools (using the world of aeronautics as an inspirational theme and involving teachers, parents and professionals) and supported teachers by providing information and materials about career opportunities in the aeronautics field and different education/training paths available to embrace them;
- The student finishing secondary school has a wide and sometimes bewildering choice of university degrees to apply for. Even restricted to aerospace engineering, there are several European universities (of which some were selected in the Table below) with promising and high-quality degrees that will provide the necessary knowledge, skills and abilities that allow them to work efficiently within the aerospace field.

University (Country)	Aerospace areas covered by the university degree (besides basic operation principles of an aircraft)					
	Airport processes and operations	Aircraft engines system / Propulsion	Structures and Materials	Business Management	Air Traffic Management (ATM)	Aircraft systems
Polytechnic University of Madrid (Spain)	x	x	x		x	x
ISAE-SUPAERO Institut Supérieur de l'Aéronautique et de l'Espace (France)	x		x			
Polytechnic University of Turin (Italy)		x	x	x		
The University of Bristol (United Kingdom)			x		x	x
Delft University of Technology (Netherlands)		x	x			
Zurich University of Applied Sciences (Switzerland)	x	x		x		
Polytechnic University of Bucharest (Romania)	x	x	x	x		

KEY ACTIONS

To achieve this objective, PARE recommends to:

1. Make available from the early teens, on-line and to secondary schools, a set of easy to implement flight experiments and challenges such as drones now so commonplace and cheap;
2. Give secondary school students at later stages the opportunity to come to presentations and laboratories at a university, together with a parent/mentor or trusted friend.

ADULTHOOD AND UNIVERSITY

The strong analytical and problem-solving skills of the graduates from the best aerospace engineering degrees are in much demand from other sectors in and out of engineering (e.g. civil construction, automotive domain, consultant and financial services, etc.). Although an aerospace engineer would have as first-choice aeronautics or space, some consultant companies may be quicker to offer professionally enticing and well- paid job opportunities, often advertising before the university degree is complete. Considering this and the increasing competitiveness from other countries (such as the US and Japan), the European aeronautical industry should do its best **to attract the brightest graduates in aeronautical engineering to industry before they are lured away by attractive, well-paid offers elsewhere (objective 45).**

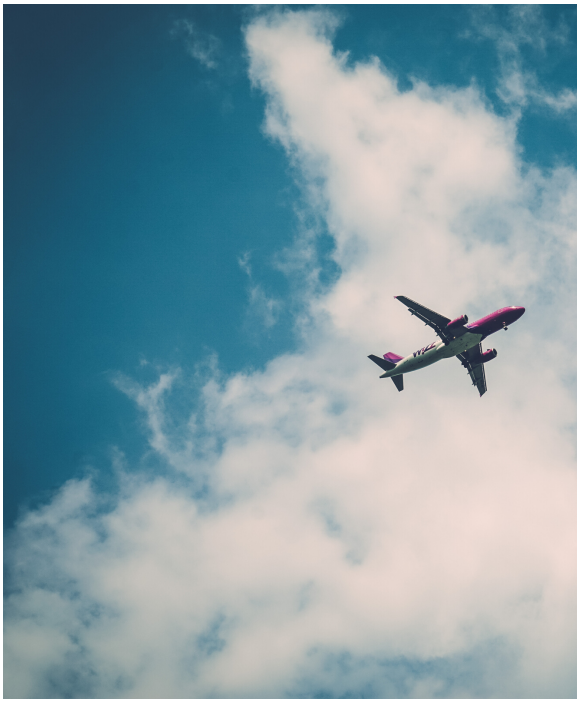
KEY FINDINGS

- Today, aeronautics and air transport are among the main drivers of European cohesion and competitiveness, representing 220 billion euros and providing 4.5 million jobs in Europe (2019 data), a figure that is expected to double in 2050. These data reveal that aeronautics plays a key role in facilitating European economic growth and social inclusion, providing income to regions that are otherwise isolated and helping people to broaden their horizons;
- Employment opportunities for which graduates in Aerospace Engineering are specifically trained lie mainly in the aerospace field: (i) major European aerospace industries; (ii) small and medium-size industries which supply the former; (iii) agencies and contractors responsible for aircraft maintenance; (iv) airline companies; (v) ATM authorities; (vi) the air force and other military aviation sectors; and (vii) public and private bodies for testing in the aerospace field;
- European-level data show that about 50% of aerospace engineers are employed in other industrial sectors, even in regions where aerospace activities are most strongly established and offer the greatest employment opportunities (France, Germany, UK, Italy, Spain). In the Netherlands, a study regarding career for graduates from TU Delft's Aerospace Engineering degree in 2017 concluded that: 88% of MSc graduates find a job within 6 months after graduating; 40% become employed in the Aerospace sector; 60% find a job within another field of engineering (wind energy, automotive) sectors, consultancy or management;
- The famous "pipeline" problem in STEM fields, which is the need to attract more students and workers too, and to retain them (especially women and minorities) can be related with self-efficacy expectations and has a special impact for aeronautics. Self-efficacy itself is linked directly to persistence and can be improved through increased self-awareness of the sector and formalized mentoring programs and initiatives that involve students in research or activities;
- To ensure the persistence of students in the aeronautical sector after graduation, industry and other employers should engage them at an early stage through professional stays and follow-up with attractive job offers without delay after graduation. For example, the Partnership of a European Group of Aeronautics and Space Universities (PEGASUS) was established with the aim of attracting the best students and also to offer highly relevant educational and research programmes. As of 2014, it included 25 members academic institutions (4 of the universities mentioned before) and most PEGASUS engineering programmes include also one or several periods of practical training, in laboratories or industrial structures.

KEY ACTIONS

To achieve this objective, PARE recommends **providing industrial stays for students of aeronautical engineering with mentoring that values their skills and keeps track of the most promising for employment after graduation.**

CAREERS IN AERONAUTICS AND SPACE



The aerospace sector can be divided into two major areas: aeronautics industry and air transport, both of which offer a diverse range of interesting career opportunities. However, young people may not be fully aware of all of them and/or need more insights and guidance to decide to pursue a career in aviation. Regarding the first area, to ensure promising students' choice (over other sectors, as stated before) or **to make careers in aeronautical industry interesting relative to other alternatives, the aeronautical industry must focus on fascinating technology with adequate reward (objective 46)** and invite them during their university course, thereby establishing early links that ensure their choice before other attractions arise.

KEY FINDINGS

- The European aeronautics industry develops and manufactures civil and military aircraft, helicopters, drones, aero-engines and other systems and equipment, which involves designing components and system, generating CAD models and drawings and undertaking fluids and thermal analysis, etc. The industry work also involves testing the systems and equipment manufactured and supporting the products in service afterwards. For this, it is necessary a range of job categories:
  - engineers (system engineer, mechanical design engineer and others),senior technicians (logistic technician, method preparer and others) and
  - operators (boilermaker, fitter-fitter and others).

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- Air transport includes the transportation of people, goods and mail on regular lines and non-scheduled activities (charter, taxi, plane rental with the pilot, flight training and others) and relies on aeronautical maintenance activities and airport assistance activities (rack and field operations, shipboard trades, civil aviation professions). Considering this, job categories in this area include:
  - Airlines or handling agents: flight crew (pilots and cabin crew), ground handling;
  - Airport operators in airport management, maintenance, security and operators: maintenance, repair and overhaul market (MRO) technicians, airport security and passenger screening operators, etc.
  - On-site employees at retail outlets, restaurants, hotels, etc.
  - Air navigation service providers: air traffic controllers.

KEY ACTIONS

To achieve this objective, PARE recommends **bringing an aeronautical engineering student together with a mentor/relative/trusted friend**, which can play a major role in advising a mature choice, **to a one-day visit to industry, with briefings and access to facilities, to be remembered for life as a career choice.**

MOTIVATING AND REWARDING THE WORKFORCE

Besides attracting people to the aerospace sector, it is necessary to have favourable conditions and create measures **to motivate and reward the existent workforce in the sector to promote dedication, ingenuity, efficiency and loyalty (objective 47)**. The best motivation and reward for the workforce is the openness to new ideas and giving an opportunity for sensible innovation that benefits also the company's interests. Moreover, some companies: i) share a part of the profits with the employees; and ii) allow employees to buy a limited number of shares at favourable prices with the condition that they cannot be sold for a number of years. Measures like these motivate employees to work harder for the aims of the company they share, knowing that the success due in part to their efforts will be recognized.

KEY FINDINGS

- According to the HiPAir project, a strategic partnership co-funded by the ERASMUS+ Programme of the European Commission, one of the new forms of work organisation, which have been developed, is the concept of High-Performance Work Practices (HPWP). Though many of the practices referred as high performance are commonly used by most organisations to motivate workers, such as financial incentives, flexible job descriptions and continuous skills development programs, the concept of HPWP is fairly unknown. HPWP can be defined as modern management practices design to stimulate the employees and organisation performance and include, for example, recruitment and integration, employee involvement, internal communication, training and reward and commitment. Some examples of practices used in companies at European level are:

Recruitment and integration	Interviews, theoretical tests Induction programs Internship programmes Search talented people in collaboration universities and other training institutions Preparation of job descriptions and selection procedures
Employees involvement	Functional flexibility program (mobility inter and intra-department) Suggestions programs Organisational climate and satisfaction Surveys Employee engagement survey Individual development plans Employee action plans Performance appraisal Annual objectives for each employee, individual and/or global Key Performance Indicators (KPIs) for teams Continuous improvement system Excellence achievement programme
Internal Communication	Communication packages for employees Intranet Webinars Communication meetings (involving all the workers, who may present their opinions and suggestions to improve the company's procedures)
Training (learning and education)	Scholastic program Post-graduate studies Language courses Training technical and non-technical (internal and external courses) Mentoring, coaching, tutoring Talent identification and development plan Talent development program to women-leadership in aeronautics industry Specific training plans based on competencies/skills matrix to answer to identified gaps and to support life-long learning processes
Reward and commitment	Compensations plans (production, administrative, management, etc.) Flexible working conditions Rooms for nursing mothers Retention policy Standardized job roles Compensation, bonuses related to objectives achievement Salary increment related to the objective review

- Companies in the aviation sector that use high-performance practices at European and global level include FerroNATS (ES), Fokker Elmo Turkey (TR), Groundforce (PT), Global Training & Aviation (ES and ID), FTB Lisi Aerospace (TR), MTU Aero Engines Polska (PL), Pratt & Whitney Rzeszów S.A. (PL) and the Southwest Airlines (US).

KEY ACTIONS

To achieve this objective, PARE recommends **to give employees opportunities for innovation, let them share important and interesting work, and recognise their contribution to the success of the company.**

RETAINING THE FIDELITY OF EMPLOYEES

The traditional model of a society of lifetime work in a company still exists in countries like Japan, but is presented by some as a 'lack of mobility'. As an alternative to the modern high-mobility, short-term employment, and not excluding intermediate cases, there is nothing wrong with the old model of a company-family which support a dedicated workforce with long experience and attracts the next generation. The mobility of employment has more to do with cultural traditions than with company efficiency. Therefore, aerospace companies in Europe should **retain a capable and faithful workforce by providing stable employment, interesting work, reliable benefits and a friendly environment (objective 48).**

KEY FINDINGS

• Employee's satisfaction is a measure of how happy workers are with their job and working environment and can be seen as an emotional state that results from the evaluation of one's job or experience. To enrich the levels of employee satisfaction, some measures include: a) foster and reward the training of employees; b) facilitate schedule flexibility; c) give opportunities for professional improvement; d) provide laptop and/or mobile phone for work; e) value the opinions expressed by the employees; f) create a good work environment and conditions for workers;

• Employee fidelity can be defined as employees who are devoted to the success of their organization and believe that being an employee of this organization is in their best interest. Not only do they plan to remain with the organization, but they do not actively seek alternative employment opportunities. The maintenance of a faithful long-experienced workforce can also attract new ideas and support further recruitment by proving a stable and progressive environment for progress;

• A significant percentage (approximately 30%) of the current aerospace workforce in Europe is at or near retirement age. Considering this, companies have to ensure they maintain current expertise while forecasting future hiring needs, such as what skill sets will be needed and when to hire for them, and transferring the talent from older to younger employees, an issue that is becoming more acute as the older employees retire;

• This lopsided demographic mix, coupled with high attrition rates and increased labour mobility, poses serious risks to the industry. Companies can mitigate the risks with employee retention and succession planning. Besides wage, other factors determine the loyalty of the workforce in an aerospace organisation: perceived high job security (reduced risk of being made redundant), a good and reliable pension system, an effective health insurance scheme and an optional extension of the retirement age could only increase the attractivity and the excitement of the employment in aerospace and retain talent, especially people with the STEM skills.

KEY ACTIONS

To achieve this objective, PARE recommends **having competent staff, able to adapt to change and to contribute to progress, sufficiently well integrated not to wish other careers and serve as example to relatives and friends.**

For more information about these topics, you can access the **full chapter here**.